The Effects of Corporate Culture on the Cost of Equity Capital

Abstract

Based on a sample of U.S. public firms from 2002 to 2021, we investigate the relationship between corporate culture, an informal corporate governance mechanism, and firms' cost of equity capital. Using a machine learning-based measure of corporate culture, we identify a negative association between strong corporate culture and the cost of equity. Findings are robust to a battery of sensitivity analyses and endogeneity tests. In addition, the beneficial impact of corporate culture on reducing firms' equity costs is more pronounced during the COVID-19 pandemic. Path analyses further suggest that the association is primarily mediated by agency cost and information asymmetry channels. Overall, we show corporate culture as an essential factor lowering firms' equity cost. Our findings have important implications for shareholders in making investment decisions and for managers seeking to leverage strong corporate culture for financial benefits.

Keywords: Corporate culture, Cost of equity, Agency conflict, Information asymmetry
JEL classification: G30, G32, M14

1. Introduction

This study investigates the association between corporate culture (CC) and the cost of equity capital. CC is broadly defined as "a system of shared values and norms that define appropriate attitudes and behaviours for organisational members" (O'Reilly & Chatman, 1996, p. 160).[1] Strong CC can serve as an informal corporate governance mechanism by mitigating agency conflicts, thereby aligning the organisation's interests between managers and shareholders (O'Reilly & Chatman, 1996; Sørensen, 2002).[2] However, the existing literature reports mixed evidence regarding the effects of strong CC on shareholders' value (e.g., O'Reilly, 1989). While strong CC has generally been found to lead to better financial performance and higher firm value (Li, Liu, Mai, & Zhang, 2021; Li, Mai, Shen, & Yan, 2021), it can also have a detrimental effect on firm value because of the substantial costs associated with establishing and maintaining CC (Li et al., 2021b; O'Reilly, 1989). Furthermore, a survey measuring how shareholders perceive CC shows that 79% of corporate leaders believe that investors do indeed take CC into account when making pricing decisions (EY, 2020). However, it is unclear how investors incorporate CC into their pricing decisions. Therefore, the association between CC and the cost of equity capital, which is "a summary measure of how investors perceive the risk and return trade-off of investing in a firm" (Chen, Li, & Zou, 2016, p. 100), remains an open question. Our study aims to fill the void.

This research is motivated by two key factors. First, existing research suggests that CC, as an informal corporate governance mechanism, can lead to differing financing decisions and firm outcomes. For instance, Jiang, Kim, Ma, Nofsinger, and Shi (2019) find that integrity

[1] Although there is no universally accepted definition of CC, this paper employs O'Reilly and Chatman's (1996) definition of CC widely recognized in the finance literature (e.g., Guiso, Sapienza, & Zingales, 2015; Li et al., 2021b). Guiso et al. (2015) claim this definition facilitates the measurement of culture's value component, which may account for its greater acceptability.

[2] For the purposes of this paper and consistent with the literature, strong CC implies norms and values that are universally accepted by organisational members, effectively facilitating social control (e.g., Afzali, 2023; Sørensen, 2002).

culture affects a firm's investment cashflow sensitivity. Similarly, Hasan (2022) shows that firms with strong CC have less usage of private-debt financing and a greater reliance on equity financing, suggesting their ease in obtaining equity financing. Despite acknowledging the crucial role of CC in the literature, it remains an open empirical question that how CC can shape important corporate financing decisions, such as the cost of equity. Our study attempts to answer this question.

Second, considering firms' cost of equity capital in this research is important because it is one of the principal determinants of firm value that affects a firm's capital structure, financing costs, and financing strategies (Chen et al., 2016; Xu, Liu, & Huang, 2015; Zheng, Lin, Yu, & Liu, 2021). Cost of equity also captures shareholders' perceptions toward the organisation (Chen et al., 2016). While the cost of equity systematically captures investors' perceptions of risk (Habib, Bhuiyan, & Wu, 2021), the literature suggests that agency problems are considered as risk factors for investors and that these risk factors limit a firm's ability to obtain external financing (e.g., Ferris, Javakhadze, & Rajkovic, 2017; Myers & Majluf, 1984). In this context, strong CC aligns the interests between shareholders and managers by mitigating agency conflict between them (Camerer & Vepsalainen, 1988; Sørensen, 2002). Therefore, this study considers CC from an agency perspective in relation to the cost of equity capital.

We posit that CC can affect the cost of equity capital in different ways. On the one hand, managers of firms with strong CC are better aligned with their shareholder's objectives, less opportunistic, and work for the benefit of shareholders (Zaman, 2024). This alignment results in improved decision-making, better firm performance, and higher firm value (Guiso et al., 2015; Li et al., 2021b; Sørensen, 2002). In this context, Van den Steen (2010a) argues that shared beliefs and values (i.e., CC) can mitigate agency problems arising from divergent objectives. Further, firms with strong CC have a lower level of information asymmetry (Zaman, 2024), thus reducing investors' monitoring costs, mitigating differences between investors' predicted cash flow, and lowering shareholders' information risk and cost of equity (Lombardo & Pagano, 1999). Therefore, shareholders consider a firm with strong CC as less risky (i.e., lower business and information risk) and, thus, require a lower rate of return.

On the other hand, firms with strong CC might not reap the benefits from a reduction in the cost of equity. 'Prospect theory' postulates that individuals exhibit loss aversion, a psychological trait that impacts on the individual perceiving a loss as outweighing an equivalent gain (Kahneman & Tversky, 1979; Tversky & Kahneman, 1991). Generally, firms with strong CC take higher risks because they can effectively process information about opportunities and make risky decisions for potential growth, but these decisions also entail increased potential for losses (Graham, Grennan, Harvey, & Rajgopal, 2022b). Consequently, risk-averse investors might not accept lower returns from firms with strong CC aligned with increased risk-taking. Further, firms with strong CC may not have good financial performance during periods of transition and face difficulties in merger and acquisitions due to cultural misfit, resulting in a loss of synergy benefits (O'Reilly, 1989). As a result, shareholders may require a higher rate of return from firms with strong CC.

To test our research question empirically, we utilise Li et al.'s (2021b) novel measure of CC, which is derived by using a machine learning approach and proved to be a valid proxy for CC in recent studies (e.g., Datta, Doan, & Toscano, 2024; Li et al., 2021a; Zaman, 2024). It consists of five dimensions of CC, including *innovation*, *integrity*, *quality*, *respect*, and *teamwork*. To measure the cost of equity, we obtain firms' implied cost of equity from Lee, So, and Wang (2021).

Our test sample includes 2,844 unique U.S. public firms with 23,028 firm-year observations from 2002 to 2021. Key findings are as follows. First, there is a negative association between strong CC and the cost of equity capital, suggesting firms with strong CC enjoy a lower cost of equity. This result is not only statistically but also economically significant. For instance, a one standard deviation increase in CC is associated with a 22.4-basis-point decrease in the cost of equity. Second, among the five dimensions, *innovation*, *quality*, *respect*, and *teamwork* all have a significant association with the cost of equity except for *integrity*. Third, both people-oriented and technology-oriented CC contribute to lowering the cost of equity. Fourth, we find that the beneficial impact of CC on the cost of equity capital is more pronounced during COVID-19. Given that existing studies show an overall increased cost of equity during this period, our results highlight that strong CC plays a critical role in affecting firms' cost of equity during economic downturns. Finally, we perform a path analysis to explore the channels through which CC reduces the cost of equity. Following the literature, we consider free cash flow as a proxy for agency cost and discretionary accruals as a proxy for information asymmetries (e.g., Chowdhury, Mollah, & Al Farooque, 2018; Lehn & Poalsen, 1989). We find that strong CC decreases the cost of equity by mitigating agency costs and reducing information asymmetries.

To mitigate potential endogeneity concerns, we perform several additional tests. Propensity score matching (PSM) is employed to deal with selection bias, and a generalized method of moments (GMM) is employed to deal with reverse causality. Findings remain consistent and robust when different proxies of CC and cost of equity are employed.

This paper makes several contributions. First, there is an emerging literature focusing on how CC influences corporate financing decisions (e.g., Hasan, 2022; Jiang et al., 2019). We extend this line of research by examining how CC affects the cost of equity. Our research also complements Li et al. (2021b) by highlighting the importance of using a multi-dimensional measure of CC to gauge its association with the cost of equity capital.

Second, we add to the literature by identifying CC as an informal governance mechanism associated with the cost of equity. Prior studies mainly focus on how formal corporate governance mechanisms, such as management discipline, independence, board structure, director attention, and audit quality, are related to firms' cost of equity (e.g., Bhuiyan & Man, 2021; Bhuiyan, Sangchan, & D'Costa, 2022; Chen, Chen, & Wei, 2009; Fernando, Abdel-Meguid, & Elder, 2010; Huang, Wang, Xie, & Zhou, 2021). Our study contributes to the literature by illustrating how informal corporate governance (as measured by CC) is associated with firms' financing decisions and shows that strong CC lowers cost of equity.

Third, our study has practical implications. Our findings illustrate an important role of a strong CC in lowering firms' cost of equity capital. Thus, the findings are of interest to managers who are concerned about financing costs. The study also highlights the role of CC in pricing decisions by investors and provides valuable guidelines for investors when evaluating their firms' cultural profile in making efficient investment decisions.

This paper proceeds as follows. Section 2 reviews the literature. Section 3 provides the hypothesis development. Section 4 elaborates the research design, including data and sample, model specification, and variable definitions. Section 5 presents the main tests and additional analyses. Section 6 concludes.

2. Literature review

2.1. Literature review on corporate culture

CC is widely considered as the most important determinant of business value (Graham, Grennan, Harvey, & Rajgopal, 2022a). It plays a crucial role in defining an organisation's mission, vision, and core values, and it can profoundly influence corporate operational, strategic, and financial outcomes (Hasan, Bhuiyan, & Taylor, 2024). CC can be compared to a social control system (O'Reilly & Chatman, 1996) and considered as a part of corporate governance (e.g., Graham et al., 2022a; Guiso et al., 2015). Corporate governance generally includes formal mechanisms that are tangible (e.g., board composition, managerial compensation) and informal mechanisms that are less tangible (e.g., norms, values). The extant literature suggests that if two similar firms are provided with identical formal inputs (e.g., contracts, technology) but have different outputs, the difference in output is probably because of the influence of CC (Graham et al., 2022a; Grennan & Li, 2023).

