Corporate integrity culture and risk taking

Abstract: Psychological research has found that honest people tend to take fewer risks. In this article, we want to know whether honest companies also take fewer risks. Based on the annual reports of Chinese listed companies from 2000 to 2020, we construct an indicator of "integrity culture" using machine learning technique—the word embedding model, and examine the impact of integrity culture on corporate risk-taking. We find that firms with integrity culture exhibit significantly lower level of risk-taking, which is value-reducing for deviating from the optimal level of risk taking. Mechanism analysis suggests that excessive conservation, emphasis on reputation and preference for stability are reasons behind the negative relationship. Furthermore, studies concerning corporate policies find that honest firms are related to less R&D expenditure, more liquid assets, lower leverage and fewer executive incentives. Our paper suggests a dark side of integrity culture, which needs to be treated with caution.
Key words: Integrity culture; risk-taking; machine learning; text analysis

1 Introduction

Integrity, as the core of culture, is depicted as “the compassionate and receptive work of making the self whole and enduringly happy through critically and assiduously separating who we truly are from the false ego” (Koehn, 2005). It is considered a valuable quality that enterprises should possess and can bring various benefits to the enterprise (Graham et al., 2022). For example, in a narrative analysis method, Koehn (2005) find that integrity can restrain short-sightedness, maintain healthy relations with all stakeholders, sell more effectively, have the courage to resist madness, get the diverse perspectives needed to make prudent decisions and act creatively. Guiso et al. (2015a) empirically find that proclaimed integrity culture appears irrelevant with firm performance, while integrity felt by employees is able to make firms more productive, more profitable, more attractive to job applicants and possess better industrial relations. Using a text analysis method, Jiang et al. (2019) find that firms with an integrity-focused culture have lower external transaction costs and investment-cash flow sensitivity.

Compared with most literature investigating various benefits of integrity culture, in this paper, we focus on a dark side of it which is seldom tested: risk-taking. Enterprise risk-taking reflects the willingness to exchange risk for a benefit that corresponds to it (Lumpkin and Dess, 1996), which is reflected in the selection of high-risk and high-yield projects in enterprise investment decisions (Amihud and Lev, 1981). The higher level of risk-taking shows that senior executives have the spirit of adventure and innovation, and will not give up investment projects with high risk but positive net present value. From a macro perspective, risk-taking is the fundamental driving force for long-term sustained economic growth. High returns from high-risk projects can promote technological progress, accelerate capital accumulation, and maintain social productivity at a high level (Acemoglu and Zilibotti, 1997; John et al., 2008). From a micro perspective, risk-taking is an inevitable result of a company's decision-making process out of profit purposes. Obtaining profits through taking-risks is the basic logic of business operations and is an important factor in promoting corporate performance and growth (Boubakri, 2013). Here, we propose that honest firms have lower risk-taking propensity, which further deviates the optimal level and is value-reducing.

Before discussing how the corporate integrity culture leads to lower firm risk-taking, we first introduce the studies concerning individual honesty and risk-taking, which helps reach our conclusion. For individuals, risk-taking refers to attitudes, activities, and behaviors that individuals engage in and are generally described as uncertain or dangerous (Blais and Weber, 2006). Psychological researches have illustrated the associations between personality (referring to the way an individual interacts, reacts and behaves with others and is often exhibited through measurable traits (Crysel et al., 2013)) and risk behaviors (e.g., Nicholson et al., 2005; Weller and Tikir, 2011). Relatedly, they have found that a specific personality, namely low honesty

is associated with a variety of risk-taking behaviors, ranging from ethical risks (e.g., having an affair), to health risks such as smoking and alcohol use (De Vries et al., 2009; Weller and Tikir, 2011). Additionally, lower honesty has been associated with low workplace integrity (e.g., stealing office supplies), status-driven risk-taking (Ashton et al., 2010; Lee et al., 2005) and the likelihood to sexually harass (Lee et al., 2003). As for the mechanisms behind the negative relationship, Ashton and Lee (2008a) suggest that low honesty individuals are hypersensitive to reward, using any advantage that they can get to obtain one (e.g., by cheating, breaking laws, etc.). Weller and Tikir (2011) further found that low honesty not only was associated with greater perceived expected benefits for engaging in a risky behavior, but also less perceived risk associated with that activity. Similarly, Weller and Thulin (2012) also find that low honesty is associated with greater risk-seeking for both potential gains and potential losses.[1]

Referring to psychological researches on personality and risk-taking, and considering that corporate culture is determined by senior leaders (e.g., Kotter and Heskett, 1992; Baron and Hannan, 2002; O'Reilly et al., 2014; Guiso et al., 2015a; Graham et al., 2022) and upper echelons theory (Hambrick and Mason, 1984), we propose that one main mechanism behind the negative relationship between firm integrity culture and risk-taking is: honest companies may be more conservative and cautious when facing risks and uncertainties, and pay more attention to avoiding negative consequences.

In addition, honesty reflects qualities such as trustworthiness, fairness, and a lack of greed, which is associated with behaviors driven by high incentive reward in the face of moral or legal considerations (Ashton and Lee, 2008b). Honest people are also more likely to help and less willing to exploit others (Weller and Thulin, 2012). In the above process, honest people will form their own reputation as reputation refers to the general opinion or perception that others hold about an individual's character, behavior, and trustworthiness. Meanwhile, honest individuals are often highly motivated to maintain their reputation and preserve the trust and respect of others because they understand that their reputation is a valuable asset that can help them build strong relationships, achieve success, and make positive contributions to society. The maintenance of reputation and emphasis on reputation will prevent them from taking excessive risks as a high-risk behavior carries a high possibility of failure, which would damage their reputation (Huang et al., 2022). As such, we propose the second mechanism behind the negative relationship between integrity culture and corporate risk-taking: honest companies may take insufficient risk to avoid damaging their reputation.

Moreover, honest individuals may not be willing to change as the external environment changes (Zuckerman, 2002; Sorensen, 2002; Guiso et al., 2015a), which means that they prefer stability over change, leading to less risk-taking. When we talk about integrity or honest people, we always link them with stereotype like calmness, steadiness, maturity, routinism and changelessness, which contradicts with qualities in risk-takers such as youngness, vigour, dynamism, energy and change. Besides, an individual who is seen as honest and trustworthy is likely to be favored by employers, colleagues, and friends, which can help them to build and maintain stable relationships over time. However, risk-taking may harm the stable relationships between honest individuals and stakeholders, which makes individuals who value honesty prefer to avoid such situations and be more risk-averse. In addition, in a firm, when current norms and values related to integrity culture are widely shared and strongly held throughout the organization, employees are highly committed to the current "worldview" (Staw and Nemeth,1989), which makes them less likely to seek out fundamentally new alternatives to existing procedures or even recognize the need for radical change in the first place. Overall, we propose the third mechanism for our research topic: firms with integrity culture may be content with the current situation and prefer stability, which is not conducive to risk-taking.

Taking into account the above three mechanisms, we believe that firm integrity culture leads to lower

[1] In a simple experiment, they asked participants to state choice preferences for hypothetical decisions involving choices (a) between a sure gain and an uncertain gain of greater value (or winning nothing), and (b) a sure loss and a chance to lose nothing (or a greater amount than the sure option). Prospect Theory predicts risk-averse tendencies for potential gains, but risk-seeking to avoid equal potential losses (i.e., loss aversion). However, they find that low honesty is associated with greater risk-seeking for both domains.

level of risk-taking. However, we also realize that integrity may push risk-taking as it is able to gather a high level of social capital and broad social trust (Koehn, 2005; Jiang et al., 2019), which increases risk-taking as enterprise risk-taking is a resource consuming activity with strong resource dependence (Fazzari et al., 1987; Almeida and Campello, 2007). Therefore, the eventual influence of integrity culture on firm risk-taking depends on the net effect.

Based on the annual reports of Chinese listed companies from 2000 to 2020, we construct an indicator of "integrity culture" using machine learning technique—the word embedding model, and examine the impact of integrity culture on corporate risk-taking systematically. After validating our integrity culture measure using well-established markers for best practices in corporate integrity, we examine the effect of firm integrity on risk-taking and find that corporate integrity culture has a negative effect on firm risk-taking, proxied by the volatility of profitability and stock return. Economically, our baseline regression shows that a one-standard deviation increase in the integrity culture is associated with a 2.74% (0.8%) decrease in firm risk-taking relative to the mean.

To establish causality, we first provide quasi-experimental estimates of the impact of integrity culture on firm risk-taking by leveraging a unique natural experiment: the staggered introduction of "Credit Demonstration City" across 43 cities in two batches: 2015 and 2016. Under a parallel trends assumption, the quasi-experimental variation in corporate integrity generated by the sharp but staggered introduction of "Credit Demonstration City" allows us to obtain causal estimates of integrity culture on firm risk-taking. We find that the staggered introduction of "Credit Demonstration City" has a negative effect on firm risk-taking. Besides, we also address recent econometric concerns with staggered difference-in-differences research designs by showing robustness to the use of a variety of alternative estimators.

Second, we conduct a propensity score matching (PSM) algorithm, whereby firm-years with high level of integrity culture are matched with otherwise indistinguishable firm-years with low level of integrity culture. This approach helps us control the effects of observable firm characteristics and pin down the effect of corporate integrity culture on risk-taking. We continue to observe a lower risk-taking for firms with higher integrity culture.

Third, corporate integrity culture can be associated with many factors including firms' size, performance, corporate governance, etc., which also affect risk-taking. To address this endogeneity concern, we follow previous literature (e.g., Wiersema & Zhang, 2011; Chen et al., 2023) and first regress integrity on all the control variables used in our main analysis. We then use the residuals from this regression as a proxy for corporate integrity culture and re-estimate our baseline model. The results are consistent with our main analyses.

Fourth, many literatures find that a firm's culture is mainly determined by its senior leaders (e.g., Kotter and Heskett, 1992; Baron and Hannan, 2002; O'Reilly et al., 2014; Guiso et al., 2015a; Graham et al., 2022), which makes some missing managerial characteristic variables may affect the level of managerial integrity and the enterprise's risk-taking at the same time. To address this, we add a series of managerial characteristic variables such as chairman age, tenure, gender and education background and the results are qualitative unchanged. Besides, we focus on the integrity-risk-taking relation for newly appointed chairmen to mitigate the concern that corporate leaders may have the ability to influence both the integrity culture and corporate decision-making. The results are robust in this analysis. In addition, to further mitigate any concern about omitted variables that are correlated with a firm's integrity culture and vary within industries and years, provinces and years or industries and provinces and years, we include industry-year, province-year and industry-province-year fixed effects and the results are robust to these specifications. Moreover, we use the method proposed by Oster (2019) to ensure that our main results are not likely driven by unobservables.

Fifth, the negative relationship between corporate firm integrity and firms' risk-taking may be caused by a potential matching issue: Certain firms hire certain types of senior leaders, who determines corporate culture. In other words, rather than corporate integrity culture determined by senior leaders having an influence on firm risk-taking, it is possible that less risky firms deliberately choose to hire senior leaders with a high integrity. To mitigate this endogeneity concern, we follow prior literature (e.g., Huang and Kisgen, 2013;

Chen et al., 2023) and examine the changes in firms' risk-taking surrounding a turnover of chairman. More specifically, we compare the differences in changes in risk-taking for a firm that replaces a chairman who has a low integrity level with one with a high integrity level, as opposed to a firm that brings in a new chairman who has a low integrity level. Our results suggest that firms' risk-taking declines noticeably if a firm replaces a chairman with low integrity with one with high integrity.

In summary, all of the above approaches and tests produce consistent evidence that increased integrity culture negatively affects firm risk-taking. Although any approach and any piece of evidence is open to alternative interpretations, all the evidence taken together is difficult to reconcile with specific alternative arguments, and hence suggests a causal link between integrity culture and risk-taking.

Next, we investigate how integrity culture influences firm policies. We find that high integrity leads to policies associated with less R&D expenditure (*RD*), more current assets (*Liq*) and lower financial risk (*Lev*), which is consistent with less risk-taking. Economically speaking, a one-standard deviation increase in the integrity culture is associated with a 2.1% (0.8%) decrease and a 0.8% increase in *RD* (*Lev*) and *Liq* relative to the mean. However, we do not find a significant effect of integrity culture on capital expense, cash holding, dividend payout, debt maturity structure and M&A activities.

