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The dark side of intangibles? Organizational capital and corporate investment efficiency

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Abstract

Purpose – Organizational capital (OK) represents an important intangible productive firm asset, yet one subject to agency problems. This paper provides a first examination of how OK impacts corporate investment inefficiency using an unbalanced panel of listed US companies from 2009 to 2020.

Design/methodology/approach – We utilize fixed-effect regressions to explore the relationship between OK and investment efficiency. Additionally, we implement a battery of robustness tests of the main study findings based on a variety of panel data techniques, including firm fixed effects, alternative measures of investment efficiency, estimators, including Newey–West as well as additional steps to address endogeneity concerns using system-GMM, two-stage least-squares and entropy balancing analyses.

Findings – OK is associated with reduced investment efficiency (underinvestment and overinvestment). A one-standard deviation increase in OK to total assets is associated with a 4.42% decrease in investment efficiency. Based on average firm investment, this represents a $390.88 million decrease in investment. CEO gender and career concerns as well as R&D intensity, positively moderate this relationship, while CEOs' age, power, tenure and connections as well as corporate governance and disclosure quality, negatively moderate it. The findings can be understood from the perspective of agency theory, whereby informational asymmetries surrounding OK make it challenging for firm outsiders to monitor and evaluate managerial investment choices.

Originality/value – We lack understanding as to how it impacts the efficiency of corporate investment. We contribute the first evidence in this regard by demonstrating that OK is associated with lower investment efficiency.

Keywords Investment efficiency, Organizational capital, Capital allocation, Intangible assets, CEO characteristics, Agency theory

Paper type Research paper

1. Introduction

Capital investment decisions are among the most important decisions made within firms that have a direct influence on firm value. The efficient market hypothesis presumes that investment and financing decisions are made independently and that firms pursue projects that maximize shareholder value (Modigliani and Miller, 1958). However, in the presence of capital market frictions, such as adverse selection, moral hazard, and information asymmetries (Biddle and Hilary, 2006; Anagnostopoulou *et al.*, 2023), firms can deviate significantly from optimal investment levels due to conflicts of interest between corporate managers and outside shareholders as well as financial constraints, as outlined by agency theory (Jensen and Meckling, 1976).

The importance of corporate investment for corporate success has inspired a growing literature that seeks to understand the firm-level factors that influence corporate investment efficiency. This literature finds that factors including the quality of accounting information and

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reporting (Biddle and Hilary, 2006; Biddle *et al*., 2009; Chen *et al*., 2011; Gomariz and Ballesta, 2014; Barth *et al*., 2017), level of employee education (Jin *et al*., 2023), accounting conservatism (Lara *et al*., 2016; Laux and Ray, 2020), choice of accounting standards (McClure and Zakolyukina, 2024), earnings management (McNichols and Stubben, 2008), managerial quality (Chemmanur *et al*., 2009; García-Sánchez and García-Meca, 2018), cash holdings (Richardson, 2006), firm ownership (Richardson, 2006; Chen *et al*., 2017), can influence corporate investment efficiency.

Although existing studies are informative, we lack understanding as to how organizational capital (OK), a key intangible asset [1], influences corporate investment efficiency. OK involves the accumulation of technological knowledge, experience, processes, designs, and business practices, which facilitates unique matching of labor and physical production resources, resulting in more efficient use of firm resources (Li *et al*., 2018; Eisfeldt and Papanikolaou, 2013). Given that OK stems directly from the input of senior managers (Carlin *et al*., 2012; Eisfeldt and Papanikolaou, 2013, 2014; Li *et al*., 2018; Attig and El Ghoul, 2018; Boguth *et al*., 2022), it has formerly been defined as "a *production factor that is embodied in the firm's key talent and has an efficiency that is firm-specif*ic, [and one where] *both shareholders and key talent have a claim to its cash flows*" (Eisfeldt and Papanikolaou, 2013, p. 1). Managers both choose to make investments in OK as well as influence its value to the firm (e.g. Carlin *et al*., 2012; Peters and Taylor, 2017; Eisfeldt and Papanikolaou, 2013, 2014; Boguth *et al*., 2022). Therefore, OK can potentially represent a source of sustainable competitive advantage for firms (Lev *et al*., 2009).

Yet how OK should influence corporate investment efficiency is theoretically ambiguous. On one hand, investments in OK could be associated with reduced investment efficiency, consistent with an agency-based interpretation (Myers and Majluf, 1984). Firms with high OK are understood to be risky (Boguth *et al*., 2022) and intangible assets are thought to exacerbate information asymmetries, which calls for enhanced disclosures of relevant and accurate information by firm executives to mitigate such information problems (Biondi and Rebérioux, 2012). Thus, heightened information asymmetries and uncertainty surrounding managerial investment choices, mean that shareholders fail to recognize or fully value the future benefits of intangible investments (Eisfeldt and Papanikolaou, 2013, 2014). Such informational asymmetries are compounded due to issues with disclosure, reporting, and general measurement difficulties associated with intangible assets in general (Barth *et al*., 2001) and OK in particular (Eisfeldt and Papanikolaou, 2013, 2014). For example, intangible assets are not normally recognized on firms' balance sheets because of the difficulties in determining their value and the uncertain nature of future payoffs related to their use. Thus, the information asymmetries associated with OK faced by corporate boards, shareholders, and other firm outsiders could result in, for example, managerial performance being evaluated more extensively based on the outcomes of their project choices in firms characterized by high OK. Consequently, managers may invest suboptimally when OK is high from the perspective of shareholders because of exacerbated career concerns (Goel *et al*., 2004; Kim *et al*., 2021).

On the other hand, OK could be associated with better corporate investment efficiency. Notably, investments in OK have been shown to facilitate greater quality and extent of informational disclosures by managers. In turn, this reduces information asymmetries surrounding managerial investment choices and could result in more efficient investment as senior managers face, *ceteris paribus*, lower career concerns (Goel *et al*., 2004; Chemmanur *et al*., 2009; Attig and El Ghoul, 2018; García-Sánchez and García-Meca, 2018) consistent with an agency theory perspective. Moreover, managers in high-OK firms may also invest more efficiently because of both better matching of managerial capital with OK and because of superior management ability; notably, investments in OK can improve the quality of matching between labor and physical production resources (Lev *et al*., 2009). In this way, OK can constitute a valuable and unique resource that can provide a source of sustainable competitive advantage for firms (Carlin *et al*., 2012; Hasan and Cheung, 2018). Consistent with these arguments Chemmanur *et al*. (2009) show that firms with better managers tend to choose

superior investment projects at any scale, resulting in both increased capital expenditures and investment in research and development (R&D), while Boguth *et al*. (2022, p. 857), who consider OK as "*a firm-specific production factor provided by key employees,*" find that while firms with high OK levels are risky, they are associated with higher future stock returns.