Extant studies measure CC in different ways, and they mainly focus on one specific dimension of CC. For example, some studies measure strong CC, such as integrity and collaboration, by applying textual analysis in various public channels, including official company websites and annual reports (e.g., Chen, Francis, Hasan, & Wu, 2022; Jiang et al., 2019; Wan, Chen, & Ke, 2020). Other studies measure weak CC, such as corruption, based on employees' general attitude toward opportunistic behaviour or non-compliance with safety regulations (e.g., Kedia, Luo, & Rajgopal, 2017; Liu, 2016; Pacelli, 2019). However, CC is multi-dimensional and some studies capture multiple aspects of CC, such as in the 'Competing Values Framework' which measures CC using four dimensions consisting of collaboration, competition, control, and creativity (e.g., Bhandari, Mammadov, Thevenot, & Vakilzadeh, 2022; Fang, Fiordelisi, Hasan, Leung, & Wong, 2023; Fiordelisi & Ricci, 2014).

More recently, Li et al. (2021b) develop a measure with five dimensions using machine language and show how CC affects firm output, including operational efficiency, earnings managements, firm value, and risk-taking behaviours. In a later study, Li et al. (2021a) demonstrate the role of CC in corporate resilience during the COVID pandemic in 2019-2020. Our study utilises this advanced and multi-dimensional measure of CC to investigate the association between CC and firms' cost of equity capital.

2.2. Literature review on the cost of equity capital

Prior studies identify key determinants of the cost of equity. Broadly speaking, factors that reduce agency conflict and/or lower information asymmetry have a negative association with the cost of equity (e.g., Al Guindy, 2021; Baginski & Rakow, 2012; Botosan, 1997; Francis, Khurana, & Pereira, 2005; Fu, Kraft, & Zhang, 2012; García Lara, García Osma, & Penalva, 2011; Hail, 2002; Lambert, Leuz, & Verrecchia, 2007; Vitolla, Salvi, Raimo, Petruzzella, & Rubino, 2020).

One stream of literature illustrates the role of corporate governance mechanisms in the relationship with the cost of equity capital. For example, board co-option and director attention are negatively related to the cost of equity (Bhuiyan et al., 2022; Huang et al., 2021). Another stream of literature reports that firm-, market-, and country-level uncertainty and risk are positively associated with firms' cost of equity. For instance, information risk generated from difficulties in understanding the annual reports is positively related to the cost of equity (Rjiba, Saadi, Boubaker, & Ding, 2021). Similarly, political risk or climate risk (i.e., temperature shock and emission of greenhouse gases) are positively associated with firms' cost of equity (Balvers, Du, & Zhao, 2017; Bui, Moses, & Houqe, 2020; Cepni, Şensoy, & Yılmaz, 2024; Mishra, 2023). This paper extends this body of knowledge by analysing the relationship between CC and the cost of equity in U.S. public firms.

This study differs from existing studies that examine the association between specific dimensions of firm-level culture and the cost of equity. For instance, Yang, Yue, Dong, & Cao (2024) measure integrity by applying textual analysis on the management discussion and analysis sections in corporate annual reports and examine its relationship with the cost of equity of Chinese listed firms. However, a potential limitation of such an approach is that publicly listed companies might standardize their annual reports to align with investor expectations, which could inadvertently obscure variations in CC across firms (Fiordelisi & Ricci, 2014). In this scenario, Li et al. (2021b) show that applying a word embedding model to analyse the Q&A sections of earning conference calls provides a substantial improvement over traditional methodologies, such as management discussion and analysis sections in corporate annual reports.[3]

Similarly, Chen, Xia, and Zhang (2021) measure integrity culture based on employees' perspectives provided on Glassdoor.com. However, the reliability and integrity of the reviews on Glassdoor have been debated, as negative comments are often removed from Glassdoor (Minvielle, 2023). Further, employee review sites often provide limited data over time, with many firms having a small number of reviews available (Li et al., 2021b). Therefore, we apply Li et al.'s (2021b) measure of CC, which is estimated from earnings conference calls and also consider the multifaceted nature of culture (see Bettinger, 1989).[4]

3. Hypothesis development

Jensen and Meckling's (1976) agency theory separates ownership from management and posits that inherent conflicts of interest exist between agents (managers) and principals (shareholders). Agency conflict stems from the misalignment of objectives between shareholders and management. So, when managers prioritize personal goals over shareholder wealth, this type of misalignment (referred to as Type I agency problem) can lead to inefficient capital allocation or excessive risk-taking, thereby reducing firm value (Hill & Jones, 1992; Jensen & Meckling, 1976). Investors who perceive this type of misalignment may demand higher returns to compensate for added risk and potential value erosion (Hu, Chen, & Liu, 2018; Kazemi & Rahmani, 2013). Further, agency costs increase when investors cannot estimate the firm's true value because of information asymmetry. Taken together, agency problems and information asymmetry increase the cost of equity since shareholders may need

[3] Measuring CC from earnings conference call is possibly a more reliable source of CC because the key objective of call is to discuss business operations and performance among U.S. public firms, rather than to highlight cultural values. Further, to minimize the impact of self-promotion, CC is assessed using the unscripted Q&A portion of the call rather than the scripted management presentation (see Li et al., 2021b).

[4] Graham et al. (2022a) also suggest considering earnings calls as the foremost way to measure CC.

to pay higher monitoring costs, which are reflected in the cost of equity (Skaife, Collins, & LaFond, 2004).

Accordingly, this study predicts that strong CC is beneficial for shareholders and can be negatively related to the cost of equity based on the agency perspective in the following ways. First, firms with strong CC may enjoy a lower cost of equity by mitigating agency conflict. Several studies suggest that firms with strong CC often experience reduced agency conflicts between shareholders and managers due to better alignment of objectives (Edmans, 2021; Van den Steen, 2010a). While shareholders typically focus on long-term company value and performance (Edmans, 2021), managers are generally driven by short-term performance incentives related to rewards and career prospects (Zaman, 2024). This misalignment can worsen shareholder-agency conflicts (Edmans, 2021; Jain & Zaman, 2020). A strong CC that promotes long-term orientation can mitigate these conflicts by curbing managers' opportunistic behaviour and short-term focus (Li et al., 2021b; Zaman, 2024). Studies suggest that a strong CC, through shared values and beliefs, enables greater delegation, reduces the necessity for intensive managerial oversight, and improves stakeholder communication, thereby alleviating agency problems (Denison & Mishra, 1995; Van den Steen, 2010a). Consequently, these firms emphasise increasing the benefits to shareholders, considering them as primary and highly salient stakeholders (Bonsall, Mammadov, & Vakilzadeh, 2021).

Further, prior research highlights that strong CC enhances business efficiency by improving coordination and control within the organisation (Zhao, Teng, & Wu, 2018), resulting in effective information sharing among staff, enabling companies to identify and address issues early, which contributes to better organisational performance (Crémers, 1993; Hossain, Rabarison, & Guo, 2024; O'Reilly & Chatman, 1996; Li et al., 2021b). Flamholtz (2001), and Kotter and Heskett (2008) observe that companies with a strong CC generally outperform their peers. Therefore, a CC characterized by high values of innovation, customer care, integrity, collaboration, and respect can enhance both internal information environments and external interactions, leading to superior overall performance (Li et al., 2021b; Sørensen, 2002). The benefits associated with strong CC suggest managers working in a firm with strong CC demonstrate less opportunistic behaviours, leading to lower agency issues between shareholders and managers (Datta et al., 2024; Zaman, 2024). Accordingly, considering that firms with strong CC are less risky, have lower agency conflicts, and have better investment decision-making, leading to higher firm performance, shareholders might require a lower rate of return. Specifically, lower business risk associated with a strong CC firm might result in a negative relationship with the cost of equity.

Second, firms with strong CC might enjoy reduced cost of equity capital through lower information asymmetry. High-quality disclosures imply lower information asymmetry minimizes shareholders monitoring costs, and improves the accuracy of earnings forecasts, thereby mitigating differences in investors' predicted cash flow. Therefore, lower information asymmetry reduces shareholders' information risk and the cost of equity (Lombardo & Pagano, 1999). In this context, existing studies suggest self-interested managers who pursue their own interests increase information asymmetry (e.g., Jain & Zaman, 2020). Supporting this view, several studies show that firms with weak CC tend to be opaque, have less accurate and less informative analyst forecasts and reports (e.g., Pacelli, 2019), and have a higher likelihood of accounting fraud (e.g., Biggerstaff, Cicero, & Puckett, 2015; Davidson, Dey, & Smith, 2015; Liu, 2016).

In contrast, firms with strong CC generally have lower information asymmetry. A survey by Graham et al. (2022a) shows that 53% of executives acknowledge that strong CC lowers managers' tendency to increase information asymmetry. Consistent with this view, Li et al. (2021b) show that firms with strong CC are less likely to engage in earnings management through discretionary accruals, thereby reducing information asymmetry. Similarly, Li, Li, &

Li (2024) demonstrate that firms with strong CC effectively mitigate information asymmetry and enhance shareholder trust, subsequently lowering the demand for accounting conservatism. Overall, an extensive body of literature suggests firms with strong CC have lower information asymmetry. Therefore, considering lower information risk, shareholders may require a lower rate of return. The arguments presented above are summarised in H1a below:

H1a: Firms with strong CC are negatively associated with the cost of equity capital.

Alternatively, there are several reasons why strong CC may not have a negative association with the cost of equity capital. First, firms with strong CC may not enjoy reduced cost of equity based on 'Prospect theory'. Prospect theory, which is grounded in the concept of mental accounting, defines the cognitive processes underlying the individual's evaluation of risk in investment decision-making (Kahneman & Tversky, 1984). The theory posits that individuals exhibit loss aversion, whereby the psychological impact of a loss outweighs that of an equivalent gain. In other words, individuals prefer options that have more certain outcomes because of their individual's natural risk aversion, thereby evaluating choices that are based on relative differences rather than on absolute similarities (Kahneman & Tversky, 1979; Tversky & Kahneman, 1991).

Firms with strong CC are generally associated with a higher propensity for risk-taking. Survey evidence gathered by Graham et al. (2022b) suggests that 61% of executives believe that culture plays an 'important' or 'very important' role in their risk decisions. Further, nearly half of the executives emphasise CC as a primary driving factor for undertaking excessive risk. In this context, one of the executives highlights that firms with strong CC take higher risks since they can effectively process information about opportunities and make risky decisions for potential growth. While firms with strong CC may take more risky investment decisions with the expectation of higher returns, there is also a possibility of higher losses (Graham et al., 2022b). Consequently, according to prospect theory, risk-averse investors may not accept a lower rate of return from firms with strong CC due to their heightened risk-taking behaviour.