Then, we study the effect of integrity culture on management incentives. Management incentives refer to a series of measures that motivate management, which pushes them to take risks. However, in firms with high integrity level, the conflicts between management and shareholders will be alleviated, which may weaken the motivation of management incentives. Consistent with our prediction, we find that companies with high integrity offer less equity incentives to executives. Economically speaking, a one-standard deviation increase in the integrity culture is associated with a 0.77% decrease in the probability of equity incentives and 3.98% decrease in the number of equity incentives. Although integrity culture is related to less management incentives, which causes less risks-taking (Chen and Steiner, 1999; Low, 2009; Jiraporn et al., 2015), on the other hand, it also mitigates the principal-agent issues between shareholders and the management, which mitigates the adverse effects of less management incentives and increases risk-taking. Therefore, the net effect from less management incentives and more moderate principal-agent issues is unclear. To test whether a culture of integrity affects risk-taking by reducing management incentives, we regress risk-taking on integrity culture, adding extra control variables of management incentives. Results show that the less management incentives caused by integrity culture does not lower risk-taking.

Afterwards, we validate the three mechanisms proposed earlier. To test the first mechanism (i.e., excessive conservatism), we examine the cross-sectional heterogeneity in the effect of integrity culture on firm risk-taking, where we reckon that the negative effect of integrity culture on risk-taking should be more prominent when the firm is experiencing a more difficult time. Specifically, we investigate whether the negative effects of integrity culture on risk-taking are more significant during stock market crashes of 2015, periods of more intense market competition, and periods of poorer business performance and the results confirm our analysis.

To test the second mechanism (i.e., firm reputation), we examine whether the effect of integrity culture on firm risk-taking varies with firm reputation, information environment and whether belonging to high-tech industry. If the facts are as we analyzed them, then the negative effect of integrity culture should be more prominent in firms with lower reputation, worse information environment and non-high-tech industries (i.e., when corporate reputation is more vulnerable to damage by risk-taking). The outcomes support our mechanism analysis.

To prove the third mechanism (preference for stability), we first regress the tenure and replacement frequency of firm chairmen on integrity culture as longer tenure and less frequent replacement of chairmen mean preference for stability (Huang et al., 2022). Secondly, we conduct cross-sectional tests that make use of variation in several characteristics of nature of equity and firm development stages. As state-owned enterprises (SOEs) and firms in maturity period are more likely to chase stability, we reckon that the negative effect of integrity culture on firm risk-taking is more prominent in non-SOEs and younger firms. The results suggest that our third mechanism is workable.

In the final part of our paper, we wonder whether the less risk-taking induced by integrity culture is harmful to firm value. We first investigate that whether integrity culture undermines the efficiency of the capital allocation. Efficient capital allocation requires that managers undertake all projects with positive expected net present value and a negative relationship between integrity and capital allocation efficiency will emerge if less risk-taking induced by integrity is a deviation from the optimal risk-taking. The results suggest that integrity weakens the sensitivity of investment levels to investment opportunities and provide evidence for the deviation from optimal risk-taking of firms with integrity. Besides, to test more directly whether the lower level of risk taking caused by a culture of integrity will reduce the value of the enterprise, we regress firm value (Tobin's Q) on integrity culture, adding the variable of risk-taking, and the changes of coefficients again prove our analysis.

Our study contributes to the existing literature as follows. First, we enrich the researches concerning informal institution and corporate decision-making, especially corporate culture and risk-taking by investigating the impact of corporate integrity culture on firm risk-taking. Specifically, we add to the literature on the determinants of firm risk-taking and economic consequences of integrity culture. Extant studies have investigated the impact of informal institution such as ethical climate (Saini and Martin, 2009), religious beliefs (Shu et al., 2012; Chen et al., 2023), Clan culture (Huang et al., 2022), Confucian culture (Yan et al., 2021), national culture (Li et al., 2013), (uncertainty-avoiding) cultural heritage (Pan et al., 2020), executives superstition (Fisman et al., 2022) and political corruption (Khieu et al., 2023) on risk-taking and have investigated the impact of integrity culture on firm value (Guiso et al., 2015a; Li et al., 2021), investment–cash flow sensitivity (Jiang et al., 2019) and corporate social responsibility (Wan et al., 2020), while we add to this strand of literature by studying the effect of corporate integrity culture on firm risk-taking.

Second, our study sheds new light on how senior leaders influence firms' risk-taking as a firm's culture is mainly determined by its senior leaders (e.g., Kotter and Heskett, 1992; Baron and Hannan, 2002; O'Reilly et al., 2014; Guiso et al., 2015a; Graham et al., 2022). While recent studies have explored how executives, particularly the CEOs, affect their firms' risk-taking behavior, the focus is usually on CEOs' past experience, emotions, demographics and cognitive biases (e.g., Malmendier et al., 2011; Roussanov and Savor, 2014; Faccio et al., 2016; Sunder et al., 2017; Chen et al., 2023). Limited attention has been devoted to executives' personality, especially integrity. Our study advances this line of investigation by revealing an influence of integrity culture (mainly determined by senior leaders) on risk-taking, which enriches existing research into the influence of an executive's personality (especially integrity) on a firm's decisions.

Moreover, we expand the relationship between integrity and risk-taking from an individual to a company (organizational) level. Psychological research has found a negative correlation between personal integrity level and risk-taking (e.g., Lee et al., 2005; De Vries et al., 2009; Ashton et al., 2010; Weller and Tikir, 2011), while we are among the first to expand the relationship to firm level and study the effect of corporate integrity culture on firm risk-taking. Consistent with individual level research, we also find a negative relationship between corporate integrity culture and firm risk-taking. However, unlike them who find less individual risk-taking caused higher individual integrity is beneficial to themselves and society, the less corporate risk-taking induced by firm integrity is detrimental to firm value, which manifests the distinct eventual outcomes by different level of integrity.

Finally, most literature on firm integrity culture mainly explores the various benefits that integrity culture can bring, especially in reducing internal and external transaction costs (e.g., Koehn, 2005; Guiso et al., 2015a; Jiang et al., 2019; Li et al., 2021). Entrepreneurs also place great emphasis on the role of integrity in business (Guiso et al., 2015a, Graham et al., 2022). However, the prerequisite for utilizing the culture of integrity to serve enterprises is to fully leverage its strengths while avoiding its weaknesses as much as possible. Our paper suggests a dark side of integrity culture, which helps us better understand and utilize corporate integrity culture.

2 Research design

2.1 Sample selection and data collection

Our sample is comprised of all listed firms on the Shanghai Stock Exchange (SHSE) and Shenzhen Stock Exchange (SZSE) during the period of 2000–2020. We exclude financial firms and observations with missing variables. Applying the above criteria yielded a final sample of 33,095 observations. We also winsorized all continuous variables at 1% and 99% levels to alleviate the influence of extreme values. We get our integrity culture data through machine learning based on 42,408 annual reports, utilizing the method in Li et al. (2021). Other financial data are from the China Stock Market & Accounting Research (CSMAR) database.

2.2 Model specification

We employ the following empirical model to examine the influence of integrity culture on firm risk-taking:

$$Y_{i,t} = \alpha_0 + \alpha_1 Int_{i,t} + \sum \alpha_k Controls_{i,t} + Year + Industry + Province + \varepsilon \#(1)$$

where *i* indexes firm and *t* indexes year. *Y*, *Int* and *Controls* means risk-taking, integrity culture and control variables separately, which will be explained later. The regression coefficient α_1 represents the effect of integrity culture on corporate risk-taking. Besides, we include Year, Industry and Province fixed effects to mitigate omitted variable bias and standard errors are clustered at the firm level.

2.3 Variables definition

2.3.1 Dependent variable: Risk-taking

Since we cannot measure corporate risk-taking behaviors directly, existing literature usually measure firm outcomes instead. According to previous literature (Ljungqvist et al., 2017; Khieu et al., 2023), the measurement of corporate risk-taking mainly use indicators related to corporate performance. Based on the principle of risk and return equivalence, the higher the level of corporate risk-taking, the more high-risk projects the enterprise will invest in, and enterprise performance will manifest obvious uncertainty, resulting in greater volatility of enterprise profits and stock return in the observation period. Therefore, we employ two proxies to measure corporate risk-taking: the volatility of ROA (Risk1) and the volatility of stock return (Risk2) which can be attributed to the firm itself.

Specifically, we calculate earnings volatility (Risk1) as the five-year rolling standard deviation of industry-adjusted ROA (t-2 to t+2). The volatility of stock return (total risk: the standard deviation of daily stock returns over the last year) can be decomposed to two parts: systematic and idiosyncratic risk. Systematic risk is the proportion of total risk due to a firm's exposure to market-wide risks, while idiosyncratic risk is the proportion of total risk specific to the firm itself. As we expect idiosyncratic risk to be particularly important to our analysis of integrity culture, we use idiosyncratic risk (which is the standard deviation of the residuals from the market model regression) as our second indicator Risk2.

2.3.2 Independent variable: Integrity culture

An obstacle before us when studying corporate culture is the measurement of culture. In the early stage, corporate culture is measured by proxy variables, questionnaires or interviews. Although measuring corporate culture by questionnaires or interviews has the advantage of being able to communicate directly with stakeholders, there are problems such as low response rate of questionnaires, subjective cognitive bias in responses, and usually only cross-sectional data can be obtained, which limits the sample size (Cycyota and Harrison, 2006; Graham et al., 2022).

With the development of computer technology, more and more scholars use text analysis method to measure corporate culture (here means conventional lexicon-based text analysis without using machine learning to expand the dictionary). However, the direct and simple use of lexicon-based text analysis has the following disadvantages. First, the subjectivity of artificially defined vocabulary (Illia et al., 2014). Second, the word set chosen to measure corporate culture is not comprehensive enough and is hard to keep pace with the times (Li et al., 2021). Third, the words chosen to measure corporate culture may not be suitable for financial text situations (Li et al., 2021). Fourth, it is susceptible to the boast of the management (Guiso et al.,

2015a).

Utilizing one of the latest machine learning techniques, Word2Vec model, can effectively avoid the above shortcomings (Li et al., 2021). On the one hand, while using the trained Word2vec model to expand seed words, we can verify the validity and accuracy of the words[2], and avoid the subjectivity and arbitrariness of the artificially defined vocabulary. On the other hand, companies are more likely to use common words when boasting about integrity culture, such as "integrity" and "honesty", while the Word2Vec machine learning method can expand the seed words to hundreds or even thousands, so the score of corporate integrity culture will depend on the whole word set, rather than the common words. Besides, we can update the culture dictionary by using the latest corpus, which is unrealistic for manually defined dictionary (Li et al., 2021). Therefore, we combine the existing Chinese and English word sets of "integrity culture", the characteristics of the annual report corpus of listed companies in China and Word2Vec model to develop a Chinese word set that can reflect the "integrity culture", and then constructs the corporate integrity culture index through the integrity culture dictionary.

We employ the method used in Li et al. (2021) to build integrity culture indicators. Specifically, the preparation process to train the Word2vec model is as follows: (1) Use Python to obtain the PDF annual reports of all listed companies from 2000 to 2020 in the official websites of Shanghai Stock Exchange and Shenzhen Stock Exchange. (2) Decrypt the PDF documents first (if needed) and then convert all PDF annual reports into TXT documents, and eliminate missing or garbled documents[3]. (3) With the period as the separator, the TXT document is processed into one sentence per line form, and all TXT documents are integrated into a single text document, which is used as the training corpus of Word2vec model[4]. In this process, we need to segment the annual report text and remove the stopwords. In this paper, we use Jieba and a user-defined dictionary based on the "Accounting Vocabulary" in Sogou thesaurus to segment the annual report text and use word list from HIT to remove the stopwords.[5]

After training the Word2vec model, the construction process of corporate integrity culture indicators is as follows.

(1) The selection of seed words. Drawing on integrity culture vocabulary in Jiang et al. (2019) and Li et al. (2021), we formulate the seed word set of "integrity culture", which applies to the Chinese corporate annual report. We also use the Word2vec model to verify the effectiveness and accuracy of the seed word set. The final seed word set includes words like "integrity", "honesty", "sincerity", "piety", "ethic", "credit", "trust", "transparency", "wholeheartedness", "fairness", etc.[6]

(2) Expand the seed words. We use the trained model to expand the seed words, and inappropriate similar words were removed[7]. Finally, the expansion words include words like "pragmatic", "grateful", "friendly", "reputation", "win-win", etc.[8] In addition, we use the Wingo data platform[9] to verify the validity of the expansion words obtained from Word2vec model. It is found that the expansion words we got are consistent with the platform, indicating that the Word2vec model we trained performs well.

(3) Calculate the integrity culture according to seeds word and expansion words. Based on the seed words and extended words we got, we use tf.idf weighting method (term frequency-inverse document frequency) to calculate integrity culture, which accounts for both the importance of a word in a document and the

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[2] The effectiveness and accuracy of seed words can be tested by using the similar word expansion function of the trained Word2vec model. If most of the expansion words of a word have nothing to do with the corporate integrity culture, it can be considered that it is not suitable to represent the corporate integrity culture. At the same time, this method can also be used to test whether the words measuring the corporate integrity culture fit the financial text situation.