In this paper, we draw on agency theory to question whether OK can impact the efficiency of corporate investments. The underlying notion is that since OK can influence the extent of informational asymmetries in firms between insiders and outsiders, this could also impact managerial investment choices. We set our study in the context of the US, which, as we explain in detail in Section 2, has experienced significant growth in the use of intangible assets within firms and changes in investment efficiency over time driven. For example, the Sarbanes-Oxley Act of 2002, especially Section 404, introduced stricter requirements for financial reporting and internal controls, requiring management and external auditors to assess their effectiveness. These measures enhanced corporate governance and financial transparency, indirectly fostering greater investment efficiency by reducing managerial opportunism (Aubert and Grudnitski, 2014). We construct an unbalanced panel of 486 listed US firms, totaling 5,819 firm-year observations for the period 2009 to 2020, to provide, to the best of our knowledge, the first empirical examination as to how OK impacts corporate investment efficiency. We employ panel regression models that utilize fixed effects at the firm and year levels, where OK is measured using the perpetual inventory method of Peters and Taylor (2017) and corporate investment is modeled based on a firm's growth opportunities (Biddle *et al*., 2009). To mitigate potential concerns associated with our OK measure, we employ two measures of OK throughout our analyses (the ratio of OK to total assets and the ratio of OK to total capital).

By way of preview, our main results document a positive (negative) and significant impact of OK on investment inefficiency (efficiency). That is, increases in OK investments are more likely to increase investment distortions and, in turn, decrease investment efficiency. In terms of economic significance, a one standard deviation increase in the ratio of organizational capital to total assets (the ratio of organizational capital to total capital) results in a 4.42% (1.85%) decrease in investment efficiency. We also conduct analyses whereby we separate investment distortions into overinvestment and underinvestment and find that high OK is associated with both investment distortions. Thus, consistent with an agency-based interpretation, our main findings support the idea that increases in firms' OK are more likely to result in information asymmetries (Biondi and Rebérioux, 2012) and, in turn, increase corporate investment inefficiency (Myers and Majluf, 1984).

In further analyses we examine several key CEO-specific factors that could moderate the relationship between OK and corporate investment. For example, we find that OK investments by female CEOs are associated with greater investment efficiency; this is consistent with the idea that female CEOs are more likely to engage in quality management practices, which reduce agency conflicts and information asymmetries (Adams and Ferreira, 2009; Jurkus *et al*., 2011). We also observe a negative moderating effect of CEO power. We interpret this result from the perspective that a potentially harmful effect of CEO power on investment efficiency may be mitigated in high-OK firms since this reduces the opportunity for such CEOs to overinvest (Chowdhury *et al*., 2023). Furthermore, we show that CEOs who are older, longer-tenured, and have more external board seats are also associated with more efficient investments when OK is higher. Moreover, having shown that OK is associated with both under- and overinvestment, we consider, in corporate governance, disclosure quality and CEO career concerns, several viable economic channels through which the negative impact of OK on investment efficiency may be conveyed. We find that the quality of corporate governance, including board size, independence and gender diversity negatively moderates the relationship between OK and investment inefficiency. In other words, high-OK firms with good governance are associated with more efficient investment. Similarly, we find that improvements in a firm's information environment matter; firms with higher OK and with higher disclosure quality tend to make more efficient (less inefficient) corporate investments compared to those with lower disclosure quality. We also examine the impact of CEO career

concerns by exploiting the passage of the inevitable disclosure doctrine as a proxy for CEO mobility and find that CEOs in high-OK firms who face greater career concerns make more inefficient investments. Finally, we examine whether the relationship between OK and investment efficiency varies according to whether a firm belongs to an R&D intensive industry, and therefore may face greater information asymmetries, and find that firms with high-OK who operate in such industries are associated with lower investment efficiency.

We run a battery of robustness tests to validate our main findings. Importantly, we take several further steps to address potential endogeneity concerns, including using alternative estimators, including the system-GMM estimator and the 2SLS method, as well as implementing entropy balancing. We also run additional tests based on two subsamples based on the nature of products firms produce ((e.g. a subsample of industries that produce more tangible assets: agriculture (01–09), mining (10–14), construction (15–17), manufacturing (20–39)), and those that produce more intangible assets ((transportation (40–49), wholesale trade (50–51), retail trade (52–59), finance, insurance, and real estate (60–67), and services (70–89)), and find that the relationship between OK and investment efficiency holds even when splitting the sample based on the (tangible and intangible) nature of products firms produce. To add credence to the findings we report, we also check the sensitivity of our results over time. We do so, by splitting the main sample into two equal time periods: 2009 to 2014 and 2015 to 2020. Moreover, given that intangible assets have implications for firm risk, as firms with higher intangibles are generally associated with greater information asymmetry (e.g. Biondi and Rebérioux, 2012; Wu and Lai, 2020), we test the stability of our findings with respect to levels of firm risk, by creating two equal subsamples based on median company beta. Finally, we rerun our main regressions using the Newey-West estimator as an alternative method to adjust standard errors. Our results remain fully robust for these tests.

We make several contributions. To the best of our knowledge, our paper is the first to directly investigate the impact of OK on corporate investment inefficiency. To do so, we combine two main research streams. First, we expand the accounting literature on corporate investment efficiency, which has mostly focused on the role of accounting disclosure and quality in influencing corporate investment (Biddle and Hilary, 2006; Biddle *et al*., 2009; Chen *et al*., 2011; Gomariz and Ballesta, 2014; Laux and Ray, 2020), to consider the impact of OK on corporate investment efficiency. Second, we complement a recent interdisciplinary OK literature that demonstrates its relevance for various firm strategic choices and outcomes (Lev *et al*., 2009; Carlin *et al*., 2012; Hasan and Cheung, 2018; Attig and Cleary, 2014; Boguth *et al*., 2022; Provaty *et al*., 2024). For example, Attig and Cleary (2014), proxying for OK with management quality practices, find that firms with higher quality management practices exhibit lower investment sensitivity to internal cash flows. Eisfeldt and Papanikolaou (2013) show that OK is riskier and faces higher costs of equity financing. Boguth *et al*. (2022) emphasize the "fragile" nature of OK and show how the risk of OK reducing firm performance correlates with the outside employment options of top managers. We add to this literature by advancing understanding regarding the implications of OK for firms' strategic choices by showing that OK is associated with lower investment efficiency, *ceteris paribus*.

Aside from presenting new findings regarding the impact of OK on investment efficiency, we further contribute to existing knowledge by showing a role for several key CEO characteristics (external directorships, power, age, tenure, gender, and career concerns) as moderators of the relationship between OK and investment efficiency. In this way, we also extend a recent strand of the literature on the efficiency of capital allocation, which has explored the effect of such CEO-specific factors on investment efficiency, including social ties (Khedmati *et al*., 2020), power (Aktas *et al*., 2019), age and tenure (Li *et al*., 2017), and gender (Faccio *et al*., 2016). For example, we extend the work of Faccio *et al*. (2016) on gender, who show that although female-run firms have lower leverage and less volatile earnings, the preference of female CEOs for lower risk-taking is also associated with suboptimal investment. Importantly, our findings speak to a more nuanced effect of female CEOs on

investment efficiency since we demonstrate that when female CEOs lead firms with high OK, they exhibit superior investment efficiency compared to male-led high-OK firms.