Further, the higher risk-taking behaviour that is associated with a firm's strong CC may require higher monitoring costs (Costa & Opare, 2024), leading to a higher cost of equity capital. Li et al. (2021b) show that firms with strong CC are higher risk-takers, measured by stock price volatility. Higher stock price volatility reduces investors' prediction in future stock price (Du & Budescu, 2007) and reflects uncertainty surrounding the stock's value (Rubin & Rubin, 2013). Because stock price volatility is derived from information risk or the firm's inconsistent performance (Rubin & Rubin, 2013), existing studies suggest that increased volatility in a firm's share price elevates its perceived risk, leading to a higher cost of equity capital (Mangena, Pike, & Li, 2010). Further, share price volatility increases the cost of equity since it attracts transient investors, trading aggressively based on short-term earnings (Botosan & Plumlee, 2002). Overall, higher share price volatility signals greater uncertainty and increases a firm's perceived riskiness (Mangena et al., 2010). Considering the higher business risk of strong CC firms, shareholders may require a higher-risk premium, leading to a higher cost of equity.

Additionally, firms with strong CC may have poor firm performance, particularly during times of transition, leading to a lower value in shareholders' wealth and higher cost of equity. Firms with strong CC may not have good financial performance because businesses may support CC that no longer aligns with their long-term objectives. For instance, a firm may need to switch from product quality to innovative products to keep pace with technological development. However, firms with strong CC often do not encourage new ideas (Graham et al., 2022b). In this context, if a firm cannot match its CC with its strategy, this may result in severe loss, similar to losses experienced by General Motors, Sears, and the Bank of America (O'Reilly, 1989). A similar situation was faced by Nokia in the early 2000s, which was once a market leader in mobile handsets. The company failed to maintain its mobile handset leadership because of its resistance to cultural change. When other competitors began to be aggressive in introducing new technology, Nokia adopted a steady approach to innovation and lost its market position (Yousse, 2020).

Further, when two companies come together in a merger or acquisition, sometimes they face problems because their ways of doing things, and their values are different. This clash of CC can lead to the acquirer or the merged company losing talented employees and the benefit of synergies (O'Reilly, 1989). Specifically, challenges, such as misaligned corporate objectives, lack of trust, diminished morale, and increased employee stress and turnover can arise (O'Reilly, 1989). These issues may hinder teamwork and coordination, complicating post-merger integration and ultimately reducing productivity (Li et al., 2021b). Consequently, it may result in poor firm performance, thus lowering shareholder wealth. Besides, there can be high costs associated with implementing CC, which may not be appreciated by shareholders (Van den Steen, 2010b). The excessive training and development costs for creating common cultural knowledge among employees may seem unnecessary to shareholders (Van den Steen, 2010b; Zhao et al., 2018).

Therefore, based on prospect theory and arguments presented above, propensity for risk-taking, and difficulties experienced during transitional events, there can be a positive association between strong CC and the cost of equity, as demonstrated in the summarised arguments in H1b.

H1b: Firms with strong CC are positively associated with the cost of equity capital.

4. Research design

4.1. Data and sample

This study is based on a sample of U.S. public firms from 2002 to 2021 since CC measures are available for this period. CC measures are obtained from Li et al. (2021b), and the cost of equity data are collected from Lee et al. (2021).[5] Monthly data in Lee et al. (2021) are converted to annual data by taking annual average to match the CC dataset. Corporate governance data are collected from Boardex. Institutional shareholding and analyst forecasting-related data are sourced from Thomson Reuters' dataset and I/B/E/S, respectively. Stock prices, returns data and firms' financial information are from CRSP and Compustat.

To investigate the association between CC and the cost of equity capital, CC and the cost of equity dataset are merged with all relevant datasets. This step generates an initial sample of 4,359 unique firms with 34,792 firm-year observations covering the period of 2002 to 2021. Then, 6967 firm-year observations in financial (SIC codes 6000–6999) and utility (SIC codes 4900–4999) industries are removed. Further, 4,797 firm-year observations are dropped because of missing control variable data. The final sample comprises 2,844 unique firms with 23,028 firm–year observations. The sample selection procedure is shown in Table 1 Panel A.

Table 1 Panel B reports Fama-French's 12 industry category-based sample distributions.[6] The business and equipment industries have the largest group in the sample (25.03%) (see Bonsall, et al., 2021) and has a similar profile to Compustat's population (untablulated). Overall, the sample based on the industry is comparable with Bonsall et al. (2021) and the Compustat population observations.

Additionally, Table 1 Panel C presents year-based sample distributions. Only the year 2002 has 3% of the total sample. Every other year has 4% to 5.5% of the total sample. The sample distribution by year is similar to that reported by Afzali (2023). For instance, the highest number of observations belong to 2018, which is 1,254 in the current study, and 1,927 in

[5] The measure of CC is publicly available at https://github.com/MS20190155/Measuring-Corporate-Culture-Using-Machine-Learning/, while data related to different proxies of the cost of equity is publicly available at https://leesowang2021.github.io/data/.

[6] While SIC-2 digit-based industry fixed effect is controlled in the main regression, for brevity, Fama-French 12 category sample distribution is displayed in descriptive statistics.

Afzali's (2023) study. Overall, the sample selection procedure and sample distributions are consistent with existing studies (e.g., Afzali, 2023; Bonsall et al., 2021).

Table 1 about here

4.2. Empirical model to test H1a and H1b

Following the literature (e.g., El Ghoul, Guedhami, Kwok, & Mishra, 2011), we apply the following model to investigate the association between CC and the cost of equity capital:

$$COE_{it+1} = \beta_0 + \beta_1 CC\_TOTAL_{it} + \beta_2 CONTROLS_{it} + YEAR\_FE + INDUSTRY\_FE + \mathcal{E}_{it+} \text{.......}(1)$$

where, *COE* is the cost of equity capital, which is the dependent variable. *CC_TOTAL* is the main explanatory variable, measuring the total CC score considering five dimensions. *CONTROLS* are firm and market level control variables included in the empirical model. Further, both year and industry-fixed effects are included in Equation 1. The following section details all variables in Equation 1, with definitions listed in Appendix 1.

4.3. Variables and measures

4.3.1. Measure of corporate culture

This study employs Li et al.'s (2021b) CC measure for several reasons. First, the machine language word embedding approach takes into account the context and position of words and phrases. Second, the measure has been validated by well-established proxies.[7] Third, this CC measure contains five dimensions, providing an opportunity to examine the association of each individual component and the strength of a firm's CC by considering five dimensional composite measures (Afzali, 2023). Further, this measure is available for a long sample period and Li et al. (2021b) show the superiority of their measure through validation tests.[8]

[7] To validate innovation, Li et al. (2021b) consider R&D spending, patent, and innovation strength; for quality measures, they apply product quality, the safety of a product, and top brand; for respect, they apply for best employer status and diversity; for teamwork, the authors consider joint ventures number and level of employee involvement, and for integrity, they use accounting malfeasance and backdating executives' option grants. The authors find that their measurement of each corporate value is correlated with these standard measures.

[8] See Li et al. (2021b) for detailed explanation.

Specifically, Li et al. (2021b) create a context-specific dictionary using the *word2vec* model for measuring cultural values, including *integrity, innovation, respect, teamwork*, and *quality*, which are the most advertised CC values on the websites of S&P 500 firms. Appendix 2 displays the most commonly used thirty words related to each dimension of CC. Five cultural dimensions for each firm-year observation are estimated based on the weighted frequency of a word related to each culture component by the total word count in the document. Consistent with the literature (e.g., Costa & Opare, 2024), we apply a continuous measure of CC (*CC_TOTAL)*, in the main analysis. For tests of robustness, we explore a dummy variable, which equals one if the sum of five culture values is in the top quartile of the overall Compustat annual sample, and zero otherwise.

4.3.2. Measure of the cost of equity capital

Studies employ diverse measures for the cost of equity. Some studies use ex-post realized returns, while there are criticisms regarding its accuracy (e.g., Chen et al., 2009; Elton, 1999; Fama & French, 1997). For instance, Easton & Monahan (2005), Elton (1999), and Lundblad, (2007) advocate use of alternative proxies for expected returns, highlighting limitations in the traditional measures used for realized returns.

Other researchers claim that the implied (ex-ante) cost of equity is a superior measure, considering its control over cash flows and growth (e.g., Hail & Leuz, 2006; Pástor, Sinha, & Swaminathan, 2008). Lee et al. (2021) provide evidence that the implied cost of equity performs better than the factor-based model in terms of measurement-error variance. Moreover, the authors show that from 1997 to 2016, 77% of research papers published in top finance and accounting journals employed implied cost of equity as a proxy for cost of equity.

We thus use the implied cost of equity, measured by Lee et al. (2021). Specifically, Lee et al. (2021) estimate four commonly used implied costs of equity capital models based on analyst forecasting, including the cost of equity model proposed by Gebhardt, Lee, & Swaminathan

(2001) (*GLS*), Claus and Thomas (2001) (*CAT*), Easton (2004) (*PEG*) and Ohlson and Juettner-Nauroth (2005) (*AGR*). To mitigate the noise of each measure, consistent with the literature (e.g., Chen et al., 2016; Gupta, Raman, & Shang, 2018), we consider the equally weighted average of these four estimations of the cost of equity as our main proxy. Appendix 3 shows the detailed description of the cost of equity models.

4.3.3. Control variables

In line with the literature, we incorporate several control variables in the model. For example, we include systematic risk, beta (*BETA*), and idiosyncratic risk (*IVOL*) for unsystematic risk (Huang et al., 2021). In general, both are positively related to the cost of equity (Huang et al., 2021). Firm characteristics, such as leverage (*LEV*) and book to market ratio (*BM*) are controlled. Leverage represents higher risk, and generally positively affects the cost of equity (Boujelbene & Affes, 2013; Orens, Aerts, & Lybaert, 2009). We anticipate a positive relationship between book-to-market ratios and the cost of equity capital, because higher ratios indicate greater uncertainty about the company's prospects for future growth (Cheng, Collins, & Huang, 2006; Orens et al., 2009). Firm profitability, including return on asset (*ROA*) and cash flow from operations (*CASH_FLOW*), are controlled because cost of equity can be affected by profitability (Ball, Gerakos, Linnainmaa, & Nikolaev, 2016). Additionally, firm size (*SIZE_AT*) is controlled (e.g., Hasan, Hossain, & Habib, 2015).[9] Further, number of analysts (*ANALYST*) and dispersion of analysts' forecasting (*DISP*) are controlled. Analysts improve the external monitoring of the firm, increase the precision of information, and reduce information asymmetry (Easley & O'Hara, 2004), therefore generally lowering the cost of equity. Moreover, literature shows firms with higher dispersion of

[9] The effect of firm size depends on many factors and difficult to predict its association with the cost of equity (e.g., Embong, Mohd-Saleh, & Sabri Hassan, 2012).

analysts' forecasts can have higher equity risk premium (e.g., Botosan, Plumlee, & Xie, 2004; Hmiden, Rjiba, & Saadi, 2022) and therefore is considered.