[3] 42,408 annual report texts are obtained finally.

[4] The training corpus is about 11 gigabytes in size.

[5] The parameters used to train the model are similar to Li et al. (2021).

[6] Due to the difference between Chinese and English, the translated seed words may be not that accurate. We list the original seed words in the Appendix B.

[7] For example, some expansion words are removed because the cosine similarity is too low, they do not fit the financial text situation, or only apply to a certain industry.

[8] We get 91 expansion words in total and they are listed in the Appendix B.

[9] Wingo data platform is the first AI financial data platform based on the text disclosed by listed companies in China. Many scholars have used it to perform a data processing (e.g., Tian et al., 2022; Liang et al., 2023).

significance of a word within the corpus. Specifically, the importance of a word representing the integrity culture in a certain annual report text is calculated by the following formula:

$$W_{i,j} = TF_{i,j} \times \log\left(\frac{N}{DF_i}\right) \#(2)$$

where *i* represents integrity word and *j* represents annual report text. $W_{i,j}$ stands for the importance of word *i* in annual report text *j*. $TF_{i,j}$ is the number of occurrences of word *i* in annual report text *j*. *N* is the total number of annual report and DF_i is the number of annual report containing the word *i*. Compared with equal-weighted word-frequency method, tf.idf weighting method gives lower weight to words with higher frequency across the documents, which makes the frequent words have less impact on the integrity culture, and can effectively alleviate the problem of managers' "boasting" (Li et al., 2021). We sum up all the words representing integrity culture, standardize it using the total number of words in the annual report text, and finally multiplies them by 100 to get our corporate integrity culture indicator *Int*. The larger the index is, the stronger the corporate integrity culture atmosphere is. Besides, in the robustness tests section, we use equal-weighted word-frequency to get integrity culture indicator *Int2* and tf.idf weighting method to get integrity culture indicator *Int3*, which is only based on the seed words.

2.3.3 Control variables

We include a series of control variables that could impact a firm's risk-taking in our regressions: *Size*, the natural logarithm of the firm's book value of assets; *Lev*, total debt over total assets; *ROA*, the return on assets; *Fixed*, net properties, plants, and equipment (PPE) scaled by total assets; *Growth*, the increased percentage of sales revenue; *Age*, the natural logarithm of one plus the number of years since the establishment of the firm; *Cash*, net cash flow generated from operating activities divided by total assets; *Duality*, whether the chairman and the CEO is the same person; *Top1*, the ownership of the largest shareholder; *Indepdir*, the proportion of independent directors; *Inst*, the ratio of the shares held by institutional investors divided by the total shares; *Boardsize*, the natural logarithm of the size of the board; *SOE*, whether the firm is state-owned; *BM*, book value of assets to market value of assets. Appendix A provides definitions of all variables used in our analysis.

2.4 Descriptive statistics

Table 1 reports descriptive statistics for the main variables to be used in our analyses. The mean (standard deviation) for *Risk1* and *Risk2* is 0.0575 (0.0785) and 0.0515 (0.0193), which is similar to Khieu et al. (2023) and He et al. (2023). *Int* depicts corporate integrity culture and the mean value of *Int* is 0.0626 which means that, on average, 0.0626% of the words in annual report are about integrity. All other variables have values within the normal range (Song et al., 2021; He et al., 2023).

Table 1
Descriptive statistics

Variables	N	Mean	SD	Min	Median	Max
Risk1	33095	0.0575	0.0785	0.0036	0.0286	0.4889
Risk2	31305	0.0515	0.0193	0.0185	0.0484	0.1155
Int	33095	0.0626	0.0415	0.0000	0.0550	1.1034
Size	33095	22.0295	1.2711	19.2360	21.8444	26.3978
Lev	33095	0.4303	0.2036	0.0274	0.4281	0.9911
ROA	33095	0.0441	0.0626	-0.3982	0.0411	0.2447
Cash	33095	0.0497	0.0708	-0.2244	0.0490	0.2825
Fixed	33095	0.2313	0.1685	0.0015	0.1975	0.8064
Growth	33095	0.1776	0.4078	-0.7368	0.1173	4.3304
Boardsize	33095	2.1504	0.2018	1.6094	2.1972	2.7081
Indepdir	33095	0.3708	0.0532	0.1000	0.3333	0.6000
Duality	33095	0.2459	0.4306	0.0000	0.0000	1.0000
Top1	33095	0.3578	0.1514	0.0832	0.3384	0.7584

SOE	33095	0.4219	0.4939	0.0000	0.0000	1.0000
Age	33095	2.7615	0.3996	0.6931	2.8332	3.5553
BM	33095	1.0203	1.0855	0.0514	0.6744	10.1418
Inst	33095	0.3491	0.2460	0.0000	0.3409	0.8867

Note: This table reports descriptive statistics of the main variables used in this paper during the sample period 2000–2020. All continuous variables are winsorized at 1% and 99% levels.

3 Empirical results

3.1 Validation of integrity culture

We employ the following OLS model to examine the validation of integrity culture indicator:

$$Validation_{i,t} = \alpha_0 + \alpha_1 Int_{i,t} + \sum \alpha_k Controls_{i,t} + Year + Industry + \varepsilon \#(3)$$

where *i* represents firm and *t* refers to year. *Validation* is a series of variables that are well-established markers for best practices in corporate integrity, including *Restatement*, *Opacity*, *UnPerks* and *Overpay*. *Restatement* is a dummy variable, which equals 1 if firm *i* issues a financial restatement notice in year *t*, and 0 otherwise. *Opacity* is the information disclosure evaluation score from the Shenzhen Stock Exchange and Shanghai Stock Exchange, with four levels: 1=Excellent, 2=Good, 3=Passed, and 4=Failed. *Unperks* and *Overpay* represents executive excess perks and overpayment separately, which is based on the method in Xu et al. (2014) and Core et al. (2008). *Int* and *Controls* mean integrity culture indicator *Int* and a series of control variables as in equation (1). If our indicator actually captures a firm's integrity culture, rather than "boasted" culture or something else, we should observe a negative α_1 across column 1 to 4.

Table 2 displays the results. As we can see, the coefficients on *Int* are all nearly significantly negative across column 1 to 4 (column 1 approaches statistical significance at the 10% level), which validates our measure of integrity culture.

Table 2
Validation of integrity culture

	(1)	(2)	(3)	(4)
Variables	*Restatement*	*Opacity*	*UnPerks*	*Overpay*
Int	-0.898	-2.493***	-0.008**	-0.220***
	(-1.49)	(-6.31)	(-2.06)	(-2.70)
Constant	0.816		0.068***	-1.981***
	(1.20)		(14.24)	(-19.58)
Observations	12,274	22,361	28,881	30,789
R-squared			0.047	0.081
Controls	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

Note: This table reports the results of the validation test of integrity culture. Column 1 and 2 use logit and ologit regression respectively, while column 3 and 4 employ OLS regression. t-Statistics in the brackets are based on robust standard errors. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

3.2 Baseline regressions

Table 3 reports the estimated results of model (1). The coefficients of *Int* in columns 1 and 2 are significantly negative at the level of 5% and 1% respectively, which means that, the higher the company's integrity culture, the lower its risk-taking. Economically speaking, a one-standard deviation increase in the integrity culture *Int* is associated with a 2.74% (0.8%) decrease in firm risk-taking *Risk1* (*Risk2*) relative to the mean. In terms of the control variables, the results of the regression coefficients are also consistent with previous research findings. For example, firms with more assets, a higher *ROA*, a larger board of directors and a higher book to market ratio are more likely to take less risks, while firms with a higher sales growth and the chairman and the CEO being the same person are more tolerant of risks (Ferris et al., 2017; Bernile et al.,

2018; Tan et al.,2022).

Table 3
Baseline regressions

Variables	(1) *Risk1*	(2) *Risk2*
Int	-0.038**	-0.010***
	(-2.41)	(-4.21)
Size	-0.003***	-0.003***
	(-2.96)	(-24.54)
Lev	-0.008	0.016***
	(-1.31)	(21.75)
ROA	-0.271***	-0.008***
	(-18.55)	(-3.90)
Cash	0.031***	-0.004**
	(3.63)	(-2.56)
Fixed	-0.010	-0.004***
	(-1.64)	(-5.07)
Growth	0.008***	0.004***
	(5.79)	(15.67)
Boardsize	-0.012**	-0.001
	(-2.40)	(-1.36)
Indepdir	-0.004	0.004*
	(-0.22)	(1.83)
Duality	0.000	0.001***
	(0.16)	(3.84)
Top1	-0.022***	0.002**
	(-3.75)	(2.07)
SOE	-0.006***	-0.001***
	(-2.82)	(-3.37)
Age	0.002	-0.001***
	(0.79)	(-3.65)
BM	-0.001	-0.003***
	(-1.49)	(-19.52)
Inst	0.013***	-0.002***
	(3.43)	(-4.41)
Constant	0.165***	0.128***
	(6.68)	(38.14)
Observations	33,095	32,241
R-squared	0.121	0.372
Industry FE	YES	YES
Year FE	YES	YES
Province FE	YES	YES

Note: This table reports the results of the effect of integrity culture on firm risk-taking. t-Statistics in the brackets are based on standard errors adjusted for clustering at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

4 Endogeneity concerns

4.1 Quasi-natural experiment: "Credit Demonstration City" pilot policy

In order to address the endogeneity concern such as reverse causality and omitted variables correlated with both integrity culture and firm risk-taking, we use a DiD approach by relying on a quasi-natural experiment: "Credit Demonstration City" pilot policy. To improve China's social credit system, the National Development and Reform Commission and the People's Bank of China jointly issued a document in August 2015, listing Shenyang, Qingdao, Nanjing, Wuxi and other 7 cities among the first batch of national credit demonstration city. On April 6, 2016, Dalian, Anshan, Liaoyang and other 29 cities are listed among the second batch of national credit demonstration city. There are 43 national credit demonstration cities in total till 2020.

According to the requirements of the pilot policy, the goals and tasks of credit demonstration cities are to implement a unified social credit code system; establish and improve credit records in various fields for

citizens, legal persons, and other organizations; strengthen promotion and use of credit records and credit products in fields such as administrative approval, bidding, government procurement, and the use of fiscal funds; establish and implement a joint disciplinary mechanism for dishonest behavior[10]; and carry out intensive activities in integrity education and promotion. During the process, corporate integrity status will be influenced for the punishments of dishonest behaviors, integrity education and publicity and improvement of integrity of corporate employees.

The entry into national credit demonstration city depends on a city's overall credit performance, such as the implementation of credit system, the construction of credit information infrastructure, honesty supervision, the promotion of credit to real economy, the propaganda of integrity system and culture and the integrity levels of citizens, enterprises and the government. In other words, the entry into national credit demonstration city is motivated largely by a city's overall credit performance rather than by the economic status or the financial characteristics of the firms in the city. This event provides us a nice quasi-natural experiment on how integrity culture affects firm innovation. The "Credit Demonstration City" pilot policy in our setting serves as a source of exogenous variation in integrity culture, which should affect a firm's subsequent firm risk-taking only through its effect on corporate integrity culture. Hence, the DiD model employed is:

$$Risk_{i,t} = \alpha_0 + \alpha_1 Policy_{i,t} + \beta Treatment_i * t + \sum \alpha_k Controls_{i,t} + \varepsilon \#(4)$$

where *i* indexes firm and *t* indexes time. The dependent variable *Risk* is the measurement of firm risk-taking. *Policy* is the exogenous shock of "Credit Demonstration Cit" pilot policy, which equals one for the year the company office is selected as the "Credit Demonstration Cit" and any year after, and zero otherwise. *Controls* represents a series of control variables, which include the same variables in the baseline regression model (1). Beyond that, we include treatment-specific linear time trends to control for the differences in time trends between the treatment and control groups. In addition, we include Year, Industry and Province fixed effects to mitigate the omitted variable bias and standard errors are adjusted for clustering at the firm level.

The result of DiD test is reported in table 4. In column 1, we check the DiD estimator for corporate integrity to verify the premise of the natural experiment: Exogenous shocks to corporate integrity due to "Credit Demonstration City" pilot policy should lead to an increase of corporate integrity culture for the treatment group relative to the controls. Consistent with this conjecture, we observe a relative rise in integrity culture of the treatment group which is significant at 5% level. Column 2 and 3 reports the DiD estimation for firm risk-taking *Risk1* and *Risk2*, respectively. The result shows that the estimated coefficients of pilot policies are significantly negative (significant at 1% and 10% level separately), which means that the "Credit Demonstration City" pilot policy reduces firm risk-taking through cultivating integrity culture.