Finally, our results also have several valuable practical implications for practitioners and investors that help explain the actual impacts of OK investments on investment decisions. From a practical perspective, our findings add to nascent understanding regarding the implications of OK for firm policies (e.g. Attig and Cleary, 2014; Attig and El Ghoul, 2018; Hasan *et al*., 2021). First, they infer that firms should be willing to improve information environments, including reporting and disclosure practices associated with intangible assets, to help investors overcome informational asymmetries associated with OK and, thus, better understand the value proposition of OK, allowing managers greater freedom from, for example, career concerns, to invest more efficiently. In this respect, since we show that female-led firms and firms with more gender diverse boards can help mitigate the negative impact informational asymmetries on investment efficiency, we lend support to international efforts to increase female leadership in large corporations, which is an important policy challenge in all countries (Huang and Kisgen, 2013). Second, in demonstrating an important negative association between OK and the efficiency of firm investment, our findings underscore the importance of robust corporate governance practices to address agency conflicts and information asymmetries linked to intangible assets such as OK. This is especially relevant for industries with high levels of OK and other intangible assets. Thus, strengthening governance structures can play a critical role in mitigating the adverse effects of OK on investment efficiency. In this vein, the importance of corporate governance mechanisms may be especially pronounced in specific industries, such as those that are R&D-intensive and require more input from human capital.

The remainder of this paper is structured as follows: Section 2 discusses intangible assets and investment efficiency reforms in the US. Section 3 explains the theoretical framework. Section 4 reviews the relevant literature on OK and corporate investment efficiency and develops the study hypotheses. Section 5 describes the research design. Section 6 presents the empirical analyses and discussion of the findings. Finally, Section 7 concludes.

2. Intangible assets and investment efficiency reforms in the US

Intangible assets play an important role in US industry. Much of the observable decline in physical investment in the US since the early 2000s, yet stable or increasing firm valuations (Gomme *et al*., 2011), has been attributed to the growing significance of intangible assets for economic rents (Crouzet and Eberly, 2023). For example, Lev and Gu (2016) emphasize that annual investments in intangible assets grew by 60% over the period 1977–2014 while investments in tangible assets decreased by 35%. Similarly, Corrado *et al*. (2022) illustrate that US investments in intangible assets had surged substantially from 1985 to 2021 and reached around 16% of the total GDP as of 2021, whereas annual investments in tangible assets had dropped by 4% during the same period, from 12.5% to 8.5% of the total GDP. Moreover, an increasing number of studies demonstrate that intangible assets, and OK in particular, are a key determinant of value creation and competitive advantage within the US economy (e.g. Corrado *et al*., 2005; Lim *et al*., 2020). Corrado *et al*. (2005) find that intangible assets contributed 75% of US economic growth in the early 2000s and valued US intangible assets at $3.4 trillion in the same time period, while Atkeson and Kehoe (2005) show that OK accounts for 40% of the total earnings produced by intangible assets in the US.

International regulations and standards for intangible assets have evolved markedly over the past 30 years to address specific challenges surrounding the treatment of intangible assets [2]. From 1994 to 2004, early reforms included the voluntary implementation of the International Accounting Standards (IAS). This resulted in many regulatory bodies around the world rewriting and revising their standards to grant companies more flexibility to choose the appropriate accounting guidelines. In 2001, these guidelines were retitled the International Financial Reporting Standards (IFRS). Like many countries, intangibles in the US accounting

framework are governed by detailed standards emphasizing recognition, measurement, and disclosure. Their treatment under US accounting standards reflects their growing importance and the challenges of accurately valuing these assets. Initially, APB Opinion No. 17 (1970) required amortization of goodwill and other intangibles over up to 40 years, emphasizing simplicity over economic realism. This shifted with SFAS 142 (2001), which replaced amortization with annual impairment testing for goodwill, aiming to better reflect an asset's true value. Codified under ASC 350, this change aligned with the increasing importance of fair value measurements.

In 2007, the IFRS and the US-preferred Generally Accepted Accounting Principles (US GAAP) began to harmonize their standards. However, despite this harmonization process and the introduction of new standards, accounting practices remain subject to ongoing debates, and there are significant differences between the treatment of intangibles in the US and internationally. For example, under US GAAP, intangibles, such as internally developed R&D costs, must be expensed immediately (ASC 730) (Canace *et al*., 2022), while IFRS (IAS 38) allows capitalization when specific criteria, like technical feasibility, are met. Goodwill is another key point of divergence; while US GAAP mandates annual impairment testing (ASC 350), IFRS allows amortization alongside impairment testing, reducing complexity but potentially obscuring economic reality.

Aside from the treatment of intangibles under prevailing accounting frameworks, there have been changes in firms' investment efficiency within the US, which have followed the passage of key regulatory changes. For example, through Section 404, the Sarbanes-Oxley Act of 2002 (SOX) added stricter requirements for financial reporting and controls, including that management and external auditors assess the effectiveness of internal controls over financial reporting. From this perspective, SOX enhanced corporate governance and financial transparency, indirectly fostering greater investment efficiency by reducing managerial opportunism (Aubert and Grudnitski, 2014). Furthermore, Section 201 of SOX, which imposed stricter rules on auditing, including prohibiting the outsourcing of internal auditing, also impacted investment efficiency through its influence on auditor conservatism (Lu and Sapra, 2009). Lu and Sapra (2009) find that Section 201 had a negative impact on investment efficiency and audit quality through its mandatory restriction of nonaudit services. More recently, the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 also had an influence on firm investment. For example, as shown by Du and Heo (2022), the introduction of the Dodd-Frank whistleblowing provision, which enhanced the protection afforded to firm whistleblowers, resulted in a negative relationship between political corruption and firm investment becoming insignificant.

The above discussion infers that while investment efficiency and intangibles are important topics within the accounting discipline, they are also subject to much ongoing debate and are characterized by significant differences between the US compared to internationally. This divergence underscores ongoing debates about the relevance, reliability, and comparability of financial reporting for intangibles (Hussinki *et al*., 2024). Taken together, we consider that these differences may mean that the relationship between OK and investment efficiency may differ in the US compared to other country settings. We therefore argue that these differences make the US setting a highly relevant and interesting setting to study the effect of OK on corporate investment efficiency.