Corporate governance can impact information asymmetry, adverse selection, and moral hazard, thereby associated with the cost of equity (Bhuiyan et al., 2022; Teti, Dell'Acqua, Etro, & Resmini, 2016). Hence, corporate governance factors, such as board independence (*BOARDIND*), board gender diversity *(DIVERSE),* and board size *(BOARD_SIZE)* are controlled to mitigate the effects of formal corporate governance factors. Further, external governance factors, such as institutional ownership (*INST_INVEST*) and audit quality (*BIGN*) are controlled. In general, higher institutional ownership is negatively associated with the cost of equity (Bhojraj & Sengupta, 2003). Finally, audit quality is controlled since audit quality is mostly negatively related to the cost of equity (Fernando, Abdel-Meguid, & Elder, 2010).

5. Results

5.1. Descriptive statistics

Table 2 presents the descriptive statistics of test variables. To mitigate the effects of outliers, all variables are winsorized (except for the CC measure) at the 1% and 99%. The mean (median) value of the cost of equity is 9.931 (9.148) with a standard deviation of 3.982, consistent with Al Guindy (2021). Further, the mean total CC and dummy CC are 14.695 and 0.220, respectively, which align with the literature (e.g., Li et al., 2021a; Zaman, 2024). The description of control variables is also comparable with the existing studies (e.g., Mishra, 2023; Rjiba et al., 2021; Zaman, 2024).

Table 2 about here

5.2. Correlation

Table 3 presents the correlation matrix for study variables. Cost of equity is significantly and negatively correlated with CC, implying CC lowers the cost of equity capital, providing preliminary support for hypothesis (H1a). As expected, cost of equity is positively correlated with systematic and unsystematic risk, leverage, book to market value, and negatively correlated with return on assets, firm size, cash flow from operation, number of analyst following, board gender diversity, board size, board independence, and institutional investors and audit quality.[10]

Table 3 about here

5.3. Main results

Table 4 shows regression results on the association between CC and the cost of equity capital. A negative coefficient for CC supports H1a, while a positive coefficient supports H1b. We examine the association between CC and the cost of equity capital using two models, with results reported in Column (1) and (2), respectively. In Column (1), CC is the only independent explanatory variable in the model and shown negatively and significantly associated with the cost of equity (coefficient 0.046, $p< 0.01$). In Column (2), in which an extensive set of control variables are included, CC remains negative and significantly (coefficient 0.040, $p< 0.01$) associated with the cost of equity. These results are consistent with the main hypothesis (H1a), suggesting that strong CC reduces the cost of equity capital. The result also has economic significance. The result (Column 2) shows that a one standard deviation increase (decrease) in CC score is associated with a 22.4-basis-point decrease (increase) in the cost of equity.[11] This result is in line with the stream of literature that shows a negative association between various formal corporate governance mechanisms, such as co-opted board, audit quality, board gender diversity, and the cost of equity capital (e.g., Bhuiyan et al., 2022; Fernando et al., 2010; Jun,

[10] None of the correlations between the independent variables raise concern, and the variance inflation factor (VIF) is less than 4, confirming that multicollinearity is not an issue in the current study.

[11] Following prior studies (e.g., Goh, Lee, Lim, & Shevlin, 2016; Habib & Bhuiyan, 2021), the economic significance of the results is measured by estimating the effect of a one-standard-deviation change in CC on the cost of equity. For instance, a one standard deviation increase in CC is related to (5.591*0.040) = 0.224% decrease in the cost of equity.

Qiyuan, Xiaofang, & Zhang, 2023). In other words, the result supports the view that strong CC reduces agency costs, resulting in a lower cost of equity.

Moreover, coefficients on control variables are consistent with prior studies. For instance, beta and idiosyncratic risk are positively associated with the cost of equity, implying both systematic and unsystematic risks increase the cost of equity, which is consistent with prior research (e.g., Al Guindy, 2021). Book to market, leverage and board independence are positively related to cost of equity, suggesting higher leveraged firms, firms with higher book value, and higher board independence increase the cost of equity. In contrast, return on assets, cash flow from operations, number of analysts following, audit quality, and institutional investors are negatively associated with the cost of equity. These results suggest that firms with greater profitability, higher external monitoring, and audit quality exhibit a lower cost of equity.

Table 4 about here

5.4. Different dimensions of corporate culture

The association between each individual dimension and the cost of equity is now examined. The five most frequently cited corporate values on the S&P 500 companies' corporate websites are: *innovation* (80% of the time), *respect* (70%), *integrity* (70%), *quality* (60%), and *teamwork* (50%) (Guiso et al., 2015). Since the existing literature argues that different dimensions of CC serve different purposes (e.g., Costa & Opare, 2024; Hasan, 2022; Zaman, 2024), the relationship of each CC dimension is examined.

Innovation means creating value through innovative processes and products (Afzali, 2023; Costa & Opare, 2024; Li et al., 2021b). While the literature suggests these firms are more likely to engage in real earnings management, resulting in higher information asymmetry (e.g., Guggenmos, & Van der Stede, 2020), the measure of innovation culture by Li et al. (2021b) is much broader than the R&D and patent definition. It also includes trade secrets, creative and innovative marketing tactics, efficiency, and optimised production processes. In that sense, innovativeness facilitates creativity, empowerment, change, and communication (Hogan & Coote, 2014). As information is more accessible in innovative workplace cultures (Balachandran, Karuna, Mishra, & Puwanenthiren, 2021) it can mitigate agency conflict and information asymmetry, leading to a negative association with the cost of equity.

Teamwork involves collaboration, coordination, cooperation, engagement, interaction, and communication. Studies suggest teamwork culture reduces agency costs (e.g., Graham et al., 2022b). Firms with strong teamwork culture fosters employee empowerment and promotes effective communication within the organisation, thereby mitigating information asymmetry inside an organisation. Further, firms with a strong teamwork culture are linked to higher information quality and reduced control risk (Chen et al., 2022). Consequently, teamwork culture may have a negative relationship with the cost of equity.

Integrity is creating value via ethics, accountability, responsibility, honesty, objectivity, transparency, trust, fairness, and compliance (Li et al., 2021b). Studies suggest integrity culture alleviates managers' opportunistic behaviour that is detrimental for shareholders' value (e.g., Jiang et al., 2019). Moreover, Li et al. (2021b) show that integrity is negatively related to restatements, implying that higher information quality is provided by firms that have strong integrity culture, thereby may negatively related to the cost of equity capital.

Quality culture creates value through mission, commitment, support, functionality, customer service, and satisfaction. Previous research shows that companies with stronger quality cultures are linked to better information environments and lower agency problems (e.g., Call, Campbell, Dhaliwal, & Moon Jr, 2017; Guiso et al., 2015). Consequently, quality culture can focus on financial report quality, reducing information asymmetry and agency costs, resulting in a negative association with the cost of equity.

Respect culture captures talent, leadership, diversity, fairness in pay and promotion, empowerment, skill set, work life balance and entrepreneurial spirit (Afzali, 2023; Clarke, 2011). According to earlier research, companies that value diversity exhibit improved financial reporting (Gull, Nekhili, Nagati, & Chtioui, 2018; Labelle, Makni Gargouri, & Francoeur, 2010). This is because these companies have lower opportunistic behaviours (Costa & Opare, 2024). Consequently, firms with strong respect culture may enjoy lower cost of equity.

Table 5 (Column 1 to 5) shows that *Innovation, Quality, Respect*, and *Teamwork* cultures are negatively and significantly associated with the cost of equity, implying these dimensions reduce costs of equity capital, whereas *Integrity* has an insignificant association with the cost of equity. One possible explanation is while integrity culture can reduce agency costs, it can also increase risk-taking behaviours of the firm. For example, CEOs with higher integrity influence the culture of the firm and encourage employees to take more risks (Palanski & Vogelgesang, 2011).

CC can be further categorized as people-oriented (*PEOPLE_CUL)* and technology-oriented cultures *(TECH_CUL)* (see Li et al., 2021a). People-oriented culture is composed of respect, integrity, and teamwork, and strong people-oriented firms focus on human capital for creating long-term value. Technology-oriented culture includes innovation and quality, and such firms create value via quality product, service innovativeness and customer loyalty (Li et al., 2021a). We test the association between both types of CC and the cost of equity capital and report results in Table 5 (Column 6 and 7). Results suggest that both people- and technology-oriented cultures are significantly and negatively related to the cost of equity capital.

Table 5 about here

5.5. Alternative proxy for corporate culture

While we measure CC using a continuous variable in the main analysis, we consider an alternative measure of CC in this section. A dummy variable is constructed (*CC_DUM*), which equals one and represents strong CC if the total CC score (i.e., sum of the five dimensions) is in the top-quartile of the annual-sample, and zero otherwise. Table 6 reports results when *CC_DUM* is used. We continue to find a negative and significant association between CC and the cost of equity, suggesting that strong CC lowers the required rate of return.

Table 6 about here

5.6. Alternative proxies for the cost of equity capital

The main analysis is based on the weighted average of four implied costs of equity models (Lee et al., 2021). For robustness, we consider four alternative measures of cost of equity. Specifically, the main regression model is re-estimated using individual measures of *GLS*, *CAT*, *PEG* and *AGM* model of cost of equity. Table 7 reports results. Columns (1) to (4) show that all coefficients on CC are negative and significant, providing support to the hypothesis that strong CC lowers the cost of equity.

Table 7 about here

5.7. Role of corporate culture during Covid

Although the COVID-19 epidemic is primarily recognized as a health crisis, it is a global economic crisis as well. Its detrimental effects on the world economy may be far worse than those of the previous financial crisis (Ke, 2022). Several studies identify the impact of COVID on business operations, such as higher cash holdings, higher dividend payments, and lower stock returns (Bretscher, Hsu, Simasek, & Tamoni, 2020; Mazur, Dang, & Vo, 2020; Qin, Huang, Shen, & Fu, 2021). In a similar vein, Ke (2022) shows that firms have experienced a higher cost of equity during this pandemic. However, Li et al. (2021a) suggests firms with strong CC have performed better during the crisis than the firms with weak CC. We thus expect firms with strong CC have enjoyed a lower cost of equity during the crisis.

To examine the role of CC in determining the cost of equity capital during the COVID-19 pandemic, we construct *COVID*, where 1 represents the Covid-19 pandemic period for the year

2020, and 0 otherwise (e.g., Zebian, Harris, & Abdelsalam, 2024). We then introduce an interaction term *CC_TOTAL* × *COVID*. Table 8 reports that the coefficient on *COVID* is insignificant, while the coefficient on CC is negative and significant. Further, the coefficient on the *CC_TOTAL* × *COVID* interaction term is negative and significant, providing further support to the argument that regardless of the COVID-19 pandemic, strong CC plays a pronounced role in affecting the cost of equity.