Table 4
Quasi-natural experiment: "Credit Demonstration City" pilot policy

	(1)	(2)	(3)	(4)	(5)
VARIABLES	*Int*	*Risk1*	*Risk2*	*Risk1*	*Risk2*
Policy	0.004**	-0.018***	-0.001*	-0.026***	-0.001**
	(2.25)	(-4.45)	(-1.81)	(-5.13)	(-2.32)
Constant	0.114***	0.157***	0.125***	0.148***	0.125***
	(8.01)	(6.34)	(36.93)	(5.50)	(34.64)
Observations	33,063	32,472	31,303	27,779	26,840
R-squared	0.067	0.123	0.370	0.124	0.372
Controls	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

[10] For example, those who are included in the list of dishonest persons subject to enforcement by the court will be restricted from engaging in high-end consumption and non-necessary spending, such as buying real estate, leasing high-end office buildings, tourism and vacationing. Their children will also be prohibited from attending high-fee private schools.

Province FE	YES	YES	YES	YES	YES

Note: This table reports the endogeneity concerns using the DiD approach. t-Statistics in the brackets are based on standard errors adjusted for clustering at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

The key to use a DiD approach is whether the parallel trends assumption is satisfied. We use event study approach proposed by Jacobson et al. (1993) to test it. The result is reported in figure 1. We take time -1, the year just before the pilot policy, as the base year. As we can see in figure 1, there is no significant difference between the treatment group and the control group before the implementation of the pilot policy, which confirms that using the DiD model is suitable. After time 0, the estimated coefficients are negative and statistically significant, indicating that the decrease of firm risk-taking in the treatment group relative to the control group is due to the increase of integrity, rather than the difference between the treatment group and the control group before the policy.

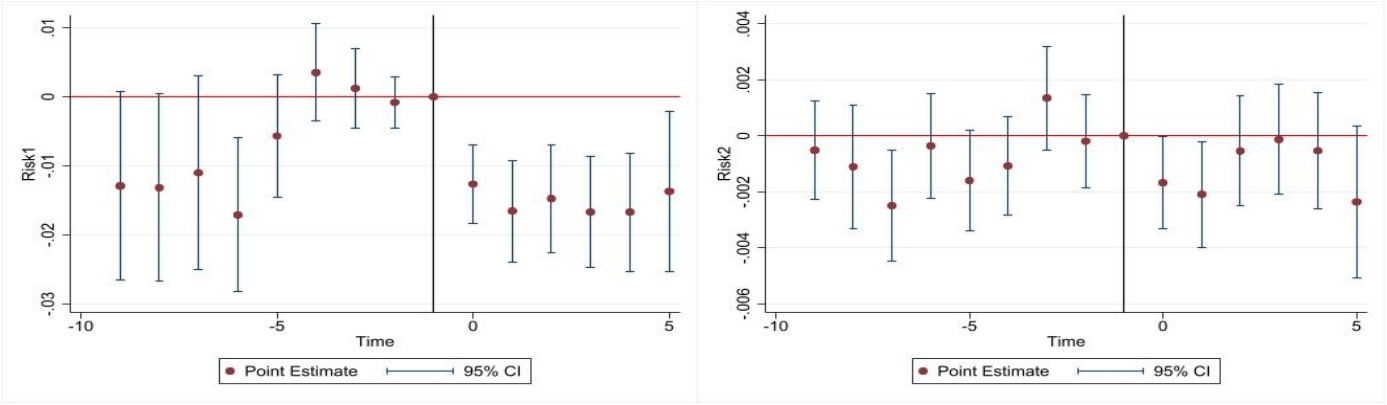


Figure 1
This figure reports the test of parallel trends assumption, where Time represents the period when the policy occurred and the solid line perpendicular to the horizontal axis represents the 95% confidence interval. The controls in the model are the same as the DiD model (4) and the Year×Industry and Year×Province fixed effects are controlled. Standard errors are clustered at the firm level.

Considering the problem of heterogeneous treatment effects when using DiD with multiple time periods, we conduct a series of robustness tests. Firstly, we adopt suggestions from de Chaisemartin and D'Haultfoeuille (2020) to use twowayfeweights Stata command and find that less than one-sixth of the weights are negative and that their sum is only 0.005. In addition, there are only two batches of pilot cities in our study, and the first batch of pilot cities accounts for 25% of all pilot cities, with corresponding observations making up 14% of all observations. So, we exclude observations in the first batch and rerun the regression. Column 4 and 5 of table 4 list our results and it is qualitatively unchanged. Lastly, we also present the event study figures generated by a set of recently proposed estimators that are robust to treatment effect heterogeneity in the Appendix C (de Chaisemartin and D'Haultfoeuille, 2020; Borusyak et al., 2021; Callaway and Sant'Anna, 2021), which is consistent with the parallel trends assumption.

4.2 Propensity score matching estimates

To further address the concern for endogeneity, we employ a PSM approach whereby firm-year observations with a high integrity culture are matched with those with a low integrity culture. As integrity culture *Int* is a continuous variable, we first divided the sample into three parts based on the size of the integrity culture *Int* to construct *Int_rank*, with the largest one-third being considered as the high integrity culture group (*Int_rank*=1) and the rest as the low integrity culture group (*Int_rank*=0)[11]. We proceed in two steps to identify a matched sample of firm-years with a low integrity that exhibit no significant differences in other observable characteristics with those with a high integrity. We first estimate the probability that a firm has a high integrity culture by running a logit regression[12], reported in column (1) of Table 5, that includes the same controls as in the baseline regressions. In the second step, we construct matched samples using the nearest-neighbor method based on the propensity scores calculated from the first-step logit model.

[11] Our results remain robust when we use alternative grouping methods, such as dividing the sample into two or four groups based on integrity.
[12] Our results remain robust when we use a probit regression.

Specifically, each firm-year observation with a high integrity (the treatment group) is matched with the firm-year observation with a low integrity (the control group) with the closest propensity score. To ensure observations in the treatment and control groups are sufficiently indistinguishable, we require that the maximum difference (i.e., the caliper) in the propensity score between each firm-year with a high integrity and that of its matched peer does not exceed 0.01 in absolute value.[13]

To verify that firms in the treatment and control groups are truly comparable, we conduct two diagnostic tests. The first test consists of re-estimating the logit model for the post-match sample. The results are shown in regression (2) of Table 5. None of the coefficient estimates are statistically significant, suggesting no distinguishable trends in risk-taking exist between the two groups. Further, the coefficient estimates in regression (2) are much smaller in magnitude than those in regression (1), suggesting the results in regression (2) are not simply an artifact of a decline in degrees of freedom in the restricted sample. The second test consists of examining the difference for each observable characteristic between the treatment firms and the matched control firms. The results are reported in the appendix D for brevity. Again, none of the differences in observable characteristics between the treatment and control firms is statistically significant. Overall, the diagnostic test results suggest PSM removes all observable differences other than the difference in the corporate integrity culture, increasing the likelihood that any difference in risk-taking between the two groups is due to integrity culture.

Column 3 and 4 of table 5 report the regression results utilizing the matched sample. The coefficients for integrity culture *Int* remain negative and significant, which is consistent with our main results.

Table 5
Propensity score matching estimates

	(1)	(2)	(3)	(4)
Variables	*Int_rank*	*Int_rank*	*Risk1*	*Risk2*
Int			-0.042**	-0.097**
			(-2.55)	(-2.54)
Size	-0.148***	0.002	-0.003**	-0.005*
	(-5.36)	(0.06)	(-2.15)	(-1.81)
Lev	-0.217	0.009	-0.006	-0.011
	(-1.61)	(0.06)	(-0.87)	(-0.69)
ROA	1.898***	0.041	-0.223***	-0.524***
	(6.05)	(0.11)	(-12.33)	(-12.93)
Cash	0.481**	0.003	0.029***	0.072***
	(2.09)	(0.01)	(3.04)	(3.26)
Fixed	0.344**	0.038	-0.009	-0.019
	(2.22)	(0.23)	(-1.33)	(-1.16)
Growth	-0.065*	-0.026	0.006***	0.016***
	(-1.93)	(-0.68)	(3.62)	(3.92)
Boardsize	-0.037	0.019	-0.009	-0.024*
	(-0.29)	(0.14)	(-1.59)	(-1.78)
Indepdir	-0.367	0.100	-0.007	-0.015
	(-0.90)	(0.22)	(-0.41)	(-0.35)
Dual	0.017	-0.004	0.001	0.000
	(0.36)	(-0.08)	(0.44)	(0.05)
Top1	0.401**	0.052	-0.021***	-0.052***
	(2.54)	(0.31)	(-3.23)	(-3.55)
SOE	-0.316***	-0.009	-0.007***	-0.014**
	(-5.39)	(-0.15)	(-2.68)	(-2.49)
Age	-0.123*	0.004	0.004	0.013*

[13] Our results remain robust when we change the maximum permissible difference in propensity scores to 0.05 or 0.005.

	(-1.73)	(0.05)	(1.14)	(1.84)
BM	-0.035	0.014	-0.002	-0.006**
	(-1.28)	(0.46)	(-1.44)	(-1.97)
Inst	-0.131	-0.025	0.016***	0.042***
	(-1.40)	(-0.25)	(3.69)	(4.30)
Constant	2.228***	-0.177	0.141***	0.300***
	(3.38)	(-0.25)	(4.92)	(4.62)
Observations	34,171	21,674	21,674	21,674
(Pseudo) R-squared	0.046	0.001	0.110	0.120
Controls	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Province FE	YES	YES	YES	YES

Note: This table reports the endogeneity concerns of using propensity score matching estimates. T-statistics in the brackets are based on standard errors adjusted for clustering at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

4.3 Residual integrity to proxy for integrity culture

Corporate integrity culture can be associated with many factors including firms' size, performance, corporate governance, etc., which also affect risk-taking (Guiso et al., 2015a). To address this endogeneity concern, we follow previous literature (e.g., Wiersema & Zhang, 2011; Chen et al., 2023) and first regress *Int* on all the control variables used in our main analysis. We then use the residuals from this regression (labelled as *Resid_Int*) as a proxy for corporate integrity culture and re-estimate our baseline model. The results are reported in the column 1 and 2 of panel A of table 6. The coefficient of *Resid_Int* is significantly negative, consistent with our main analyses.

4.4 Address concerns of omitted variables

We add a series of executive characteristics (here means chairman), which are important determinants of corporate risk-taking and may be potential determinants of integrity culture, as extra control variables to mitigate the omitted variables bias. Specifically, we add chairman age, tenure, gender and education background, where chairman age and tenure often proxy for chairman risk-aversion, while male and well-educated chairmen are usually believed to be overconfident (e.g., Prendergast and Stole, 1996; Byrnes et al., 1999; Forbes, 2005; Heavey et al., 2022). The regression results shown in column 3 and 4 of panel A of table 6 are qualitatively unchanged.

To further address the concern that some unobservable executive characteristics might affect both integrity culture and risk-taking, resulting in the observed negative integrity-risk-taking relation, we examine a subset of newly appointed chairmen who should have little or no time to gain control over corporate decisions or integrity culture (Chang et al., 2016). The results are reported in the column 5 and 6 of panel A of table 6, which is consistent with our baseline regressions.

Besides, to further mitigate any concern about omitted variables that are correlated with a firm's integrity culture and vary within industries and years, provinces and years or industries and provinces and years, we include industry-year, province-year and industry-province-year fixed effects and the results shown in column 1 to 4 of panel B of table 6 are robust to these specifications.

In order to further prove that the benchmark regression model in this article does not have serious omitted variable bias, we follow the method proposed by Oster (2019), whose idea is to exploit changes in coefficients and R-squared with the introduction of covariates in the models to compute a lower bound for the parameter of interest, under a set of assumptions about the degree of selection on unobservables (Aubery and Sahn, 2021). Under the assumption that equal selection on observables and unobservables (δ=1), and for a R_{max} set to 1.3 R-squared (R_{max}=1.3), as recommended by Oster (2019), the "true" β is likely bounded at [−0.045, −0.038] for *Risk1* and [−0.016, −0.010] for *Risk2* as reported in the panel C of table 6. Oster (2019)

proposes two ways for assessing the robustness of estimated β coefficients: whether the bound (1) falls within the 99.5% confidence interval for the coefficient, and (2) excludes zero. Because the (1) likely bounds for β [−0.045, −0.038] ([−0.016, −0.010]) fall within the 99.5% confidence interval for β in table 3 [−0.082, 0.006] ([−0.017, -0.003]), and (2) the bounding estimate excludes zero, the estimated β coefficient in table 3 is not likely driven by unobservable variables that are at least as important as the observable, controlled covariates. In addition, panel C reports that δ=6.22 (1.96), suggesting that unobservable variables must be more than nearly sixth (twice) as important as control variables to eliminate the effect of integrity culture entirely, which is unlikely. In conclusion, our main results are not likely driven by unobservables.