3. Theory

Investment opportunities are a key determinant of corporate investment under the framework of Modigliani and Miller (1958). From the perspective of shareholders, managers should select positive net present value (NPV) projects and forgo those with negative NPVs. However, in corporations the separation of firm ownership and control can result in agency problems, attributable to the misalignment of managerial and shareholder incentives (Jensen and Meckling, 1976). Agency theory (Jensen and Meckling, 1976) posits that a firm is just a

spectrum of contracts among shareholders and managers (principals and agents). Jensen and Meckling (1976) argue that firms are mere legal fictions and agency relationships can be reflected in contracts. Bonding, monitoring vehicles, and incentives pursued to diminish agency costs are the key ingredients of the contracts. Based on these contracts, principals (shareholders) delegate the running of the business to agents (managers), who they expect will run the business to maximize shareholder value. Here, agency theory presumes that corporate managers will engage in managerial opportunistic behavior (e.g. empire building and expense preference behavior) when there is a conflict of interests between managers and shareholders.

These are important observations, given that the prior investment literature considers agency conflict and asymmetric information as the most important frictions that can result in corporate investment deviating from an optimal level (Biddle and Hilary, 2006; McNichols and Stubben, 2008; Biddle *et al*., 2009; Anagnostopoulou *et al*., 2023). Myers and Majluf (1984) and Myers (1984) demonstrate that asymmetric information between shareholders and corporate managers does not only affect the cost of capital but also the investment choice. Incentive misalignment and asymmetric information between managers and firm outsiders can result in under- or overinvestment (Jensen and Meckling, 1976; Lambert *et al*., 2007; Biddle *et al*., 2009).

The presence of high informational asymmetries between managers and firm outsiders also gives rise to moral hazard and adverse selection issues, which can impact the efficiency of investment (Biddle *et al*., 2009). An important reason is that managers are more likely to pursue self-interest at the expense of shareholders when agency costs and informational asymmetries are high. For example, as argued by Jensen (1986), managers may overinvest in certain projects, such as pursuing empire building through acquisitions, when there is an abundance of resources to invest (Chen *et al*., 2017). Similarly, when corporate managers know that the company's equities are overvalued, they tend to issue new equities and obtain more funds. However, corporate shareholders predicting this behavior are more likely to discount new equities if there are high information asymmetries (Lara *et al*., 2016; Wu *et al*., 2022). In line with these arguments, Barth and Kasznik (1999) predict and find that in firms with high intangible assets, which they associate with more substantial informational asymmetries, the stock market reacts more positively to share repurchase announcements. The reason being that such repurchases provide important information regarding managers' beliefs regarding firm value, which helps mitigate information asymmetries present in high intangible asset firms. Conversely, managers may underinvest for several reasons, including career concerns (Goel *et al*., 2004; Kim *et al*., 2021), which are generally understood to be higher when information asymmetries between firm insiders and outsiders are more pronounced (Goel *et al*., 2004; Chemmanur *et al*., 2009; Attig and El Ghoul, 2018; García-Sánchez and García-Meca, 2018), such as in firms with significant intangible investments (Biondi and Rebérioux, 2012). Furthermore, suppliers of capital, recognizing the potential for managers to deviate from shareholder objectives in firms with high information asymmetries, may restrict funding to such firms, which could exacerbate the tendency for self-interested managers to invest suboptimally. For example, underinvestment may be more likely as managers face financial constraints and, in turn, higher costs of firm capital.

Consistent with prior studies, we consider that intangibles, including OK, impact firm information asymmetries and agency problems and that this matters from the perspective of investment efficiency (e.g. Barth and Kasznik, 1999; Barth *et al*., 2001; Park, 2019; Choi *et al*., 2013). Based on the consensus in the investment literature that firms with higher (lower) informational asymmetries exhibit lower (better) investment inefficiency (Barth and Kasznik, 1999; Barth *et al*., 2001; Biddle and Hilary, 2006; Biddle *et al*., 2009; Chemmanur *et al*., 2009; Chen *et al*., 2011, 2023; Benlemlih and Bitar, 2018), our main conjecture, as we hypothesize in subsection 4.3, is therefore that firms with high OK make less efficient investments, *ceteris paribus*. This is based on the notion that agency problems and informational asymmetries between firm insiders and outsiders are increasing with intangible assets (Barth and Kasznik, 1999; Barth *et al*., 2001; Biondi and Rebérioux, 2012), which exacerbates agency problems and increases the scope for managers to act according to self-interest. There are several reasons

why intangible assets should be associated with higher informational asymmetries and agency problems. For example, there is substantial economic uncertainty surrounding intangible assets, which helps explain why they are not recognized in financial statements given measurement difficulties (Barth and Kasznik, 1999; Barth *et al*., 2001; Hussinki *et al*., 2024). Moreover, since intangibles are not typically unrecognized and fair values undisclosed, ceteris paribus, firms with high intangibles have less informative prices (e.g. Barth *et al*., 2001).

4. Empirical literature review and hypotheses development

4.1 Corporate investment efficiency

Corporate investment efficiency relates to how firms choose to invest, with deviations from optimal investment representing under- or overinvestment. The importance of understanding firm investment choices has led to a rich literature on corporate investment efficiency emerging over the past two decades [3]. The majority of this literature focuses on the implications of accounting quality and conservatism for investment efficiency. A seminal paper by Biddle and Hilary (2006) focuses on the relationship between accounting quality and capital investment. They show that accurate and transparent financial reporting enhances the effectiveness of investment choices by bridging the knowledge gap between company management and external investors. Similarly, Biddle *et al*. (2009) present evidence consistent with the notion that financial reporting quality reduces frictions such as moral hazards and adverse selection, which can hinder effective investment. While these studies focus on large, publicly listed US firms, Chen *et al*. (2011) and Gomariz and Ballesta (2014) focus on other country contexts. Chen *et al*. (2011) show similarity to Biddle *et al*. (2009) in the case of private firms in emerging markets, while Gomariz and Ballesta (2014) examine the impact of financial reporting quality on investment efficiency using a sample of Spanish-listed companies covering the period 1998–2008. They demonstrate that higher reporting quality can enhance investment efficiency and reduce investment distortions. In the same vein, Lara *et al*. (2016) investigate the impact of accounting conservatism on investment efficiency. They find that accounting conservatism enhances investment efficiency, mitigates equity-debt conflicts and underinvestment, and facilitates access to debt finance. Finally, Laux and Ray (2020) also study the relationship between accounting conservatism and investment efficiency in a theoretical setting and argue that the relationship depends on prevailing managerial incentives.

A separate strand of the literature focuses on other firm-level factors that can influence investment efficiency, including earnings management (McNichols and Stubben, 2008), managerial quality (Chemmanur *et al*., 2009; García-Sánchez and García-Meca, 2018), cash holdings (Richardson, 2006), firm ownership (Richardson, 2006; Chen *et al*., 2017), and a firm's choice of accounting standards (McClure and Zakolyukina, 2024). For example, McNichols and Stubben (2008) present evidence that managers who engage in firm earnings manipulation also overinvest during these periods, while McClure and Zakolyukina (2024) find that firms' reporting standards matter for how managers invest. Specifically, they consider whether a firm's choice to report earnings under GAAP or non-GAAP accounting standards has relevance for managerial investment. The authors show that when investors exclusively rely on a firm's GAAP earnings, this encourages managers to distort from optimum levels (e.g. underinvestment). However, when non-GAAP earnings are used, this can mitigate underinvestment yet also result in overinvestment as it allows managers to more easily hide inefficient investment.