Table 8 about here

5.8. Dealing with endogeneity

CC can be endogenous because different stakeholders might be involved in determining CC (Costa & Opare, 2024). Potential endogeneity can arise between CC and the cost of equity capital from reverse causality, omitted variable bias, and selection bias issues. For instance, it is well known that problems, such as self-selection, can bias estimates when comparing a treatment group to a non-experimental comparison group (Dehejia & Wahba, 2002). Specifically, selection bias is generated from a non-random process when selecting samples. Further, reverse causality may potentially affect the results, i.e., it is possible that the cost of equity influences CC. Another potential endogeneity issue may arise from omitted variables that are correlated with both CC and the cost of equity. To address these concerns, we conduct a series of endogeneity tests, such as PSM to mitigate concerns of self-selection bias, and a GMM model to deal with reverse causality. While triangulation approaches (PSM, GMM, and linear regression modelling) are performed to mitigate potential concerns of endogeneity, we acknowledge that endogeneity cannot be fully eliminated in this study.

5.8.1. Propensity score matching

There is a possibility that selection bias could impact the study's findings. For instance, there can be systematic differences between strong and weak cultural firms (Afzali, 2023). Therefore, we consider a PSM approach to mitigate concerns of sample selection bias generated from observable differences between the treatment and control groups (Rosenbaum & Rubin, 1983).

To apply PSM, the full sample is divided into two groups: treatment and control groups, considering the CC score (e.g., Hasan et al., 2024; Zaman 2024). If a firm has a CC score higher (lower) than the sample median, it is denoted as a treatment (control) group. The PSM method employs one-to-one matching within a caliper of 0.01, without replacement, to ensure similarity between the two groups.[12] Table 9 presents the results for PSM. A univariate comparison of the covariates between the treatment and control groups, together with the corresponding t-statistics, is presented in Panel A of Table 9. The mean values of the treatment and control covariates do not differ significantly, with the exception of the dependent variable's mean values, which is significant at the 5% level. After matching the treatment and control groups, the baseline equation model is re-applied. Table 9 Panel B shows the result is consist with the main findings that CC is negatively and significantly associated with the cost of equity capital.[13]

Table 9 about here

5.8.2. Generalized method of moments

Following the existing studies, to mitigate concerns that endogeneity generated from reverse causality, a two-step GMM is undertaken (e.g., Hasan, Taylor, & Richardson, 2022; Lemma, Khan, Muttakin, & Mihret, 2019; Roodman, 2009). Using the GMM technique, the equation is first transformed into a first-difference model. The transformed first differenced regressors are then instrumented using the lagged levels of regressors and the differences in lagged variables. The approach subsequently employs the lagged levels of the regressors, along with the differences in the lagged variables, as instruments for the transformed first differenced

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[12] Samples are balanced in the treatment and control groups based on all fourteen firm-specific and market level control variables applied in Equation 1.
[13] Untablulated result shows applying entropy balancing provides similar result.

regressors. Consistent with the literature, two significant diagnostic tests are undertaken to assess the GMM results (e.g., Blundell & Bond, 1998; Roodman, 2009). First, it is expected that there is significant AR (1) (first-order serial) but insignificant AR (2) (second-order correlation in the first-differenced residuals) to satisfy the condition that there is no significant second-order serial correlation in the residuals. Second, a nonsignificant value for Hansen J-statistic is anticipated to provide support to the hypothesis that the instruments employed in the dynamic system GMM specifications are valid as well as uncorrelated with the error term (Arellano & Bover, 1995; Wintoki, Linck, & Netter, 2012).

The GMM model is applied to this study's main model and results are presented in Table 10. Results show both conditions mentioned above are satisfied. Moreover, the CC coefficient is negative and significant, suggesting the baseline results are robust to endogeneity issues. For example, the estimated coefficient for CC is -0.100 ($p < 0.01$), suggesting that the two-step system GMM provides additional evidence for the robustness of the baseline findings and H1a, that is, strong CC is negatively related to the cost of equity.

Table 10 about here

5.9. Path analysis

In the main analysis, we identify a significant association between strong CC and the cost of equity capital. Prior studies show that agency conflict and information asymmetry increase the cost of equity (e.g., Al Guindy, 2021; Gupta et al., 2018; Iatridis, 2012; Skaife et al., 2004). Further, as discussed earlier, firms with strong CC generally have lower agency conflict and information asymmetry. Therefore, a concern is the extent to which strong CC influences the cost of equity capital through mediating mechanisms, such as lower agency conflict and information asymmetry. To address this, we conduct mediation tests by applying structural equation models (SEM). Specifically, we examine a direct and indirect effect of CC on the cost of equity by applying the following model.

$$MEDIATORS_{it} = \gamma_0 + \gamma_1\, CC\_TOTAL_{it} + \gamma_2\, CONTROLS_{it} + YEAR\_FE + INDUSTRY\_FE + \varepsilon_{it} \qquad (2a)$$

$$COE_{it+1} = \beta_0 + \beta_1\, CC\_TOTAL_{it} + \beta_2\, CONTROLS_{it} + \beta_3\, MEDIATORS_{it} + YEAR\_FE + INDUSTRY\_FE + \varepsilon_{it+1} \qquad (2b)$$

The mediation analysis consists of two equations. Equation (2a) specifies how the mediators, including agency conflict proxied by free cash flow (*FREE_CASH_FLOW)* and information asymmetry proxied by discretionary accruals (*DA*) are associated with CC.[14] Equation (2b) indicates how CC affects the cost of equity through mediators. The controls are explained under Equation (1). A direct path consists of a single path coefficient linking the explanatory variable to the outcome variable. An indirect path has a path coefficient between the mediator variable and the outcome variable in addition to a path coefficient between the explanatory and mediator variables. The overall effect of the indirect effect is determined by the product of these two path coefficients. Specifically, the direct effects of mediators are captured by β_1 while the indirect effects of mediators are captured by $\gamma_1 \times \beta_3$.

Table 11 presents results.[15] Panel A Column (1) shows that CC significantly reduces agency costs, proxied by free cash flow. Column (2) shows that CC is negatively and significantly associated with discretionary accruals, implying that strong CC reduces information asymmetry. Results in Column (3) indicate that an increase in agency costs, captured by free cash flow, as well as an increase in information asymmetry, as captured by discretionary accruals, increase the cost of equity (coefficient = 0.385; $p<0.01$ for *FREE_CASH_FLOW* and coefficient = 1.287; $p<0.01$ for *DA*). Table 11 Panel B shows that the indirect effect of agency conflict and information asymmetry on the cost of equity is

[14] Following literature (e.g., Griffin, Lont, & Sun, 2010) free cash flow is considered as the proxy for agency problem. The higher the free cash flow the higher the agency problem (Lehn & Poalsen, 1989). Further, discretionary accruals proxies for information asymmetry. Higher the discretionary accruals, higher the information asymmetry (Chowdhury et al., 2018).

[15] Structural equation model requires full sample (Enders & Bandalos, 2001; Li & Lomax, 2017). As a result, the sample size reduces from 23,028 to 22,830 firm-year observations.

statistically significant, implying that strong CC reduces the cost of equity by mitigating agency costs and lowering information asymmetry channels. Figure 1 shows the path analysis. Overall, results suggest that strong CC reduces the cost of equity directly, as well as indirectly by mitigating agency costs and reducing information asymmetry.

Table 11 about here

Figure 1 about here

6. Conclusion

Using data from U.S. public firms covering the period 2002 to 2021, we examine the association between CC and the cost of equity capital and report several important findings. First, the negative association between strong CC and the cost of equity capital is economically significant. For instance, an increase (decrease) in CC by one standard deviation is associated with a 22.4-basis-point decrease (increase) in the cost of equity. Second, among the five dimensions of CC, innovation, quality, respect and teamwork mainly drive the result, and both people- and technology-oriented CC lowers the cost of equity, suggesting that investors value these cultures and consider them in investment decisions. Third, regardless of the COVID- 19 pandemic, the effect of CC on the cost of equity capital remains pronounced, supporting the hypothesis that strong CC have provided resilience during pandemic. Additionally, the results remain consistent when subjected to a series of sensitivity tests. Finally, to clarify the channel through which CC reduces the cost of equity, a mediation test is undertaken. Results suggest strong CC lowers the cost of equity by mitigating agency costs and reducing information asymmetry. Overall, the results suggest that strong CC, as an informal corporate governance, mitigates agency conflict and information asymmetry, reducing the cost of equity capital.

This paper contributes to both theory and practice in several respects. First, this study expands the literature by showing that CC has important implications for corporate financing decisions, particularly in determining the cost of equity, and it complements Li et al.’s (2021b) research by showing another important application of CC. Second, it contributes to the literature on the cost of equity by identifying CC as another governance factor that is associated with the cost of equity.

This result has practical significance. The paper highlights the role of firm's culture in pricing decisions by investors. The findings can help managers better understand how strong CC alters investor expectations regarding the expected returns on their capital investments. Thus, the findings provide valuable guidelines to managers and investors for evaluating their firms' culture profiles. The findings can benefit managers in establishing strong CC and making better corporate financing decisions, while for investors it may assist in making efficient investment decisions. In a broader sense, this study contributes to a better understanding of CC and corporate financing policies.

The study is subject to some limitations. This research is based on U.S. firms. For a wider view of the association between CC and the cost of equity (i.e., to establish external validity), future studies may consider international settings. Moreover, we acknowledge that despite the several benefits associated with the CC measure used in this study, there is further scope to improve the CC measure. Finally, while we attempt to address endogeneity issues in the relationship between CC and the cost of equity, it cannot be completely ruled out.