Table 6
Residual integrity and addressing concerns of omitted variables

Panel A. Residual integrity and omitted executive characteristics

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	*Risk1*	*Risk2*	*Risk1*	*Risk2*	*Risk1*	*Risk2*
Resid_Int	-0.038**	-0.010***				
	(-2.41)	(-4.21)				
Int			-0.030*	-0.008***	-0.095***	-0.012*
			(-1.71)	(-3.15)	(-3.25)	(-1.69)
Constant	0.161***	0.126***	0.223***	0.140***	0.261***	0.119***
	(6.52)	(38.02)	(5.79)	(27.03)	(6.30)	(14.31)
Observations	33,095	32,241	26,037	24,834	3,950	3,957
R-squared	0.121	0.372	0.113	0.381	0.197	0.368
Controls	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Province FE	YES	YES	YES	YES	YES	YES

Panel B. Addressing concerns of omitted variables by interactive fixed effects

	(1)	(2)	(3)	(4)
Variables	*Risk1*	*Risk2*	*Risk1*	*Risk2*
Int	-0.031**	-0.011***	-0.040**	-0.010***
	(-2.17)	(-4.30)	(-2.51)	(-3.64)
Constant	0.133***	0.129***	0.127***	0.130***
	(5.82)	(37.57)	(5.07)	(35.75)
Observations	33,086	32,231	31,504	30,660
R-squared	0.260	0.403	0.286	0.436
Controls	YES	YES	YES	YES
Industry*Year FE	YES	YES	NO	NO
Province*Year FE	YES	YES	NO	NO
Industry*Province*Year	NO	NO	YES	YES

Panel C. Oster (2019) method

	(1)	(2)
Variables	*Risk1*	*Risk2*
"True" β bound	[−0.045, −0.038]	[−0.016, −0.010]
99.5% confidence interval for β	[−0.082, 0.006]	[−0.017, -0.003]
δ for β=0	6.22	1.96

Note: This table reports the results of using residual integrity and addressing concerns of omitted variables. T-statistics in the brackets are based on standard errors adjusted for clustering at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

4.5 A Difference-in-Differences (DID) analysis of chairman turnover

The negative relationship between corporate firm integrity and firms' risk-taking may be caused by a potential matching issue: Certain firms hire certain types of senior leaders, who determines corporate culture. In other words, rather than corporate integrity culture determined by senior leaders having an influence on firm risk-taking, it is possible that less risky firms deliberately choose to hire senior leaders with a high integrity. To mitigate this endogeneity concern, we follow prior literature (e.g., Huang and Kisgen, 2013; Chen et al., 2023) and examine the changes in firms' risk-taking surrounding a turnover of chairman. More specifically, we compare the differences in changes in risk-taking for a firm that replaces a chairman who has a low integrity level with one with a high integrity level, as opposed to a firm that brings in a new chairman who has a low integrity level.

To construct the chairman turnover sample, we first require an incoming chairman to have remained subsequently in the position for at least 3 consecutive years to ensure that the incoming chairman could actually have an impact on the firm's risk-taking. We also require the outgoing chairman to have a low integrity level (we use the average value of corporate integrity culture during the chairman's tenure as the proxy for the chairman's level of integrity and those who have an integrity status below the median of the sample are consider a chairman with a low integrity level, otherwise a chairman with a high integrity level). Hence, our sample includes firm-years in which a firm experiences a chairman turnover, with the outgoing chairman having a low integrity level, and the incoming chairman may or may not have a high integrity level. We include firm-year observations at least 3 years before and 3 years after chairman turnover for all firms experiencing chairman turnover. We code a dummy variable *Post* that equals 1 for firm-year observations after chairman turnover events and 0 for all firm-year observations before the said events. *High_Int* is a dummy variable that equals 1 for an incoming chairman with a high integrity level and 0 otherwise. Table 7 Column 1 and 2 presents the DID results. As we expect, the coefficient on *Post*High_Int* is negative and significant in predicting firms' risk-taking (significant at a level of nearly 10% for *Risk2*), suggesting that firms' risk-taking declines noticeably if a firm replaces a chairman with a low integrity level with one with a high integrity level.

Table 7
A Difference-in-Differences (DID) analysis of chairman turnover

	(1)	(2)
Variables	*Risk1*	*Risk2*
*Post*High_Int*	-0.012***	-0.001
	(-2.63)	(-1.41)
High_Int	-0.001	0.000
	(-0.37)	(0.10)
Post	0.006*	-0.001
	(1.83)	(-1.17)
Constant	0.189***	0.108***
	(5.22)	(17.01)
Observations	4,655	4,585
R-squared	0.192	0.428
Controls	YES	YES
Industry FE	YES	YES
Year FE	YES	YES
Province FE	YES	YES

Note: This table reports the results of a Difference-in-Differences (DID) analysis of chairman turnover. T-statistics in the brackets are based on robust standard errors. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

5 Robustness tests

5.1 Alternative measures of dependent variables

In this part, several alternative proxies are employed to evaluate firm risk-taking: the maximum difference value of the industry-adjusted ROA from period t-2 to t+2 (*Risk3*); the three-year rolling standard deviation of industry-adjusted ROA (t-2 to t) (*Risk4*); the maximum difference value of the industry-adjusted ROA from period t-2 to t (*Risk5*); the five-year rolling standard deviation of industry-adjusted ROE (t-2 to t+2) (*Risk6*); the maximum difference value of the industry-adjusted ROE from period t-2 to t+2 (*Risk7*); the next five-year rolling standard deviation of industry-adjusted ROA (t to t+4) (*Risk8*); the standard deviation of daily stock returns over the last year (*Risk9*).

Table 8 displays the results, indicating that integrity culture has a significant and negative correlation with alternative firm risk-taking measures, which is consistent with our baseline regressions.

Table 8
Alternative measures of dependent variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables	*Risk3*	*Risk4*	*Risk5*	*Risk6*	*Risk7*	*Risk8*	*Risk9*
Int	-0.088**	-0.015***	-0.027**	-0.026*	-0.059*	-0.016**	-0.003*
	(-2.41)	(-2.60)	(-2.57)	(-1.94)	(-1.90)	(-2.14)	(-1.78)
Constant	0.356***	0.098***	0.183***	0.173***	0.375***	0.090***	0.087***
	(6.28)	(10.83)	(10.85)	(7.83)	(7.36)	(7.86)	(36.12)
Observations	33,172	33,267	33,267	33,831	33,831	30,483	34,140
R-squared	0.130	0.179	0.177	0.241	0.238	0.184	0.351
Controls	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Province FE	YES	YES	YES	YES	YES	YES	YES

Note: This table reports the robustness tests of alternative proxies for firm risk-taking. T-statistics in the brackets are based on standard errors adjusted for clustering at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

5.2 Alternative measures of independent variables

We use an expanded dictionary (including seed words and expansion words) and a tf.idf weighting method to get our independent variable *Int*. In this part, we use three alternative measures of corporate integrity culture. Specifically, we use equal-weighted word-frequency to get integrity culture indicator *Int2* (based on the expanded dictionary) and tf.idf weighting method to get integrity culture indicator *Int3* (based on the seed words only). The column 1 to 4 of table 9 displays the results, indicating that alternative corporate integrity culture measures have a significant and negative correlation with firm risk-taking, which is consistent with our baseline regressions. In addition, in order to eliminate the differences in integrity culture among different industries, we use the industry average adjusted indicators *Int4* to measure the integrity level of enterprises, and the results in column 5 and 6 of table 9 suggest that the coefficient of integrity culture indicator is still significantly negative.

Table 9
Alternative measures of independent variables

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	*Risk1*	*Risk2*	*Risk1*	*Risk2*	*Risk1*	*Risk2*
Int2	-0.050**	-0.012***				
	(-2.19)	(-3.06)				
Int3			-0.067**	-0.009*		
			(-2.50)	(-1.84)		
Int4					-0.029*	-0.011***
					(-1.81)	(-4.36)

Constant	0.166***	0.128***	0.164***	0.127***	0.163***	0.127***
	(6.70)	(38.01)	(6.62)	(37.98)	(6.58)	(38.13)
Observations	33,095	32,241	33,095	32,241	33,095	32,241
R-squared	0.121	0.372	0.121	0.372	0.121	0.372
Controls	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Province FE	YES	YES	YES	YES	YES	YES

Note: This table reports the robustness tests of alternative proxies for firm integrity culture. T-statistics in the brackets are based on standard errors adjusted for clustering at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

5.3 Exclude the period of financial crisis and stock market disaster

Considering the negative effect of financial crisis during 2008-2009 and China's stock market rout in 2015-2016 on firm earnings volatility and stock return volatility, we drop observations in these two periods. The results are reported in column 1 and 2 of table 10, which are consistent with the baseline regression.

5.4 Use lagged independent variables

There is a potential lag effect of integrity culture on corporate risk-taking activities. While current integrity may influence current managerial risk-taking decision, the outcomes of managers' risk-taking decision are realized and observed in the following year. In order to consider the need of some time for integrity culture to take effect and mitigate the endogeneity concern of reverse causality, we regress the contemporaneous firm risk-taking measures on the one-period lag values of integrity culture. The results reported in column 3 and 4 of table 10 are qualitatively similar to those presented in the baseline regression.

5.5 Rule out alternative interpretation

Take (avoid) risks actively is related to greater (less) earnings and stock return volatility, while greater (less) earnings and stock return volatility cannot completely be attributed to greater (less) risk-taking. In our paper, the negative relationship between integrity culture and risk-taking measures may be ascribed to a firm's more stable social network. Honest companies tend to have higher employee loyalty and social appraisal, more harmonious industrial relations, more stable customer relationships, and closer partnerships, so they have more stable relationships with stakeholders and face lower uncertainty (Zuckerman, 2002; Hsu, 2007), which may confound our interpretation. To exclude this explanation, we add an extra control variable (firm reputation *Rep*[14]) which proxies for a firm's social network. The results reported in column 5 and 6 of table 10 rule out the alternative interpretation[15].

Besides, in our paper, we take earnings and stock return volatility as proxies for risk-taking, while they can also represent a firm's performance stability, which means the negative relationship between integrity culture and earnings and stock return volatility can also be understood as: honest companies have more stable performance. However, we believe that more stable performance itself is a sign of less risk taking by enterprises, which is why most literature considers earnings and stock return volatility as proxies variables for risk-taking. Moreover, in the subsequent analysis, we find that integrity culture is related to less R&D expense, less leverage and more liquid assets, which is consistent with our finding of the negative relationship between integrity culture and risk-taking.

Table 10
Exclude extreme periods and use lagged independent variables

[14] Taking into account the evaluation of corporate reputation by various stakeholders, we select 12 corporate reputation indicators and use factor analysis method to calculate the corporate reputation score. According to the reputation score of the enterprise, we divided the whole sample into ten groups and each group is assigned a Rep of 1 to 10 in ascending order. Specifically, the indicators used include: assets, sales, net profit, market value, asset liability ratio, current ratio, long-term liabilities ratio, earnings per share, dividend per share, whether it is audited by the big four accounting firms, sustainable growth rate, and the proportion of independent directors.

[15] In addition, while regressing *Risk1* (*Risk2*) on *Int*, we also added an additional control variable *Risk2* (*Risk1*) which proxies for a firm's stable social network. The untabulated results are qualitative similar to those in the baseline regression.

Variables	(1) *Risk1*	(2) *Risk2*	(3) *Risk1*	(4) *Risk2*	(5) *Risk1*	(6) *Risk2*
Int	-0.046***	-0.010***			-0.034**	-0.010***
	(-2.73)	(-3.56)			(-2.16)	(-3.71)
L.Int			-0.038**	-0.010***		
			(-2.41)	(-4.04)		
Constant	0.162***	0.118***	0.159***	0.123***	0.189***	0.099***
	(6.84)	(32.63)	(6.21)	(36.51)	(5.65)	(20.96)
Observations	25,749	25,287	29,858	30,244	29,726	28,837
R-squared	0.124	0.288	0.127	0.373	0.090	0.379
Controls	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Province FE	YES	YES	YES	YES	YES	YES
Industry*Year	NO	NO	NO	NO	NO	NO
Province*Year	NO	NO	NO	NO	NO	NO

Note: This table reports the robustness tests of excluding extreme periods and using lagged independent variables. T-statistics in the brackets are based on standard errors adjusted for clustering at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

6 Integrity culture and corporate policies

In the previous section, we show that higher integrity culture is associated with lower firm risk-taking. This section examines how integrity culture affects specific important business decisions. First, we focus on integrity culture's impact on financing and investment policies. Second, we consider how it influences the management incentive of the firm and M&A activities.