4.2 Organizational capital (OK)

OK, still quite a new concept within the accounting and finance literature, involves the accumulation of technological knowledge, experience, processes, designs, and business practices that facilitate unique matching of labor and physical production resources, which combine to facilitate the efficient use of firm resources (Eisfeldt and Papanikolaou, 2013,

2014; Li *et al*., 2018). Existing studies suggest that OK is partially embedded within senior managers and other key employees (Attig and El Ghoul, 2018; Eisfeldt and Papanikolaou, 2013, 2014). Carlin *et al*. (2012) theorize that the value of OK for firm performance depends on the extent to which managers are willing and able to coordinate within the firm to share OK, while a body of literature supports a positive relationship between managerial quality and the value of OK (Peters and Taylor, 2017; Eisfeldt and Papanikolaou, 2013, 2014). Boguth *et al*. (2022) argue that the value of OK for firms also depends on the "fragility" of OK and that this fragility is determined by the marginal contribution of managers to OK. Specifically, their findings demonstrate that high-OK firms suffer more significant declines in firm market performance from the departure of key managers when they have smaller top management teams compared to firms with larger teams.

Extant literature presents mixed findings as to whether OK should convey a positive or negative impact on firms' strategic choices and outcomes. From one perspective, OK can represent a source of unique and sustainable competitive advantage for firms (Lev *et al*., 2009; Carlin *et al*., 2012; Hasan and Cheung, 2018). In this way, OK can help mitigate agency conflicts between managers and shareholders by improving the information environment. Consistent with this, Attig and El Ghoul (2018) present evidence that OK can reduce information asymmetries between managers and firm outsiders. They show that firms' investments in OK are rewarded with superior management practices; specifically, such firms disclose more and better-quality information to investors, which reduces information asymmetries and reduces the implied cost of firm equity. Provaty *et al*. (2024, p. 2) make comparable arguments, using a signaling theory perspective, to propose that firms with high OK may undertake initiatives to reduce greenhouse gas (GHG) emissions to "*communicate and signal their outstanding capabilities*". In support of such arguments, there are a number of studies that highlight several benefits to firms associated with OK, including, a lower cost of equity financing (Attig and El Ghoul, 2018), higher firm values and stock returns (Orhangazi, 2019; Lev *et al*., 2009; Eisfeldt and Papanikolaou, 2013; Gao *et al*., 2021), and higher firm productivity (Gao *et al*., 2021). For example, Gao *et al*. (2021) show that investment in OK is associated with enhanced firm productivity and shareholder value, while Eisfeldt and Papanikolaou (2013) estimate that firms with more OK realize average returns 4.6% higher compared to low OK firms. A few studies focus on various other dimensions of firm performance. The influence of OK on merger and acquisition (M&A) performance is the focus of Li *et al*. (2018). Using data on US acquisitions between 1984 and 2014, they show that higher OK is associated with better deal performance – both in terms of short-term market returns to M&A announcements and post-merger operating and stock performance. Hasan *et al*. (2021) find that higher OK is associated with increased future cash flows and that tax avoidance strategies, including investing in tax haven subsidiaries, are a mechanism through which this can occur. Finally, Provaty *et al*. (2024) demonstrate that high-OK firms are associated with lower direct and indirect GHG emissions.

Conversely, OK may have a negative impact on firms' strategic choices and outcomes. Investments in OK are often considered risky and uncertain (Eisfeldt and Papanikolaou, 2013, 2014; Attig and El Ghoul, 2018; Boguth *et al*., 2022), and information asymmetries and uncertainty surrounding managerial investment choices mean that firm outsiders fail to recognize the value of OK investments (Eisfeldt and Papanikolaou, 2013, 2014). Consistent with this, Eisfeldt and Papanikolaou (2013) show that firms with higher OK are more exposed to firm-specific and aggregate shocks, which raises the cost of equity financing. Furthermore, issues with disclosure, reporting, and general measurement of OK could lead to managerial performance being evaluated more extensively based on the outcomes of their project choices in firms characterized by high OK. Consequently, managers may invest suboptimally in high-OK firms because of exacerbated career concerns (Goel *et al*., 2004; Kim *et al*., 2021). This could also imply that managers may hold more cash to offset such risks. Consistent with this notion, Marwick *et al*. (2020) focus on the relationship between OK and corporate cash holdings and show that firms that invest more in OK hold more cash and that this effect is

strongest amongst financially constrained firms and those with riskier cash flows. To the extent that high cash holdings may reflect an agency concern from the perspective of shareholders, shareholders may be wary of allowing managers to cash in firms with high OK. For example, Hasan and Uddin (2022) examined the relationship between OK and payout policies. Using a sample of US firms from 1980–2017, they find that firms with higher OK tend to have higher levels of cash dividends and share repurchases. The authors interpret their results from the perspective of agency theory, whereby managers in high-OK firms may invest suboptimally to maximize private benefits and dividend payouts, which therefore serves as a means to discipline managers.

4.3 Linking organizational capital (OK) with corporate investment efficiency

Since we lack prior studies that examine the implications of OK for corporate investment efficiency, in this section we integrate the existing literature on OK and the literature on corporate investment efficiency to outline two hypotheses regarding the effect of OK on investment efficiency.

The first hypothesis we consider relates to the fundamental relationship between OK and investment efficiency. As we discussed earlier in the introduction section, the effect of OK on investment is theoretically ambiguous. Yet as we explain, we consider that the balance of arguments supports a negative relationship between OK and investment efficiency.

From one perspective, OK could be positively related to investment efficiency. For example, OK could potentially enhance corporate investment efficiency by improving the quality and extent of managerial disclosures, thereby reducing information asymmetries and lowering managerial career concerns (Goel *et al*., 2004; Chemmanur *et al*., 2009; Attig and El Ghoul, 2018; García-Sánchez and García-Meca, 2018). Additionally, high-OK firms may be more likely to possess superior management capabilities, including better alignment of managerial capital with OK, resulting in more efficient resource allocation (Carlin *et al*., 2012; Hasan and Cheung, 2018). Consistent with this, Chemmanur *et al*. (2009) demonstrate that firms with strong managers make better investment choices, increasing capital expenditures and R&D investment. Similarly, Boguth *et al*. (2022) find that while firms with high OK are riskier, they also yield higher future stock returns, highlighting OK as a source of sustainable competitive advantage.