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Appendices

Appendix 1. Variable definitions

Variables	Definition	Source
CC_TOTAL_{it}	CC score, measured by the sum of five culture values (integrity, innovation, respect, quality, and teamwork). Following Li et al. (2021b), annual scores are based on three years moving average value.	Li et al. (2021b)
CC_DUM_{it}	CC dummy variable, following Li et al. (2021b), this study uses a composite culture score, which is coded one, denoting strong CC if the sum of five culture values (integrity, innovation, respect, quality, and teamwork) is in the top-quartile of the annual sample, zero otherwise, denoting weak CC.	Li et al. (2021b)
COE_{it+1}	Cost of equity, measured by equally weighted average of four estimation of cost of equity, including residual income-based model develop by Gebhardt et al. (2001) and Claus and Thomas (2001); and abnormal earning-based model by Easton (2004); Ohlson and Juettner-Nauroth (2005). $COE= (k_{CAT} + k_{GLS} + k_{AGM} + k_{PEG})/4$	Lee et al. (2021)
$BETA_{it}$	Market beta, measured by average market beta throughout year obtained from regressions of firms' monthly excess stock returns on the corresponding CRSP value-weighted index excess returns, using at least 24 (and up to 60) months.	Beta suite
$IVOL_{it}$	Idiosyncratic risk, measured by the standard deviation of the residuals from the above regression used to estimate *BETA.*	Beta suite
ROA_{it}	Return on asset, calculated as net income by total assets.	CRSP
$CASH\_FLOW_{it}$	Cash flows from operations, measured by cash flows from operations by total assets.	CRSP
BM_{it}	Book to market value, measured by natural log of book-to-market ratio.	CRSP
LEV_{it}	Leverage ratio, defined as the ratio of total debt to the market value of equity.	CRSP
$SIZE\_AT_{it}$	Firm size, measured by natural log of the total assets.	CRSP
$ANALYST_{it}$	Number of analysist following, measured by the natural logarithm of the number of analysts providing one-year-ahead earnings forecasts.	I/B/E/S
$DISP_{it}$	The dispersion of analyst forecasts, measured by the standard deviation of analysts' forecasts by the mean of estimates.	I/B/E/S
$BIND_{it}$	Board gender diversity, measured by the percentage of female directors on a board.	BoardEx
$BOARD\_SIZE_{it}$	Board size, measured by the natural logarithm of total number of directors on a board.	Boardex
$BOARDIND_{it}$	Board independence, measured by the proportion of independent directors on a board.	BoardEx
$INST\_INVEST_{it}$	Institutional ownership, measured by the percentage of outstanding common equity owned by the institutions.	Thomson Reuters' database
$BIGN_{it}$	Auditor quality, measured by a dummy variable denoting one if auditor is Deloitte, EY, KPMG, or PwC and otherwise zero.	CRSP
$FREE\_CASH\_FLOW_{it}$	Free cash flow, calculated as operating income before depreciation minus taxes, interest expenses, preferred dividends and ordinary dividends, scaled by the total book value of equity.	CRSP
DA_{it}	Discretionary accruals, measured by following modified Jones' (1991).	CRSP

Appendix 2. Thirty most representative words for each cultural value in the culture dictionary

Innovation	Creativity, Innovative, Innovate, Innovation, Creative, Excellence, Passion, World-class, Technology, Operational_excellence, Passionate, Product_innovation, Capability, Customer_experience, Thought_leadership, Expertise, Agility, Efficient, Technology_innovation, Competency, Know-how, Cutting-edge, Agile, Creatively, Customer-centric, Enable, Value_proposition, Reinvent, Focus, Innovation_capability.
Integrity	Accountability, Ethic, Integrity, Responsibility, Transparency, Accountable, Governance, Ethical, Transparent, Trust, Responsible, Oversight, Independence, Objectivity, Moral, Trustworthy, Fairness, Hold_accountable, Corporate_governance, Autonomy, Core_value, Assure, Stakeholder, Fiduciary_responsibility, Continuity, Credibility, Honesty, Privacy, Fiduciary_duty, Rigor.
Quality	Dedicated, Quality, Dedication, Customer_service, Customer, Dedicate, Service_level, Mission, Service_delivery, Customer_satisfaction, Service, Reliability, Commitment, Customer_need, Customer_support, High-quality, Ensure, Customer_relationship, Quality_service, Product_quality, Quality_product, Capable, Service_quality, End_user, Quality_level, Customer_expectation, Service_capability, Client, Customer_requirement, Sla.
Respect	Talented, Talent, Empower, Team_member, Employee, Team, Leadership, Leadership_team, Culture, Teammate, Organisation, Entrepreneurial, Skill, Executive, Empowerment, Management_team, Best_brightest, Professionalism, Staff, Highly_skilled, Skill_set, Technologist, Competent, Entrepreneur, Experienced, Energize, Entrepreneurial_spirit, High-caliber, Manager, Leadership_skill.
Teamwork	Collaborate, Cooperation, Collaboration, Collaborative, Cooperative, Partnership, Cooperate, Collaboratively, Partner, Co-operation, Coordination, Engage, Jointly, Coordinate, Teamwork, Business_partner, Alliance, Team_up, Technology_partner, Joint, Cooperatively, Relationship, Collaborator, Interaction, Working_relationship, Co-operate, Technology_partnership, Association, Dialogue, Dialog.

(Source: Li et al., 2021b, p. 160)

Appendix 3: Models of cost of equity capital

Common variables

P_t = Stock price

DPS_0 = Actual dividend per share

EPS_0 = Actual earnings per share

LTG = Long-term growth forecast

$FEPS_{t+\tau}$ = Forecasted earnings per share

B_t = Book value per share

r_f = Yield on a 10-year Treasury note

1. Claus and Thomas (2001)

This model is based on clean surplus accounting. This model enables share price to be expressed in terms of predicted residual earnings and book values. Five years is the stated forecast horizon; after that, projected residual earnings are expected to grow at the predicted rate of inflation, and the dividend payout is assumed to remain constant at 50%. The valuation equation is:

$$P_t = B_t + \sum_{\tau=1}^{5} \frac{(ae_{t+\tau})}{(1+k_{CAT})^{\tau}} + \frac{ae_{t+5}\ (1+g)}{(k_{CAT}-g)(1+k_{CAT})^5}$$

where,

$ae_{t+\tau} = FEPS_{t+\tau} - k_{CAT}\ B_{t+\tau-1}$

$B_{t+\tau} = B_{t+\tau-1} + FEPS_{t+\tau}(1 - DPR_{t+\tau})$

$DPR_{t+\tau} = 0.5$

$g\ = r_f - 0.03$

2. Gebhardt et al. (2001)

This model also makes the assumption of clean surplus accounting. This model also enables share price to be stated in terms of predicted returns on equity (ROE) and book values. Three years is the stated forecast horizon with the predicted ROE decays to the industry median ROE by the 12th year and after that it remains constant. Further, dividend payout is also constant. The following is the valuation equation:

$$P_t = B_t + \sum_{\tau=1}^{11} \frac{(FROE_{\tau+t} - k_{GLS})}{(1 + k_{GLS})^{\tau}} B_{t+\tau-1} + \frac{FORE_{t+12} - k_{GLS}}{k_{GLS}(1 + k_{GLS})^{11}} B_{t+11}$$

where,
$FORE_{t+\tau}$ = Forecasted return on equity
$B_{t+\tau} = B_{t+\tau-1}(1\text{-}DPR_{t+\tau})$
$DPR_{t+\tau}$ = Expected dividend payout ratio

3. Ohlson and Juettner-Nauroth (2005)

This model is characterised as a generalization of the Gordon constant growth model, allowing share price to be expressed in terms of the one-year-ahead earnings forecast, as well as near-term and perpetual growth predictions. The explicit forecast horizon is considered as one year, after which earnings growth follows a near-term rate that turns into a perpetual rate. The near-term growth rate is calculated as the average of (i) the percentage difference between the two-year-ahead and one-year-ahead earnings forecasts and (ii) long-term growth forecast. The perpetual growth rate is assumed to correspond to the predicted inflation rate. Furthermore, the model assumes a constant dividend per share. To ensure validity, it requires positive earnings forecasts for both the one-year-ahead and two-year-ahead periods. The corresponding valuation equation is:

$$k_{AGM} = A + \sqrt{\mathrm{A}^2 + \frac{(FEPS_{t+1})}{P_t}(g_2 - (\gamma - 1))}$$

where,

$$A = \frac{1}{2}(\gamma - 1) + \frac{(DPS_{t+1})}{P_t 0}$$

$$g_2 = \frac{(STG + LTG)}{2}$$

$$STG = \frac{(FEPS_{t+2} - FEPS_{t+1})}{FEPS_{t+1}}$$

$$(\gamma - 1) = r_f - 0.03$$

4. Easton (2004)

This model builds upon the Price–Earnings–Growth (PEG) model. It enable share price to be expressed as a function of the one-year-ahead forecasted dividend per share, along with the one-year-ahead and two-year-ahead earnings forecasts. The explicit forecast horizon is set at two years, after which predicted-abnormal earnings are assumed to grow at perpetuity constantly. The valuation equation is:

$$k_{PEG} = \sqrt{\frac{(EPS_{t+2} - EPS_{t+1})}{P_t}}$$

Table 1: Sample selection for the study

Panel A: Sample selection procedure

Sample selection process	Observations
Total firm-year observations (2002-2021) with available CC and Compustat data	34,792
Exclusions:	
Observations in the financial and utility industries	6,967
Observations with missing data for control variables	4,797
Final sample	23,028

Panel B: Sample distribution by industry

Industry code	Fama French Industries	N	Percent
1	Consumer Non-Durable	1,418	6.16
2	Consumer Durable	801	3.48
3	Manufacturing	3,452	14.99
4	Oil, Gas, and Coal	975	4.23
5	Chemicals and Allied	964	4.19
6	Business Equipment	5,764	25.03
7	Telephone and Telecom	502	2.18
9	Wholesale, Retail	3,172	13.77
10	Healthcare, Medicine	2,289	9.94
12	Other	3,691	16.03
	Total	23,028	100

Panel C: Sample distribution by year

Year	N	Percent	Year	N	Percent
2002	690	3.00	2012	1,244	5.40
2003	975	4.23	2013	1,212	5.26
2004	1,060	4.60	2014	1,218	5.29
2005	1,072	4.66	2015	1,164	5.05
2006	1,096	4.76	2016	1,149	4.99
2007	1,158	5.03	2017	1,243	5.40
2008	1,167	5.07	2018	1,254	5.45
2009	1,195	5.19	2019	1,240	5.38
2010	1,174	5.10	2020	1,249	5.42
2011	1,232	5.35	2021	1,236	5.37
Total				23,028	100

This table shows the sample selection procedure, sample distribution based on Fama-French 12 industry category and sample distribution based on year. Variables are defined in Appendix 1.