6.1 Investment and financing policies

We first investigate the effects of integrity culture on corporate investment and financial policies. Our hypotheses predict that firms with high integrity culture adopt less risky investment and financial policies, respectively. Specifically, we regress various investment and financial policies on firm integrity culture, including R&D input (*RD*: R&D expenditure to assets), capital expenditure (*Capexp*: Capital expenditure to assets), liquid assets ratio (*Liq*: current assets to assets), cash holding (*Cash*: cash to assets), dividend-to-equity ratio (*DE*) and debt structure (*Lev*: assets-liabilities ratio; *LD*: long-term liabilities to total liabilities; *SD*: current liabilities to total liabilities).

The regression results are reported in table 11. Consistent with high integrity level adopting policies that reduce the risk, the estimates in columns 1, 3 and 6 of table 11 show that high integrity leads to policies associated with less R&D expenditure, more current assets and lower financial risk[16]. Economically speaking, a one-standard deviation increase in the integrity culture *Int* is associated with a 2.1% (0.8%) decrease and a 0.8% increase in *RD* (*Lev*) and *Liq* relative to the mean. Interestingly, we do not find a significant effect of integrity culture on capital expense, which indicates that higher current assets ratio and lower debt ratio do not come at the cost of the firm's organic growth. Similarly, we find that integrity culture also has no statistically significant impact on cash holding, dividend payout or debt maturity structure.

Table 11
The effect of integrity culture on corporate investment and financing policies

Variables	(1) *RD*	(2) *Capexp*	(3) *Liq*	(4) *Cash*	(5) *DE*	(6) *Lev*	(7) *LD*	(8) *SD*
Int	-0.011**	0.011	0.117***	-0.028	0.002	-0.085**	-0.023	0.023
	(-2.49)	(1.14)	(3.31)	(-1.31)	(0.43)	(-2.52)	(-0.56)	(0.56)

[16] Prior research (e.g., Begley et al., 1996; Kothari et al., 2002; Coles et al., 2006) suggests that more R&D expenditures, higher debt ratio and less liquid assets are more risky policy choices.

Constant	0.065***	-0.005	1.312***	0.536***	-0.067***	-0.724***	-1.064***	2.064***
	(8.07)	(-0.38)	(23.53)	(14.43)	(-8.44)	(-13.39)	(-18.93)	(36.73)
Observations	23,515	33,645	33,645	33,609	30,737	34,171	33,831	33,831
R-squared	0.321	0.138	0.614	0.392	0.393	0.509	0.329	0.329
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Province FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: This table reports the effect of integrity culture on corporate investment and financing policies. T-statistics in the brackets are based on standard errors adjusted for clustering at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

6.2 Management incentives and M&A activities

Management incentives refer to a series of measures that motivate management, including management ownership initiatives, stock-based compensation plans, monetary compensation incentives, and so on, which aims to relieve principal-agent issues (Chen et al., 2022). However, in firms with high integrity level, the conflicts between management and shareholders will be alleviated[17], which may weaken the motivation of management incentives.

To explore the impact of integrity on management incentives, we regress a series of management incentives variables on integrity culture, including *MS* (management shareholding ratio), *MC* (the natural logarithm of management compensation), *EI_dummy* (whether to carry out equity incentives), *EI_number* (the number of equity incentives, in logarithmic form), *EI_ratio* (the ratio of incentive quantity to total equity), *PPS* (pay-for-performance sensitivity based on the method in Abowd (1990) and Yu et al.(2022)).

The results are shown in table 12. Consistent with our prediction, we find that companies with high integrity offer less equity incentives to executives, based on the estimates in column 3, 4 and 5 of table 12. Economically speaking, a one-standard deviation increase in the integrity culture *Int* is associated with a 0.77% decrease in the probability of equity incentives and 3.98% (5.22%) decrease in *EI_number* (*EI_ratio*) relative to the mean. Meanwhile, we do not find a significant effect of integrity on management shareholding, management compensation and pay-for-performance sensitivity.

Although integrity culture is related to less management incentives, which causes less risks-taking (Chen and Steiner, 1999; Low, 2009; Jiraporn et al., 2015), on the other hand, it also mitigates the principal-agent issues between shareholders and the management, which mitigates the adverse effects of less management incentives and increases risk-taking. Therefore, the net effect from less management incentives and more moderate principal-agent issues is unclear. To test whether a culture of integrity affects risk-taking by reducing management incentives, we regress *Risk1* and *Risk2* on integrity culture, adding an extra control variable *EI_dummy* (*EI_number*, *EI_ratio*)[18]. As we can see from the column 7 and 8 of table 12, the coefficients of *Int* increase 0.007 and 0.004 (in absolute value form) for *Risk1* and *Risk2*, respectively after adding management incentives variable, which implies that the net effect is positive and the less management incentives caused by integrity culture does not lower risk-taking.

Next, we investigate the effect of integrity on corporate M&A activities, which is positively related to risk-taking (Cain and Mckeon, 2016). Specifically, we regress *M&A_dummy* (whether to carry out M&A activities), *M&A_count* (the number of M&A activities in a given year) and *M&A_expense* (the expense of M&A activities in a given year) on integrity culture, respectively. The results in the appendix D shows that the culture of integrity has no significant impact on the merger and acquisition behavior of enterprises.

Table 12
The effect of integrity culture on management incentives

[17] In the part of validation of integrity culture, we find integrity culture can improve information disclosure quality, decrease the probability of financial restatement, executive excess perks and overpayment, which provides evidence that the integrity culture we get is able to relieve principal-agent issues.

[18] For brevity, we only demonstrate the results of adding *EI_dummy* as an extra control variable, while replacing *EI_dummy* with *EI_number* or *EI_ratio* does not change our results qualitatively.

Variables	(1) *MS*	(2) *MC*	(3) *EI_dummy*	(4) *EI_number*	(5) *EI_ratio*	(6) *PPS*	(7) *Risk1*	(8) *Risk2*
Int	0.026	0.002	-0.187**	-1.695*	-0.290**	-0.001	-0.045***	-0.014***
	(0.96)	(0.01)	(-2.58)	(-1.83)	(-2.01)	(-0.01)	(-2.71)	(-4.12)
Constant	0.269***	7.445***	-0.026	-1.587	0.720***	0.318**	0.150***	0.138***
	(7.86)	(26.50)	(-0.25)	(-1.19)	(3.79)	(2.47)	(6.46)	(35.08)
Observations	31,728	32,612	25,793	25,793	25,793	32,607	25,054	24,367
R-squared	0.406	0.417	0.116	0.085	0.053	0.016	0.125	0.358
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Province FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: This table reports the effect of integrity culture on management incentives. T-statistics in the brackets are based on standard errors adjusted for clustering at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

7 Mechanism analysis

7.1 Excessive conservation

Honest companies may be more conservative and cautious when facing risks and uncertainties, and pay more attention to avoiding negative consequences, which causes less risk-taking. If this is the case, then the negative effect of integrity culture on risk-taking should be more prominent when the firm is experiencing a more difficult time. Specifically, we investigate whether the negative effects of integrity culture on risk-taking are more significant during stock market crashes of 2015[19], periods of more intense market competition, and periods of poorer business performance.

Column 1 and 3 of table 13 reports the effect of integrity culture on risk-taking during stock market crashes. Compared with the coefficients of other periods at the column 2 and 4, the estimates during the extreme event are far greater (twice larger and seven times larger, respectively) and the difference between the coefficients is significant (p=0.03 and 0.00, respectively, based on the Fisher's permutation test), which suggests that the effect of integrity on risk-taking is more obvious during difficult times (stock market crashes). Column 5 and 6 examines the effect of market competition (*Lerner*: industry Lerner Index, which is weighted firm Lerner Index based on firm sales) on the relation between integrity culture and risk-taking. The coefficients of interaction term *Int*Lerner* in column 5 and 6 are significantly positive, which shows that market competition magnifies the negative impact of integrity culture and is consistent with our prediction. Column 7 and 8 examines the effect of ROE (adjusted by industry-year mean) on the relation between integrity culture and risk-taking. The significantly positive estimates show that the negative effect of integrity culture is greater in firms with poorer business performance (lower ROE). Besides, we also conduct subgroup analysis based on the ROA growth rate (we regard the observations with ROA growth rate less than the 33th percentile of the industry in the same year as the difficult group, and the rest as the stable group) and we find that the negative effect of integrity is more obvious in the difficult group, which is consistent with our prediction (for the sake of brevity, we list the results in the appendix D).

Table 13
Mechanism analysis: Excessive conservation

Variables	(1) *Risk1*	(2) *Risk1*	(3) *Risk2*	(4) *Risk2*	(5) *Risk1*	(6) *Risk2*	(7) *Risk1*	(8) *Risk2*
Int	-0.073**	-0.036**	-0.057***	-0.008***	-0.071***	-0.016***	-0.042**	-0.011***
	(-2.24)	(-2.22)	(-4.79)	(-3.26)	(-2.82)	(-4.00)	(-2.56)	(-4.40)

[19] In 2015, the Chinese stock market experienced the largest cliff-like decline since December 1990 and over a thousand stocks reach limit-down. Nearly half of the stock price was halved in this round of stock disasters. Within a month, the Shanghai Composite Index fell from its highest point of 5178 points to 3373 points, a drop of 35%, and the total market value of A-shares evaporated by approximately 24.5 trillion RMB, a drop of 34%.

Lerner					-0.167***	-0.010***		
					(-10.75)	(-4.02)		
*Int*Lerner*					0.328**	0.053**		
					(2.52)	(2.04)		
Adj_roe							-0.107***	-0.007***
							(-7.22)	(-3.13)
Int Adj_roe*							0.380**	0.036*
							(2.54)	(1.78)
Constant	0.046	0.168***	0.217***	0.120***	0.180***	0.128***	0.140***	0.127***
	(0.87)	(6.79)	(16.24)	(35.18)	(7.27)	(38.19)	(5.68)	(37.47)
Observations	2,351	30,743	2,207	30,033	33,075	31,923	33,065	32,207
R-squared	0.135	0.127	0.312	0.288	0.133	0.372	0.123	0.372
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Province FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: This table reports the mechanism analysis: Excessive conservation. T-statistics in the brackets are based on standard errors adjusted for clustering at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

7.2 Firm reputation

Honest companies may take insufficient risk to avoid damaging their reputation. To test this, we examine whether the effect of integrity culture on firm risk-taking varies with firm reputation (*Rep*), information disclosure quality (*AbsDA*, the absolute value of discretionary accruals, based on the method in Dechow et al. (1995)) and whether belonging to high-tech industry. If the facts are as we analyzed them, then the negative effect of integrity culture should be more prominent in firms with lower reputation, lower disclosure quality and non-high-tech industries[20] (i.e., when corporate reputation is more vulnerable to risk-taking).

Specifically, we divide the sample into three groups based on the size of the company's reputation (disclosure quality), with the top 1/3 being considered a high reputation (disclosure quality) group and the bottom 1/3 being considered a low reputation (disclosure quality) group. Table 14 reports the regression results.[21] Column 1, 3 and 5 demonstrate the outcomes in low reputation, low disclosure quality and non-high-tech firms, while column 2, 4 and 6 demonstrate the results of high reputation, high disclosure quality and high-tech firms. The significantly negative estimates in column 1, 3 and 5, together with the insignificant estimates in column 2, 4 and 6, confirm our analysis that firm reputation is one of the reasons preventing firms from taking sufficient risks. Besides, we also run a model with an interaction term *Int*Rep* and the results are reported in the column 7 of table 14. As we can see, the interaction term *Int*Rep* is significantly positive, which is consistent with previous analysis and further confirms our mechanism analysis.

Table 14
Mechanism analysis: Firm reputation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables	*Risk1*	*Risk1*	*Risk1*	*Risk1*	*Risk1*	*Risk1*	*Risk1*
Int	-0.060***	-0.010	-0.049**	-0.022	-0.030*	-0.034	-0.104***
	(-2.60)	(-0.39)	(-2.05)	(-1.05)	(-1.69)	(-1.11)	(-4.15)
Rep							0.000
							(0.69)
*Int*Rep*							0.012***
							(3.00)

[20] Compared with high-tech industries, risk-taking in non-high-tech industries is more likely to lead to the decline of corporate reputation, as risk-taking is considered a necessity in high-tech industries.