However, we postulate that, *ceteris paribus*, OK should be negatively associated with investment efficiency for several reasons. Investments in OK in particular and intangible assets in general can exacerbate agency conflicts between shareholders and managers. One important reason is that the high information complexity of intangible assets increases information problems and moral hazards, rendering it more difficult for outsiders to evaluate firm operations (Barth *et al*., 2001; Gu and Wang, 2005; Lev *et al*., 2009). For example, it is more difficult for analysts to understand and predict the future performance of intangible-intensive firms, which can result in higher forecast errors (Gu and Wang, 2005). The difficulties firm outsiders face with assessing the value of firms' OK are further compounded by the fact that OK experiences measurement challenges under current accounting principles (Atkeson and Kehoe, 2005; Crouzet and Eberly, 2023). For instance, OK is always expensed on the income statement, does not appear as an asset on the balance sheet (Danielova *et al*., 2023), and is typically not capitalized (Crouzet and Eberly, 2023). Furthermore, current accounting principles largely lack detailed requirements related to the reporting and disclosure of intangible assets, and the use of book value to value OK can result in an under- or over-valuation problem (Peters and Taylor, 2017; Chan *et al*., 2022; Crouzet and Eberly, 2023). Thus, a fair value for OK is unlikely to exist in financial statements. Such issues may lead investors to not fully recognize the future benefits of OK investment, which increases information asymmetries between investors and managers (Eisfeldt and Papanikolaou, 2013, 2014).

For these reasons, external shareholders may resist increases in OK investments, which eventually deepens the agency conflict between shareholders and top managers (Boguth *et al*.,

2022) and makes it more difficult for shareholders to monitor (Richardson, 2006; Morellec and Schürhoff, 2011). Moreover, firms with higher OK tend to have less informative prices (Barth *et al*., 2001) and are more prone to negative financial shocks, which increases the riskiness of their cash flows (He, 2018). Consequently, managers of high-OK firms may invest suboptimally because of exacerbated career concerns (Goel *et al*., 2004; Kim *et al*., 2021). One reason is that evaluations of their performance by shareholders are more closely linked to the outcome of their investment decisions in firms with higher information asymmetries (Goel *et al*., 2004). Consistent with this, Carlin *et al*. (2012) present a model in which managers in firms with stronger employment protection regulations, and hence who face lower managerial career concerns, are more likely to invest in OK. In other words, managerial career concerns in firms with high OK are likely to be more salient and are expected to impact corporate investment efficiency. Thus, based on these arguments, we hypothesize:

H1. Firms with high levels of organizational capital have lower investment efficiency, ceteris paribus.

However, while intangible assets are typically associated with more pronounced agency problems and informational asymmetries (e.g. Biondi and Rebérioux, 2012), there are several important factors that could moderate the expected impact of OK on investment efficiency. Notably, firms with higher OK have been associated with more efficient organizational structures that facilitate better quality information flows, management practices, product quality, reputations, and greater stability of firm operations and production (Attig and Cleary, 2014; Hasan *et al*., 2022; Danielova *et al*., 2023). Such findings support the notion that OK investments can contribute to valuable and sustainable advantages for firms (Carlin *et al*., 2012; Hasan and Cheung, 2018; Danielova *et al*., 2023). Furthermore, aside from corporate governance, investments in OK have been shown to facilitate greater quality and number of informational disclosures by managers (Goel *et al*., 2004; Chemmanur *et al*., 2009; Attig and El Ghoul, 2018; García-Sánchez and García-Meca, 2018). Based on such observations, better corporate governance arrangements and information disclosures by managers could mitigate information asymmetries in high-OK firms. Therefore, we further posit that stronger corporate governance arrangements, better disclosure quality, and the extent of labor market frictions (e.g. Biddle and Hilary, 2006; Gomariz and Ballestra, 2014; Chen *et al*., 2021, 2023; Danielova *et al*., 2023; Jiang *et al*., 2024) [4] could positively moderate the expected negative impact of OK on corporate investment efficiency; that is, they may represent key economic channels through which OK investments could potentially lead to an increase in investment efficiency. We test for these possibilities in Section 6.1, Economic channels. If true, this would help explain recent findings of a positive relationship between OK for and the stock price of firms (Lev *et al*., 2009; Eisfeldt and Papanikolaou, 2013) and the finding of Danielova *et al*. (2023) that OK is negatively related to the cost of bank loans.

Based on this discussion, while H1 predicts a negative relationship between OK and corporate investment efficiency, we further conjecture that the impact of OK on corporate investment may be positive in the context of firms with lower information asymmetries. That is, we posit that specific firm-level conditions associated with lower agency costs could serve to moderate the negative impact of OK on investment efficiency:

H2. Organizational capital is associated with better investment efficiency in firms with lower agency costs.

5. Research design

5.1 Sample and data

Our unbalanced panel dataset is based on the constituents of the S&P 500 index, which comprises the leading 500 companies in the US economy with a contribution of more than 80% of the US market capitalization (S&P 500, 2023). We source firm financials and other relevant

data from LSEG's DataStream platform (formerly Thomson Refinitiv) for all companies present in the S&P 500 over the period 2009–2020 to mitigate survivorship bias [5]. This yields a final sample of 486 firms with 5,819 firm-year observations [6]. All data are winsorized at 1 and 99% to mitigate the effect of potential outliers.

Since S&P 500 firms encounter the lowest degree of information asymmetry between management and shareholders [7], due to the continuing flow of private and public information, we select only S&P 500 constituents rather than, for example, the wider S&P 1500 in order to isolate the effect of OK on corporate investment efficiency. The S&P 500 is widely considered as the best representation of the U.S. stock market (Jiang and Fang, 2015; Cornaggia *et al*., 2017; Krauss *et al*., 2017). Furthermore, our dataset is not extended to cover the post-COVID-19 pandemic period 2021–2023 in order to mitigate the potential influence of the COVID-19 pandemic on corporate investment policies [8]. In this vein, Howe *et al*. (2021) and Buchheim *et al*. (2022) illustrate that the COVID-19 pandemic has left a deep effect on corporate behavior and has forced firms to change all aspects of corporate strategy (investment, finance, marketing, operations, and HR).

5.2 Investment inefficiency

In a theoretical world absent of market imperfections or "frictions," investment efficiency infers the efficient use of firm resources in projects that return positive net present value (hereinafter, NPV) (Modigliani and Miller, 1958). However, in reality, frictions exist. These frictions render it challenging for investors to observe managerial investments and firm cash flows (Stulz, 1990). Accordingly, this can give rise to overinvestment, whereby managers pursue projects with zero or negative NPVs, or underinvestment, where managers forego positive NPV investments (Biddle *et al*., 2009).