Table 2: Descriptive statistics

Variables	N	Mean	SD	Q1	Median	Q3
COE_{it+1}	23,028	9.931	3.982	7.585	9.148	11.267
CC_TOTAL_{it}	23,028	14.695	5.591	10.711	13.630	17.550
$BETA_{it}$	23,028	1.144	0.636	0.733	1.077	1.467
$IVOL_{it}$	23,028	0.104	0.052	0.068	0.093	0.128
LEV_{it}	23,028	0.387	1.290	0.026	0.170	0.413
BM_{it}	23,028	0.362	0.217	0.209	0.330	0.479
ROA_{it}	23,028	0.048	0.097	0.015	0.052	0.092
$CASH\_FLOW_{it}$	23,028	0.101	0.080	0.060	0.099	0.143
$SIZE\_AT_{it}$	23,028	7.384	1.687	6.177	7.297	8.460
$ANALYST_{it}$	23,028	2.377	0.670	1.946	2.398	2.890
$BOARDIND_{it}$	23,028	0.838	0.083	0.800	0.867	0.889
$DIVERSE_{it}$	23,028	0.139	0.116	0.000	0.125	0.222
$BOARD\_SIZE_{it}$	23,028	2.265	0.222	2.079	2.303	2.398
$INST\_INVEST_{it}$	23,028	0.774	0.198	0.674	0.825	0.923
$BIGN_{it}$	23,028	0.877	0.328	1.000	1.000	1.000
Variables for additional tests						
GLS_{it+1}	23,027	9.223	3.125	7.338	9.028	10.766
CAT_{it+1}	23,018	7.976	3.837	5.885	7.504	9.277
PEG_{it+1}	23,028	10.518	5.756	7.362	9.281	12.283
AGM_{it+1}	22,807	12.292	6.657	8.503	10.474	14.006
CC_DUM_{it}	23,028	0.220	0.415	0.000	0.000	0.000
$INNOVATION_{it}$	23,028	4.881	2.840	2.909	4.196	6.071
$INTEGRITY_{it}$	23,028	2.130	0.994	1.452	1.952	2.609
$QUALITY_{it}$	23,028	2.624	1.480	1.577	2.293	3.296
$RESPECT_{it}$	23,028	2.890	2.010	1.503	2.360	3.687
$TEAMWORK_{it}$	23,028	2.169	1.298	1.259	1.855	2.741
$FREE\_CASH\_FLOW_{it}$	22,830	0.230	0.450	0.120	0.190	0.280
DA_{it}	22,830	-0.020	0.080	-0.060	-0.020	0.030

This table shows the descriptive statistics for variables related to Equation 1. Variables are defined in Appendix 1.

Table 3: Correlation matrix

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. COE_{it+1}	1.000														
2. CC_TOTAL_{it}	-0.165***	1.000													
3. $BETA_{it}$	0.201***	-0.050***	1.000												
4. $IVOL_{it}$	0.275***	0.065***	0.361***	1.000											
5. LEV_{it}	0.212***	-0.058***	0.061***	0.022***	1.000										
6. BM_{it}	0.422***	-0.207***	0.089***	0.109***	0.231***	1.000									
7. ROA_{it}	-0.314***	-0.055***	-0.133***	-0.199***	-0.126***	-0.282***	1.000								
8. $CASH\_FLOW_{it}$	-0.292***	0.003	-0.115***	-0.164***	-0.084***	-0.280***	0.570***	1.000							
9. $SIZE\_AT_{it}$	-0.135***	-0.070***	-0.017**	-0.498***	0.130***	-0.085***	0.136***	0.099***	1.000						
10. $ANALYST_{it}$	-0.213***	0.066***	0.045***	-0.244***	-0.026***	-0.261***	0.116***	0.197***	0.645***	1.000					
11. $DISP_{it}$	-0.008	-0.011*	-0.002	0.011*	-0.002	0.044***	0.043***	0.031***	-0.008	-0.030***	1.000				
12. $BOARDIND_{it}$	-0.035***	0.016**	-0.006	-0.209***	0.014**	-0.067***	-0.010	-0.002	0.291***	0.162***	-0.006	1.000			
13. $DIVERSE_{it}$	-0.139***	0.170***	-0.103***	-0.284***	0.026***	-0.159***	0.069***	0.065***	0.369***	0.205***	-0.013**	0.264***	1.000		
14. $BOARD\_SIZE_{it}$	-0.105***	-0.051***	-0.083***	-0.384***	0.045***	-0.103***	0.091***	0.071***	0.626***	0.381***	-0.020***	0.341***	0.346***	1.000	
15. $INST\_INVEST_{it}$	-0.138***	-0.020***	-0.018***	-0.282***	-0.027***	-0.050***	0.086***	0.099***	0.199***	0.242***	-0.009	0.206***	0.155***	0.099***	1.000
16. $BIGN_{it}$	-0.102***	-0.035***	0.038***	-0.163***	0.016**	-0.089***	0.035***	0.063***	0.343***	0.294***	-0.027***	0.170***	0.146***	0.282***	0.233***

This table shows Pearson correlation analysis for variables applied in Equation 1. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Variables are defined in Appendix 1.

Table 4: Relation between corporate culture and the cost of equity

Variables	(1) COE_{it+1}	(2) COE_{it+1}
CC_TOTAL_{it}	-0.046***	-0.040***
	(0.000)	(0.000)
$BETA_{it}$		0.446***
		(0.000)
$IVOL_{it}$		12.262***
		(0.000)
LEV_{it}		0.312***
		(0.008)
BM_{it}		4.091***
		(0.000)
ROA_{it}		-6.203***
		(0.000)
$CASH\_FLOW_{it}$		-4.175***
		(0.000)
$SIZE\_AT_{it}$		0.039
		(0.385)
$ANALYST_{it}$		-0.535***
		(0.000)
$DISP_{it}$		-0.225**
		(0.036)
$BOARDIND_{it}$		1.028**
		(0.022)
$DIVERSE_{it}$		-0.136
		(0.714)
$BOARD\_SIZE_{it}$		0.288
		(0.166)
$INST\_INVEST_{it}$		-1.042***
		(0.000)
$BIGN_{it}$		-0.376***
		(0.003)
Constant	10.692***	7.068***
	(0.000)	(0.000)
Observations	23,028	23,028
Year and Ind FE	Yes	Yes
Adj R-squared	0.136	0.368

This table shows the regression results for Equation 1. Column (1) is based on without considering control variables. Column (2) is based on considering control variables. The *p*-values in parentheses are based on robust standard errors clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1. Variables are defined in Appendix 1.

Table 5: Relation between different dimensions of culture and the cost of equity capital

	COE_{it+1}						
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$INNOVATION_{it}$	-0.080***						
	(0.000)						
$INTEGRITY_{it}$		0.042					
		(0.228)					
$QUALITY_{it}$			-0.044*				
			(0.078)				
$RESPECT_{it}$				-0.092***			
				(0.000)			
$TEAMWORK_{it}$					-0.098***		
					(0.001)		
$PEOPLE\_CUL_{it}$						-0.045***	
						(0.000)	
$TECH\_CUL_{it}$							-0.060***
							(0.000)
$BETA_{it}$	0.459***	0.472***	0.469***	0.450***	0.451***	0.447***	0.463***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$IVOL_{it}$	12.091***	11.733***	11.834***	11.924***	12.226***	12.124***	12.069***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
LEV_{it}	0.312***	0.316***	0.315***	0.315***	0.314***	0.314***	0.312***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
BM_{it}	4.094***	4.181***	4.177***	4.120***	4.136***	4.127***	4.113***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
ROA_{it}	-6.203***	-6.060***	-6.098***	-6.092***	-6.132***	-6.120***	-6.207***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$CASH\_FLOW_{it}$	-4.076***	-4.141***	-4.133***	-4.211***	-4.255***	-4.239***	-4.070***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$SIZE\_AT_{it}$	0.051	0.053	0.051	0.033	0.050	0.044	0.046
	(0.267)	(0.254)	(0.269)	(0.476)	(0.277)	(0.335)	(0.313)
$ANALYST_{it}$	-0.526***	-0.586***	-0.580***	-0.566***	-0.570***	-0.571***	-0.530***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$DISP_{it}$	-0.228**	-0.229**	-0.226**	-0.228**	-0.227**	-0.226**	-0.226**
	(0.033)	(0.033)	(0.035)	(0.034)	(0.035)	(0.035)	(0.035)
$BOARDIND_{it}$	1.077**	0.976**	0.972**	0.944**	1.025**	0.985**	1.044**
	(0.016)	(0.029)	(0.030)	(0.035)	(0.022)	(0.028)	(0.020)
$DIVERSE_{it}$	-0.102	-0.242	-0.262	-0.138	-0.215	-0.178	-0.165
	(0.783)	(0.516)	(0.482)	(0.710)	(0.563)	(0.632)	(0.656)
$BOARD\_SIZE_{it}$	0.291	0.276	0.268	0.302	0.280	0.293	0.274
	(0.160)	(0.186)	(0.200)	(0.148)	(0.179)	(0.161)	(0.187)
$INST\_INVEST_{it}$	-1.032***	-0.967***	-0.993***	-0.987***	-0.999***	-0.999***	-1.044***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$BIGN_{it}$	-0.362***	-0.379***	-0.378***	-0.396***	-0.379***	-0.391***	-0.360***
	(0.005)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)	(0.005)
Constant	6.707***	6.575***	6.788***	6.971***	6.806***	6.980***	6.861***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	23,028	23,028	23,028	23,028	23,028	23,028	23,028
Year and Ind FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj R-squared	0.368	0.366	0.366	0.367	0.367	0.367	0.368

This table shows the result of the association between CC dimensions and the cost of equity. The *p*-values in parentheses are based on robust standard errors clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1. Variables are defined in Appendix 1.

Table 6: Alternative proxy for corporate culture

Variables	COE_{it+1}
CC_DUM_{it}	-0.372***
	(0.000)
$BETA_{it}$	0.456***
	(0.000)
$IVOL_{it}$	12.110***
	(0.000)
LEV_{it}	0.313***
	(0.008)
BM_{it}	4.125***
	(0.000)
ROA_{it}	-6.163***
	(0.000)
$CASH\_FLOW_{it}$	-4.161***
	(0.000)
$SIZE\_AT_{it}$	0.044
	(0.331)
$ANALYST_{it}$	-0.561***
	(0.000)
$DISP_{it}$	-0.226**
	(0.035)
$BOARDIND_{it}$	0.995**
	(0.026)
$DIVERSE_{it}$	-0.193
	(0.603)
$BOARD\_SIZE_{it}$	0.296
	(0.156)
$INST\_INVEST_{it}$	-1.016***
	(0.000)
$BIGN_{it}$	-0.381***
	(0.003)
Constant	6.664***
	(0.000)
Observations	23,028
Year and Ind FE	Yes
Adj R-squared	0.367

This table shows the result of the association between alternative proxy for CC and the cost of equity capital. The *p*-values in parentheses are based on robust standard errors clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1. Variables are defined in Appendix 1.