[21] For brevity, we only report results when dependent variable is *Risk1* and the outcomes for *Risk2* are in the appendix D.

Constant	0.285***	0.150***	0.184***	0.162***	0.134***	0.132***	0.188***
	(4.91)	(3.04)	(5.74)	(4.88)	(4.88)	(3.03)	(11.03)
Observations	11,541	9,120	9,739	9,997	22,377	10,103	29,726
R-squared	0.085	0.140	0.172	0.113	0.151	0.210	0.091
Controls	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Province FE	YES	YES	YES	YES	YES	YES	YES

Note: This table reports the mechanism analysis: Firm reputation. T-statistics in the brackets are based on standard errors adjusted for clustering at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

7.3 Preference for stability

Firms with integrity culture may be content with the current situation and prefer stability, which is not conducive to risk-taking. To prove this, we first regress the tenure (*Chair_tenure*: average tenure of a firm's chairman) and replacement frequency (*Chair_turnover*: the natural logarithm of the number of times chairmen changed during our observation period) of firm chairmen on integrity culture as longer tenure and less frequent replacement of chairmen mean preference for stability (Huang et al., 2022). Secondly, we conduct cross-sectional tests that make use of variation in several characteristics of nature of equity and firm development stages (we divide the sample into young and mature companies based on the median value of years since the company was listed). As state-owned enterprises (SOEs) and firms in maturity period are more likely to chase stability, we reckon that the negative effect of integrity culture on firm risk-taking is more prominent in non-SOEs and younger firms.

Table 15 reports the results. Column 1 and 2 show the regression outcomes for *Chair_tenure* and *Chair_turnover*, respectively. The significantly positive estimates in column 1 and significantly negative estimates in column 2 suggest that integrity culture is related to longer chairmen tenure and smaller chairmen turnover, which is consistent with our hypothesis. Column 3 to 6 report the cross-sectional tests[22]. Column 3 and 4 demonstrate the results for non-SOEs and SOEs, separately, and the results show that the negative effect of integrity culture is more prominent in non-SOEs. Column 5 and 6 give results for young and mature firms and the results further validates our analysis. All together, we provide ample evidence that preference for stability is one of the reasons for the negative relationship between integrity culture and risk-taking.

Table 15
Mechanism analysis: Preference for stability

	(1)	(2)	(3)	(4)	(5)	(6)
			Non-SOEs	SOEs	Young	Mature
Variables	*Chair_tenure*	*Chair_turnover*	*Risk1*	*Risk1*	*Risk1*	*Risk1*
Int	0.201*	-0.555***	-0.041*	-0.030	-0.048**	-0.020
	(1.65)	(-3.67)	(-1.88)	(-1.35)	(-2.24)	(-0.99)
Constant	3.596***	-0.029	0.147***	0.154***	0.117***	0.209***
	(18.22)	(-0.11)	(4.19)	(4.41)	(3.04)	(6.42)
Observations	33,632	33,390	19,133	13,962	15,787	17,308
R-squared	0.242	0.485	0.138	0.129	0.112	0.159
Controls	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Province FE	YES	YES	YES	YES	YES	YES

Note: This table reports the mechanism analysis: Preference for stability. T-statistics in the brackets are based on standard errors adjusted for clustering at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

[22] For brevity, we only report results when dependent variable is *Risk1* and the outcomes for *Risk2* are in the appendix D.

8 Further analysis

8.1 Integrity culture and capital allocation efficiency

We have found that integrity culture has a negative effect on risk-taking. Now, we investigate that whether integrity culture undermines the efficiency of the capital allocation. Efficient capital allocation requires that managers undertake all projects with positive expected net present value, which may be influenced by the less risk-taking caused by integrity culture. To test this, we employ the method in Faccio et al. (2016), which examines the degree to which investment is related to the marginal (Tobin's) Q. Specifically, we use the following OLS model:

$$Investment_{i,t} = \alpha_0 + \alpha_1 Int_{i,t} + \alpha_2 TobinQ_{i,t-1} + \beta Int_{i,t} * TobinQ_{i,t-1} + \sum \alpha_k Controls_{i,t} + \varepsilon \#(5)$$

where *i* refers firm, *t* represents year, *Investment* is firm investment expenditure, which is the ratio of cash paid for acquisition and construction of fixed assets, intangible assets and other long-term assets to total assets. *TobinQ* is the one-period lag values of Tobin's Q ((book value of assets - book value of equity + market value of equity)/book value of assets). The coefficient on the interaction term β is the variable of interest. If integrity culture harms the efficiency of capital allocation, we should observe a negative β.

Table 16 reports the regression results. The estimate of *TobinQ*Int* in column 1 is negative and statistically significant, suggesting that integrity culture undermines the capital allocation efficiency, which is consistent with our analysis that managers in honest firms are risk averse and are unable to fully seize investment opportunities. Column 2 and 3 are results based on subgroup regression. We divide the entire sample into three groups based on the integrity culture score of the enterprise. The top 33% are high integrity enterprises, and the last 33% are low integrity enterprises. The results show that there is a positive and significant association between investments and Tobin's Q for firms with low integrity, while a significantly negative relationship for high integrity firms, which further confirms that integrity weakens the sensitivity of investment levels to investment opportunities and provides evidence for the deviation from optimal risk-taking of firms with integrity.

Table 16
Integrity culture and capital allocation efficiency

	(1)	(2)	(3)
		Low integrity	High integrity
Variables	*Investment*	*Investment*	*Investment*
TobinQ	0.000	0.001*	-0.002***
	(0.77)	(1.73)	(-2.97)
Int	0.030**		
	(1.99)		
*TobinQ*Int*	-0.011*		
	(-1.91)		
Constant	0.048***	0.042**	0.055**
	(3.37)	(2.13)	(2.45)
Observations	29,760	9,720	9,640
R-squared	0.206	0.213	0.219
Controls	YES	YES	YES
Industry FE	YES	YES	YES
Year FE	YES	YES	YES
Province FE	YES	YES	YES

Note: This table reports the effect of integrity culture on capital allocation efficiency. T-statistics in the brackets are based on standard errors adjusted for clustering at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

8.2 Integrity culture, risk-taking and firm value

The previous section shows that integrity culture leads to inefficient capital allocation, which provides evidence for the suboptimal risk-taking of honest firms and for the negative correlation between integrity and firm value through risk-taking. In this part, we will test more directly whether the lower level of risk taking caused by a culture of integrity will reduce the value of the enterprise. Specifically, we estimate the following models:

$$TobinQ_{i,t} = \alpha_0 + \alpha_1 Int_{i,t} + \sum \alpha_k Controls_{i,t} + \varepsilon \#(6)$$

$$Risk_{i,t} = \alpha_0 + \alpha_1 Int_{i,t} + \sum \alpha_k Controls_{i,t} + \varepsilon \#(7)$$

$$TobinQ_{i,t} = \alpha_0 + \alpha_1 Int_{i,t} + \alpha_2 Risk_{i,t} + \sum \alpha_k Controls_{i,t} + \varepsilon \#(8)$$

Here, we use Tobin's Q to measure firm value. Tobin's Q is a common indicator of company performance and growth, which is the market value of the firm, divided by the replacement value of its assets (Morck et al., 1988; Bharadwaj et al., 1999). Compared with other accounting performance indicators, Tobin's Q implies the valuation of the company's existing assets and expectations of future growth potential, which matches our research as integrity culture is thought to be related to a firm's long-term value (Guiso et al., 2015a).

The results are reported in table 17. Column 1 demonstrates the estimates of equation (6). As is shown, integrity has a negative effect on Tobin's Q[23]. Column 2 and 3 shows the results of equation (7), which have been listed in table 3. Column 4 and 5 displays the outcomes of equation (8). As we can see, the coefficients of *Int* decrease (in absolute value form) from -0.637 to -0.623 and -0.555, respectively (the significance level also slightly decreased), which suggests that integrity culture harms firm value through risk-taking. In terms of the magnitude of the decline, the estimate decreases 0.014 in column 4 and 0.082 in column 5, which means that risk-taking accounts for 2.2% to 12.87% of the impact of integrity culture on corporate value. We further test this relationship by performing a Sobel (1982) test, which shows that risk-taking behavior is a partial mediator (Sobel test p<0.01). Besides, the estimators of *Risk1* and *Risk2* in column 4 and 5 are significantly positive, implying that greater risk-taking is related to greater firm value, which are consistent with previous literature (John et al., 2008; Kim and Lu, 2011; Chen et al., 2023).

Table 17
Integrity culture, risk-taking and firm value

	(1)	(2)	(3)	(4)	(5)
Variables	*TobinQ*	*Rsik1*	*Risk2*	*TobinQ*	*TobinQ*
Int	-0.637***	-0.038**	-0.010***	-0.623***	-0.555***
	(-3.26)	(-2.41)	(-4.21)	(-3.24)	(-2.84)
Risk1				1.166***	
				(7.28)	
Risk2					9.780***
					(21.48)
Constant	10.024***	0.165***	0.128***	9.505***	8.839***
	(25.01)	(6.68)	(38.14)	(24.62)	(21.74)
Observations	33,610	33,095	32,241	32,579	31,815
R-squared	0.392	0.121	0.372	0.398	0.414
Controls	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Province FE	YES	YES	YES	YES	YES
Sobel Z				-3.559***	-4.677***

Note: This table reports the effect of integrity culture on firm value through risk-taking. T-statistics in the brackets are based on standard errors adjusted for clustering at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

[23] We notice that our results are different from Guiso et al. (2015a) and Li et al. (2021), who suggest a positive relation between integrity and firm value. However, considering that this article uses a sample of Chinese listed companies and this is not the focus of our study, we will leave it to future studies.

9 Conclusion

In this article, we explore the relationship between corporate integrity culture and firm risk-taking. Based on the annual reports of Chinese listed companies from 2000 to 2020, we construct an indicator of "integrity culture" using machine learning technique—the word embedding model, and examine the impact of integrity culture on corporate risk-taking. We find that firms with integrity culture exhibit significantly lower level of risk-taking, which is robust after mitigating endogeneity concerns and stands a series of other robustness tests, including replacing dependent and independent variables, using lagged independent variables and excluding extreme periods and alternative explanation. Studies concerning corporate policies find that honest firms are related to less R&D expenditure, more liquid assets, lower leverage and fewer executive incentives. Mechanism analysis suggests that excessive conservation, emphasis on reputation and preference for stability are reasons behind the negative relationship. Furthermore, we find that integrity culture undermines the efficiency of the capital allocation and less risk-taking induced by higher integrity is detrimental to firm value.

The following enlightenments can be obtained from our paper. Firstly, the enterprise should approach the culture of integrity with caution. Although it is widely believed that integrity culture can bring various benefits to a firm, our paper shows a dark side of integrity culture, which is less risk-taking and harmful to firm value.

Therefore, for managers, they need to recognize the advantages and disadvantages brought about by integrity culture in order to adopt appropriate strategies to leverage strengths and avoid weaknesses. Secondly, we find honest firms are related to lower asset liability ratio and higher current asset ratio, which manifests as a paradox as companies with integrity can gain widespread social trust and are able to finance at a lower cost. As such, we propose that honest firms can appropriately increase their asset liability ratio and lower their current asset ratio to obtain greater profits.

Appendix

Appendix A. Variable definition

Table A1

Variable definition.

This table gives variable definition.

Variable	Definition
Panel A: risk-taking variables	
Risk1	the five-year rolling standard deviation of industry-adjusted ROA (t-2 to t+2)
Risk2	the standard deviation of the residuals from the market model regression
Panel B: integrity variables	
Int	based on the method explained in this paper
Int2	(the total number of words representing the integrity culture in the annual report)/(the total number of words in the annual report text) ×100
Int3	the same as *Int* except that only seed words are used, compared with seeds words plus the expanded words in *Int*
Panel C: control variables	
Cash	net cash flow generated from operating activities divided by total assets
Lev	total debt over total assets
ROA	net income over total assets
Size	the natural logarithm of the firm's book value of assets
Growth	the increased percentage of sales revenue
SOE	1 if the firm is state-owned; 0 otherwise
Fixed	net properties, plants, and equipment (PPE) scaled by total assets
Age	the natural logarithm of one plus the number of years since the establishment of the firm
BM	book value of assets to market value of assets
Top1	the ownership of the largest shareholder
Indepdir	the proportion of independent directors
Duality	1 if the chairman and the CEO is the same person; 0 otherwise
Inst	the ratio of the shares held by institutional investors divided by the total shares
Boardsize	the natural logarithm of the size of the board

Appendix B.