Following the corporate investment literature, we construct our main measure of investment efficiency by first modeling the expected levels of total investment as a function of investment opportunities, internal finance competencies (McNichols and Stubben, 2008), and growth opportunities (Biddle *et al*., 2009). Investment inefficiency is then estimated as the deviations or residuals from the optimal investment model as follows (e.g. Richardson, 2006; Biddle *et al*., 2009; Gomariz and Ballesta, 2014; Barth *et al*., 2017). Positive (or negative) residuals from equation (1) infer overinvestment (underinvestment) relative to the expected level of investment.

$$Investment_{i,t+1} = \beta_0 + \beta_1 Sales\,Growth_{i,t} + \beta_2 Tobins\,Q_{i,t} + \beta_3 CFO_{i,t} + e_{i,t} \quad (1)$$

where $Investment_{i,t+1}$ is the total investment of a firm, computed as the net increase in tangible and intangible assets scaled by lagged total assets; $Sales\,Growth_{i,t}$ is the percentage change in sales from t−1 to *t*; $Tobins\,Q_{i,t}$ is the market-to-book ratio; $CFO_{i,t}$ is the operating cash flows; and $e_{i,t}$ is the error term, which is also the key residual from the optimal investment model and our measurement of *investment inefficiency*, our main dependent variable.

5.3 Organizational capital (OK) measures

To estimate a firm's OK we join Hasan *et al*. (2021) in adopting the perpetual inventory method proposed by Peters and Taylor (2017), which utilizes a firm's selling, general, and administrative (SG&A) expenses and includes a firm's operating expenses that are not directly related to the production of goods or services, including costs relating to IT outlays, employee training costs, brand enhancement activities, payments to consultants, and costs associated with establishing and maintaining online supply and distribution channels (Lev *et al*., 2009). Specifically, we follow Peters and Taylor (2017) in computing the level of OK for each firm year as follows:

$$OK_{i,t} = (1 - \delta_{OC})OC_{i,t-1} + (SG\&A_{i,t} \times \lambda_{OC}) \quad (2)$$

And where the initial value of OK is calculated as:

$$OK_{i,t} = \left(\frac{SG\&A_{i,t} \times \lambda_{OC}}{g + \delta_{OC}} \right) \quad (3)$$

where $OK_{i,t}$ represents the OK of firm i at time *t*, δ_{OC} indicates the rate at which OK depreciates, and is set equal to 20% (0.2) (Eisfeldt and Papanikolaou, 2013; Peters and Taylor, 2017; Hasan *et al*., 2021). $SG\&A_{i,t}$ expenses of firm *i* in year *t*, are denoted by $SG\&A_{i,t}$. The percentage of SG&A expenditure allocated to OK investment is shown by λ_{OC} and is set equal to 30% (0.3) (Eisfeldt and Papanikolaou, 2013; Peters and Taylor, 2017; Hasan *et al*., 2021). Lastly, the average growth rate in firm-level SG&A expenses is represented by *g*.

5.4 Model specification and control variables

To examine the effect of OK on corporate investment efficiency, we follow the latest developments in investment efficiency and estimate panel regressions with firm- and year-fixed effects and with standard errors clustered at the firm level (following Hasan and Cheung, 2018; Hasan *et al*., 2021; Chan *et al*., 2022; Xu *et al*., 2024). Equation (4) presents the baseline fixed effects model [9]:

$$\begin{aligned} Investment\ inefficiency_{i,t} &= \beta_0 + \beta_1 OK_{i,t} + \Sigma \beta_2 CONTROLS_{i,t} + \beta_3 Firm_i FE \\ &\quad + \beta_4 Year_t FE + \varepsilon_{i,t} \end{aligned} \quad (4)$$

where $Investment\ inefficiency_{i,t}$ denotes the residuals from the optimal investment model and is the dependent variable. $OK_{i,t}$, is the main variable of interest, which is represented by the ratio of OK to total assets (*OKTA*) or the ratio of OK to total capital (*OKTC*) (Hasan *et al*., 2021). Right-hand side variables are contemporaneous in the model, consistent with best practices in the literature (Hasan and Cheung, 2018; Chan *et al*., 2022; Hasan *et al*., 2021).

We include a vector of control variables motivated by prior literature. *SIZE* is the log of annual market capitalization. Prior literature infers that firm size can convey a strong impact on firm investment decisions (Wu *et al*., 2022). Moreover, larger firms are less prone to agency problems and default (Rajkovic, 2020). *LEVERAGE* is computed as the ratio of total debt to total capital. The effect of leverage on investment efficiency can vary and result in both over- and underinvestment (Biddle *et al*., 2009). Based on agency theory, Biddle *et al*. (2009) explain that firms with low (high) leverage and those that have low (high) cash holdings are more likely to overinvest (underinvest). Agrawal and Knoeber (1996) argue that leverage can reduce manager-shareholder agency problems through the additional monitoring provided by debtholders. However, Aivazian *et al*. (2005) find a negative and significant impact of leverage on corporate investment and confirm that this relationship is stronger among firms with lower growth opportunities. *ROA* represents return on investment and is computed as the ratio of earnings before interest and taxes to total assets. We control for whether a firm has negative earnings with *LOSS*, a dummy variable that takes a value of 1 if a firm makes a loss and 0 if it does not (e.g. Chen *et al*., 2017). Both variables, ROA and LOSS, are employed to control firm performance. Following Biddle and Hilary (2006), we control for a firm's investment opportunities using *TOBIN'S Q*, proxied by the market-to-book equity ratio. Biddle and Hilary (2006) find a negative relationship between *TOBIN'S Q* and investment efficiency. *AGE* is firm age, computed as the number of years since the company was listed on the stock market. Firm age is typically found to have a positive impact on investment efficiency, as younger firms tend to be less visible and less known by investors and debtholders (Xu *et al*., 2024). Also, more established firms often have easier access to external finance resources compared to younger firms. Consequently, older firms tend to have more capital investments and more efficient investments (Sufi, 2007). *SLACK* is measured using the ratio of cash holdings to total assets and is used to control for the impact of cash on investment efficiency (Biddle and Hilary, 2006; Biddle *et al*., 2009; Gomariz and Ballesta, 2014), since

this could result in either underinvestment or overinvestment (Biddle *et al*., 2009). To better isolate any effect of OK on corporate investment efficiency, we also control for the degree of tangibility of a firm's assets with *TANGIBILITY*, measured as the ratio of fixed assets to total assets. Ferris *et al*. (2017) demonstrate that the inclusion of tangibility and leverage can control the likelihood of firm financial distress. Finally, we include firm (Chen *et al*., 2017) and year-fixed effects (Lara *et al*., 2016; Chen *et al*., 2017) to account for unobserved firm- and year-specific factors that could influence investment (Chen *et al*., 2017).

6. Empirical results and discussion

6.1 Baseline results

6.1.1 Summary statistics. Table 1 presents the descriptive statistics for the dependent and independent variables based on the full sample of 486 firms and 5,819 firm-year observations. The average organizational capital to total assets, *OKTA*, is 0.193 with a standard deviation of 0.206, while the average organizational capital to total capital, *OKTC*, is 0.284 with a standard deviation of 0.325. The minimum values of *OKTA* and *OKTC* are 0.000 for both, while the 25th (75th) percentile value is 0.054 (0.260) for *OKTA* and 0.080 (0.364) for *OKTC*. Finally, the maximum values are 1.110 and 1.798, respectively. These values are very similar to those reported in Marwick *et al*. (2020), who use a comparable sample of US firms. The average sample investment inefficiency is −0.001 with a range from −0.018 to 0.030, which is also similar to prior studies (e.g. Benlemlih and Bitar, 2018). These values suggest that both overinvestment (positive residuals) and underinvestment (negative residuals) are present in our sample. The instrumental variable (IV), *industry-level growth uncertainty*, has a sample mean of 0.127 and a standard deviation of 0.121. The minimum value of the IV is 0.001, while the 25th (75th) percentile value is 0.055 (0.149) and the maximum value is 0.704. These estimates are comparable to prior studies (e.g. Li *et al*., 2018).