Table 7: Alternative proxies for the cost of equity capital

Variables	(1) GLS_{it+1}	(2) CAT_{it+1}	(3) PEG_{it+1}	(4) AGM_{it+1}
CC_TOTAL_{it}	-0.029***	-0.057***	-0.022**	-0.053***
	(0.000)	(0.000)	(0.024)	(0.000)
$BETA_{it}$	0.194***	0.268***	0.672***	0.572***
	(0.000)	(0.000)	(0.000)	(0.000)
$IVOL_{it}$	11.562***	11.459***	13.603***	16.713***
	(0.000)	(0.000)	(0.000)	(0.000)
LEV_{it}	0.163**	0.447**	0.340***	0.381**
	(0.024)	(0.038)	(0.007)	(0.022)
BM_{it}	5.873***	2.756***	3.026***	5.529***
	(0.000)	(0.000)	(0.000)	(0.000)
ROA_{it}	0.934**	0.515	-13.558***	-11.351***
	(0.017)	(0.367)	(0.000)	(0.000)
$CASH\_FLOW_{it}$	-0.926**	-0.074	-8.961***	-5.747***
	(0.043)	(0.904)	(0.000)	(0.000)
$SIZE\_AT_{it}$	0.237***	0.404***	-0.416***	-0.039
	(0.000)	(0.000)	(0.000)	(0.602)
$ANALYST_{it}$	-0.636***	-1.105***	0.027	-0.454***
	(0.000)	(0.000)	(0.808)	(0.001)
$DISP_{it}$	-0.026	0.031	-0.417***	-0.302*
	(0.752)	(0.805)	(0.006)	(0.065)
$BOARDIND_{it}$	0.402	1.279***	1.060	1.414*
	(0.287)	(0.007)	(0.108)	(0.053)
$DIVERSE_{it}$	-0.392	0.006	-0.152	0.251
	(0.198)	(0.989)	(0.762)	(0.692)
$BOARD\_SIZE_{it}$	-0.034	0.180	0.208	0.786**
	(0.841)	(0.419)	(0.473)	(0.026)
$INST\_INVEST_{it}$	0.498***	-0.466*	-1.540***	-2.524***
	(0.005)	(0.055)	(0.000)	(0.000)
$BIGN_{it}$	-0.286***	-0.470***	-0.319*	-0.447**
	(0.006)	(0.001)	(0.065)	(0.045)
Constant	3.383***	3.302***	11.688***	8.747***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	23,027	23,018	23,028	22,807
Year and Ind FE	Yes	Yes	Yes	Yes
Adj R-squared	0.403	0.241	0.316	0.300

This table shows the result of the association between CC and the alternative proxies of the cost of equity. The *p*-values in parentheses are based on robust standard errors clustered at the firm level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Variables are defined in Appendix 1.

Table 8: The effects of COVID in the association between CC and the cost of equity

Variables	COE_{it+1}
CC_TOTAL_{it}	-0.037***
	(0.000)
$COVID$	0.362
	(0.251)
$CC\_TOTAL_{it} \times COVID$	-0.041***
	(0.004)
$BETA_{it}$	0.445***
	(0.000)
$IVOL_{it}$	12.249***
	(0.000)
LEV_{it}	0.312***
	(0.008)
BM_{it}	4.084***
	(0.000)
ROA_{it}	-6.182***
	(0.000)
$CASH\_FLOW_{it}$	-4.206***
	(0.000)
$SIZE\_AT_{it}$	0.040
	(0.376)
$ANALYST_{it}$	-0.535***
	(0.000)
$DISP_{it}$	-0.224**
	(0.036)
$BOARDIND_{it}$	1.029**
	(0.021)
$DIVERSE_{it}$	-0.135
	(0.715)
$BOARD\_SIZE_{it}$	0.288
	(0.167)
$INST\_INVEST_{it}$	-1.041***
	(0.000)
$BIGN_{it}$	-0.376***
	(0.003)
Constant	7.035***
	(0.000)
Observations	23,028
Year and Ind FE	Yes
Adj R-squared	0.368

This table shows the association between CC and the cost of equity during COVID pandemic. The *p*-values in parentheses are based on robust standard errors clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1. Variables are defined in Appendix 1.

Table 9: PSM analysis

Panel A: Comparison of treatment and control firms

Variable	N	Treatment	Control	Difference	T-stat	P-value
Dependent variable						
COE_{it+1}	4,450	9.7217	9.9209	-0.1992	-2.4784	0.0132 **
Independent variables						
$BETA_{it}$	4,450	1.1368	1.1232	0.0136	0.9805	0.3269
$IVOL_{it}$	4,450	0.1077	0.1077	0.0000	0.0190	0.9849
LEV_{it}	4,450	0.3419	0.3406	0.0013	0.0670	0.9466
BM_{it}	4,450	0.3498	0.3542	-0.0044	-1.0097	0.3127
ROA_{it}	4,450	0.0513	0.0516	-0.0003	-0.1538	0.8778
$CASH\_FLOW_{it}$	4,450	0.1013	0.1017	-0.0004	-0.2412	0.8094
$SIZE\_AT_{it}$	4,450	7.2399	7.2326	0.0073	0.2008	0.8408
$ANALYST_{it}$	4,450	2.359	2.3571	0.0019	0.1351	0.8925
$DISP_{it}$	4,450	0.0533	0.0442	0.0091	1.3238	0.1856
$BOARDIND_{it}$	4,450	0.8347	0.8345	0.0002	0.1013	0.9193
$DIVERSE_{it}$	4,450	0.1397	0.1393	0.0004	0.1515	0.8796
$BOARD\_SIZE_{it}$	4,450	2.2524	2.2483	0.0040	0.8546	0.3928
$INST\_INVEST_{it}$	4,450	0.768	0.7677	0.0003	0.0736	0.9414
$BIGN_{it}$	4,450	0.8692	0.8658	0.0034	0.469	0.6391

Panel B: PSM regression

Variables	COE_{it+1}
CC_D_{it}	-0.194**
	(0.016)
$BETA_{it}$	0.361***
	(0.000)
$IVOL_{it}$	13.658***
	(0.000)
LEV_{it}	0.512**
	(0.012)
BM_{it}	3.804***
	(0.000)
ROA_{it}	-5.818***
	(0.000)
$CASH\_FLOW_{it}$	-3.549***
	(0.000)
$SIZE\_AT_{it}$	-0.024
	(0.686)
$ANALYST_{it}$	-0.414***
	(0.000)
$DISP_{it}$	-0.126
	(0.420)
$BOARDIND_{it}$	0.861
	(0.112)
$DIVERSE_{it}$	0.174

	(0.701)
$BOARD\_SIZE_{it}$	0.129
	(0.606)
$INST\_INVEST_{it}$	-0.680***
	(0.006)
$BIGN_{it}$	-0.250
	(0.107)
Constant	7.060***
	(0.000)
Observations	8,900
Year and Ind FE	Yes
Adj R-squared	0.357

This table shows the PSM analysis for the association between CC and the cost of equity. The *p*-values in parentheses are based on robust standard errors clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1. Variables are defined in Appendix 1.

Table 10: Two-step system GMM regression results

Variables	COE_{it+1}
$L.COE_{it+1}$	0.210***
	(0.001)
CC_TOTAL	-0.100***
	(0.006)
$BETA_{it}$	0.403
	(0.454)
$IVOL_{it}$	0.824
	(0.920)
LEV_{it}	-0.165
	(0.419)
BM_{it}	8.485***
	(0.000)
ROA_{it}	1.197
	(0.725)
$CASH\_FLOW_{it}$	-27.125***
	(0.000)
$SIZE\_AT_{it}$	-0.314
	(0.369)
$ANALYST_{it}$	0.519
	(0.298)
$DISP_{it}$	-2.517***
	(0.006)
$BOARDIND_{it}$	4.825
	(0.395)
$DIVERSE_{it}$	-3.426**
	(0.032)
$BOARD\_SIZE_{it}$	2.720
	(0.270)
$INST\_INVEST_{it}$	-0.425
	(0.837)
$BIGN_{it}$	0.022
	(0.986)
Constant	2.842
	(0.657)
Observations	22,413
Year and Ind FE	Yes
AR (1) test (p value)	0.000
AR (2) test (p value)	0.749
Hansen J statistics	103.2
Hansen J (p value)	(0.42)
Number of Groups	2,779
Number of Instruments	146

This table shows the GMM model for the association between CC and the cost of equity capital. The *p*-values in parentheses are based on robust standard errors clustered at the firm level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Variables are defined in Appendix 1.

Table 11: Path analysis

Panel A: Regression results

Variables	(1) $FREE\_CASH\_FLOW_{it}$	(2) DA_{it}	(3) COE_{it+1}
$FREE\_CASH\_FLOW_{it}$			0.385***
			(0.000)
DA_{it}			1.287***
			(0.001)
CC_TOTAL_{it}	-0.006***	-0.001***	-0.044***
	(0.000)	(0.000)	(0.000)
$BETA_{it}$	0.014***	0.001	0.561***
	(0.009)	(0.331)	(0.000)
$IVOL_{it}$	0.630***	-0.012	11.577***
	(0.000)	(0.395)	(0.000)
LEV_{it}	0.049***	0.004***	0.799***
	(0.000)	(0.000)	(0.000)
BM_{it}	-0.326***	0.013***	4.616***
	(0.000)	(0.000)	(0.000)
ROA_{it}	0.602***	0.567***	-5.196***
	(0.000)	(0.000)	(0.000)
$CASH\_FLOW_{it}$	0.910***	-0.618***	-3.159***
	(0.000)	(0.000)	(0.000)
$SIZE\_AT_{it}$	0.038***	-0.001	-0.074*
	(0.000)	(0.290)	(0.095)
$ANALYST_{it}$	-0.069***	-0.001	-0.330***
	(0.000)	(0.569)	(0.000)
$DISP_{it}$	0.039***	-0.001	-0.288**
	(0.000)	(0.708)	(0.021)
$BOARDIND_{it}$	0.164***	-0.016**	1.229***
	(0.000)	(0.015)	(0.000)
$DIVERSE_{it}$	-0.012	0.016***	0.348
	(0.702)	(0.002)	(0.184)
$BOARD\_SIZE_{it}$	0.020	-0.002	0.267*
	(0.246)	(0.434)	(0.073)
$INST\_INVEST_{it}$	0.117***	-0.015***	-0.547***
	(0.000)	(0.000)	(0.001)
$BIGN_{it}$	0.005	-0.002	-0.407***
	(0.523)	(0.315)	(0.000)
Constant	-1.362	0.884***	34.273***
	(0.313)	(0.000)	(0.006)
Year and Ind FE	Yes	Yes	Yes
Observations	22,830	22,830	22,830

Panel B: Direct and indirect effects

Channels	Coefficient	Std. err.	z	P>z
Indirect effect:				
$FREE\_CASH\_FLOW_{it}$	-0.002	0.001	-3.180	0.001
DA_{it}	-0.001	0.000	-3.090	0.002
Total indirect effect	-0.004	0.001	-4.310	0.000
Total effect	-0.048	0.005	-9.150	0.000

This table shows the path analysis for the association between CC and the cost of equity capital. The *p*-values in parentheses are based on robust standard errors clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1. Variables are defined in Appendix 1.

Figure 1: The direct and indirect association between corporate culture and the cost of equity capital