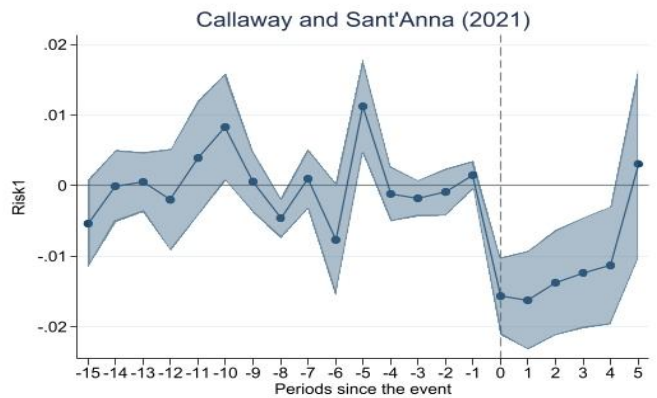
Appendix B1. Culture dictionary (in original language)

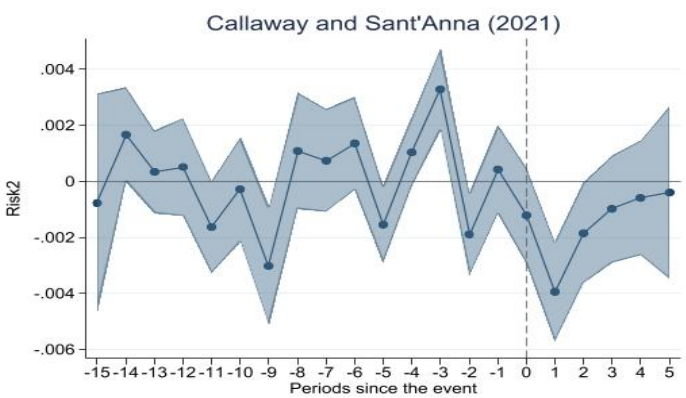
Seed words：诚信 诚实 真诚 虔诚 道德 信誉 信任 透明度 竭诚 正直 公平 言行一致
Expansion words：守信 守诺 以诚相待 守纪 求实 以信为本 与人为善 言必信 讲信用 以诚待人 重合同 遵规 诺言 信守合同 自觉 诚心 待人以诚 恪尽职守 兢兢业业 敬业 互惠互利 公正 坦诚 坦率 认真负责 守约 商业道德 务实 一诺千金 将心比心 感恩 说到做到 友善 真心实意 乐于助人 热诚 以人为本 感激 互助友爱 全心全意 通情达理 团结友爱 老实 坦荡 持中守正 律己 守规矩 声誉 口碑 资信度 资信状况 资信等级 互信 信赖 友好关系 赞誉 伙伴关系 风雨同舟 相互尊重 精诚合作 携手并肩 双赢 共赢 友好合作 品牌形象 相互支持 赞许 共荣 休戚与共 公众形象 透明性 尊老爱幼 真情实意 真心实意 正派 平等 机会均等 一视同仁 责任感 使命感 幸福感 责任意识 责任心 归属感 奉献 认同感 以身作则 归宿感 优良作风 志存高远 感召力

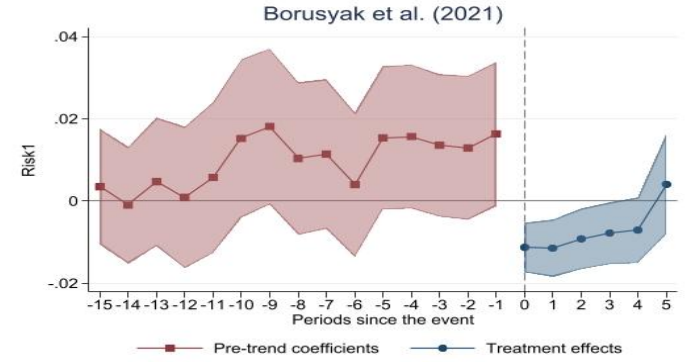
Appendix B2. Culture dictionary (translated to English)

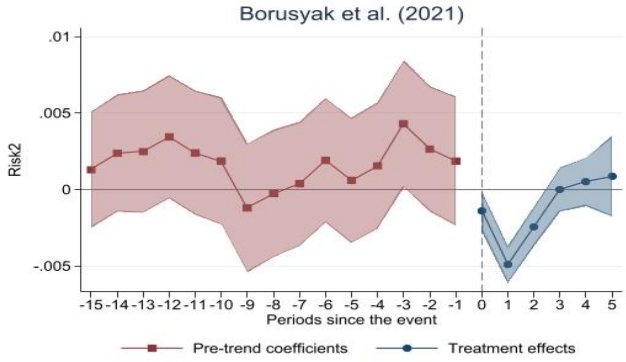
Seed words： Integrity, Honesty, Sincerity, Piety, Ethic, Credit, Trust, Transparency, Wholeheartedness, Probity, Fairness, Keep one's word
Expansion words： Honor one's word, Keep the promise, Treat sb with sincerity, Observe discipline, Realistic, Honesty foremost, Kindness, Be faithful to your words, Value credit, Treat people sincerely, Value contracts, Compliance with regulations, Promise, Abide by the contract, Consciousness, Sincere, Treat people with sincerity, Accountability, Assiduous, Dedication, Reciprocity, Just, Frank, Candid, Responsible, Keep an appointment, Business ethics, Pragmatic, Honor one's agreement, Feel for others, Gratitude, Act as one says, Friendly, Wholeheartedly, Accommodating, Enthusiasm, People oriented, Grateful, Camaraderie, Heart and soul, Sanity, Solidarity and friendship, Guileless, Magnanimous, Rectitude, Self-discipline, Discipline, Reputation, Word of mouth, Credibility, Credibility status, Credibility rank, Mutual trust, Dependence, Entente, Praise, Partnership, Mutual help, Mutual respect, Cooperation, Collaboration, Win-win, All-win, Friendship, Brand image, Mutual support, Compliment, Co-prosperity, Share weal and woe, Public image, Transparent, Respect the aged and cherish the young, Genuine, Earnest, Decent, Equal, Fair, Nondiscrimination, Sense of responsibility, Sense of mission, Happiness, Conscientiousness, Accountable, Sense of belonging, Devotion, Sense of identity, Give a lead, Feeling of belonging, Fine style of work, Ambition, Appeal
It is worth mentioning that our translation of the culture dictionary may not be that accurate and understandable for non-Chinese natives as the words in the dictionary are intended to measure a Chinese firm's integrity culture and the language and culture gap between China and non-China areas may stifle the understanding of the dictionary.

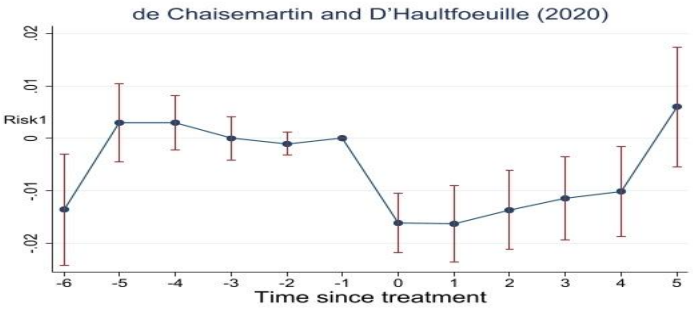
Appendix C. Address heterogeneous treatment effects

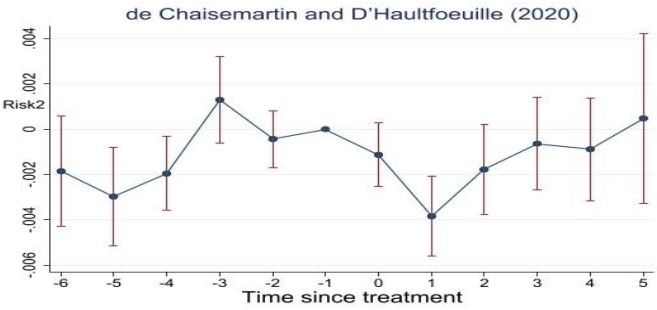












Appendix D. Omitted tables

Table D1.

PSM: Difference in firm characteristics

	High integrity firms	Low integrity firms	Difference	t-stat
Size	21.8250	21.8150	0.0100	0.64
Lev	0.4018	0.4015	0.0003	0.11
ROA	0.0509	0.0510	-0.0001	-0.22
Cash	0.0529	0.0528	0.0001	0.10
Fixed	0.2275	0.2253	0.0022	0.99
Growth	0.1779	0.1810	-0.0031	-0.59
Boardsize	2.1375	2.1367	0.0008	0.29
Indepdir	0.3709	0.3707	0.0002	0.17
Duality	0.2719	0.2733	-0.0014	-0.23
Top1	0.3557	0.3542	0.0015	0.76
SOE	0.3479	0.3450	0.0029	0.44
Age	2.7408	2.7417	-0.0009	-0.17
BM	0.8665	0.8571	0.0094	0.79
Inst	0.3291	0.3297	-0.0006	-0.18

Table D2.

Policy analysis: corporate integrity culture and M&A activities

	(1)	(2)	(3)
Variables	*M&A_dummy*	*M&A_count*	*M&A_expense*
Int	-0.255	-0.369	-0.584
	(-0.63)	(-0.91)	(-0.51)
Constant	-2.013***	-3.118***	0.823
	(-3.70)	(-5.14)	(0.53)
Observations	34,171	34,171	34,171
R-squared			0.050
Controls	YES	YES	YES

Industry FE	YES	YES	YES
Year FE	YES	YES	YES
Province FE	YES	YES	YES

Note: This table reports the results of the effect of corporate integrity culture on M&A activities. Logit and poisson model are used for column 1 and 2 and ols regression is employed for column 3. T-statistics in the brackets are based on standard errors adjusted for clustering at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Table D3.

Mechanism analysis: excessive conservation

	(1)	(2)	(3)	(4)
	Difficult	Stable	Difficult	Stable
Variables	*Risk1*	*Risk1*	*Risk2*	*Risk2*
Int	-0.069***	-0.024	-0.011***	-0.009***
	(-3.10)	(-1.41)	(-2.91)	(-3.21)
Constant	0.188***	0.155***	0.117***	0.131***
	(5.31)	(6.11)	(22.69)	(33.44)
Observations	10,156	22,325	10,254	21,065
R-squared	0.159	0.101	0.353	0.386
Controls	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Province FE	YES	YES	YES	YES
P value	<0.1		<0.2	

Note: This table reports the results of the effect of corporate integrity culture on firm risk-taking in different subsets. T-statistics in the brackets are based on standard errors adjusted for clustering at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Table D4.

Mechanism analysis: firm reputation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables	*Risk2*	*Risk2*	*Risk2*	*Risk2*	*Risk2*	*Risk2*	*Risk2*
Int	-0.014***	0.002	-0.011***	-0.006	-0.013***	-0.008**	-0.018***
	(-3.30)	(0.48)	(-3.78)	(-1.56)	(-3.23)	(-2.19)	(-3.24)
Rep							-0.001***
							(-9.13)
*Int*Rep*							0.001*
							(1.68)
Constant	0.100***	0.098***	0.123***	0.128***	0.117***	0.124***	0.105***
	(10.68)	(15.45)	(28.76)	(21.20)	(21.63)	(24.84)	(29.84)
Observations	10,880	9,029	21,692	9,626	9,798	9,997	28,837
R-squared	0.361	0.421	0.384	0.343	0.360	0.381	0.379
Controls	YES	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Province FE	YES	YES	YES	YES	YES	YES	YES
P value	<0.1		<0.1		<0.2		

Note: This table reports the results of mechanism analysis: firm reputation. Column 1, 3 and 5 demonstrate the outcomes in low reputation, non-high-tech firms and low information disclosure quality, while column 2, 4 demonstrate the results of high reputation, high-tech firms and high information disclosure quality. T-statistics in the brackets are based on standard errors adjusted for clustering at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Table D5.

Mechanism analysis: preference for stability

	(1)	(2)	(3)	(4)
	Non-SOEs	SOEs	Young	Mature
Variables	*Risk2*	*Risk2*	*Risk2*	*Risk2*
Int	-0.012***	-0.005	-0.016***	-0.004
	(-3.77)	(-1.51)	(-4.92)	(-1.31)
Constant	0.136***	0.107***	0.132***	0.108***
	(27.23)	(22.49)	(24.84)	(23.79)
Observations	18,305	13,936	14,646	17,595
R-squared	0.346	0.404	0.383	0.375
Controls	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Province FE	YES	YES	YES	YES

Note: This table reports the results of mechanism analysis: preference for stability. Column 1 and 2 demonstrate the results for non-SOEs and SOEs and Column 3 and 4 give results for young and mature firms. T-statistics in the brackets are based on standard errors adjusted for clustering at the firm level. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

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