Table 1. Descriptive statistics for organizational capital and investment efficiency

Variable	Mean	Std. dev.	Min	Max	25th	75th	Observations
OKTA	0.193	0.206	0.000	1.110	0.054	0.260	5,742
OKTC	0.284	0.325	0.000	1.798	0.080	0.364	5,706
Investment inefficiency	−0.001	0.005	−0.018	0.030	−0.002	0.001	5,161
Size (log)	16.513	1.253	12.735	19.521	15.961	17.354	5,742
ROA	0.010	0.011	−0.110	0.161	0.041	0.101	5,685
Slack	0.144	0.163	0.000	1.000	0.025	0.189	5,712
Tangibility	0.625	0.220	0.067	1.000	0.468	0.835	5,742
Firm age (log)	23.864	12.280	0.000	50.000	14.000	35.000	5,479
Leverage	0.663	0.512	0.106	1.000	0.253	0.564	5,783
Tobin' Q	0.002	0.002	0.001	0.025	0.008	0.016	5,676
Loss	0.054	0.226	0.000	1.000	0.000	0.000	5,819
Industry-level growth uncertainty	0.127	0.121	0.001	0.704	0.055	0.149	5,797
CEO age	55.763	7.139	21	86	52	61	5,769
CEO gender	0.035	0.182	0.000	1.000	0.000	0.000	5,762
CEO duality (power)	0.472	0.499	0.000	1.000	0.000	0.000	5,783
CEO tenure	6.420	6.347	0.000	49.000	2.000	10.000	5,745
CEO external board seats	2.382	2.450	0.000	29.000	1.000	3.000	5,273
IDD	0.365	0.481	0.000	1.000	0.000	0.000	5,819

Note(s): This table presents the descriptive statistics, including mean, standard deviation, minimum, maximum, 25th and 75th percentiles and number of observations of the empirical data for all the study variables, including the instrumental variable: *Industry-level growth uncertainty.* All variables are defined in Appendix 1
Source(s): Authors' own work

Table 2 shows correlations between our main variables. OK measures (*OKTA* and *OKTC*) are negatively correlated with investment, in line with the descriptive statistics presented in Table 2. All correlation coefficients range from −0.600 to 0.554, suggesting they are within commonly acceptable levels. Hence, we do not expect to have a multicollinearity problem.

6.1.2 Baseline regressions. Table 3 exhibits the results of the baseline multivariate regressions that examine the impact of OK on investment efficiency. The first two columns present the results of the first measure of organizational capital (*OKTA*), while the last two columns present the results of the second measure of OK (*OKTC*). We found that OK is associated with a positive impact on investment inefficiency, with regression coefficients of 0.021 (t = 4.82) and 0.009 (t = 5.35) for *OKTA* and *OKTC*, respectively, statistically significant at a 1% significance level. The positive sign on the OK coefficients indicates that a higher OK is associated with increased investment inefficiency [10]. The results are also economically meaningful. For example, a one-standard deviation increase in the ratio of *OKTA* (*OKTC*) is associated with a 4.42% (1.85%) decrease in investment efficiency. To calculate the dollar economic value of investment inefficiency, we multiply the percentage of deviation by the absolute mean of investments. This gives an average of $390.88 million (8843.382 × 4.42%) and $163.60 (8843.382 × 1.85%). This means that a one standard deviation in *OKTA* (*OKTC*) is associated with an investment distortion of $390.88 (163.60) million.

We therefore find support for our first hypothesis and for an agency-based interpretation of OK investments. That is, OK investments can exacerbate agency conflicts between managers and stakeholders (e.g. Biondi and Rebérioux, 2012), resulting in deviations from optimal investment (Goel *et al.*, 2004; Kim *et al.*, 2021). In this vein, managers may suboptimally invest because of heightened informational asymmetries surrounding OK that make it more difficult and costly for shareholders to monitor and evaluate managerial investment choices (Richardson, 2006; Morellec and Schürhoff, 2011). Furthermore, managers may also invest suboptimally because of heightened career concerns attributable to the fact that investors choose to rely more extensively on the outcome of managers' project choices as indicators of managerial ability. This could lead to overinvestment in short-term projects and underinvestment in longer-term projects (Kim *et al.*, 2021). With respect to context, our results may be partially explained by the US setting. For example, they tentatively infer that ASC 730, which requires that internally developed R&D costs must be expensed immediately (ASC 73), may be ineffective in reducing information asymmetries stemming from intangible assets. An important reason is that ASC 730 may encourage financial officers to capitalize R&D expenditures to manipulate earnings and investment levels (Canace *et al.*, 2023).

6.1.3 Overinvestment and underinvestment. Having established that OK investment is associated with reduced investment efficiency, in this section we examine the direction of deviations from investment efficiency in terms of under- and overinvestment (Biddle *et al.*, 2009; Richardson, 2006; Kim *et al.*, 2021). Although investment efficiency is generally expected to decrease in organizational environments characterized by high informational asymmetries because managers have more opportunity to prioritize their own interests over those of shareholders, as predicted by agency theory, this could result in both underinvestment and overinvestment.

If informational asymmetries surrounding OK investments render it difficult for firm outsiders to correctly value OK, then managers operating in high-OK firms could deviate, and underinvest, from optimal levels. For example, higher informational asymmetries associated with OK could lead investors to rely more extensively on the outcome of managers' project choices as indicators of managerial ability (Goel *et al.*, 2004). In turn, this would be expected to mitigate the likelihood that managers overinvest and could result in underinvestment due to exacerbated managerial career concerns (Kim *et al.*, 2021). More specifically, this could result in overinvestment in short-term projects and underinvestment in longer-term projects (Kim *et al.*, 2021). Another important reason for potential underinvestment relates to managers' concerns that the market will apply a discount to new equity or debt securities issued because

Table 2. Correlation matrix

Variable	OKTA	OKTC	Investment inefficiency	Size	ROA	Slack	Tangibility	Firm age	Loss	Lev	TQ
OKTA	1.000										
OKTC	0.929	1.000									
Investment inefficiency	−0.079	−0.050	1.000								
Size	−0.054	−0.046	−0.244	1.000							
ROA	0.374	0.329	−0.323	0.135	1.000						
Slack	0.118	0.126	−0.040	0.038	0.171	1.000					
Tangibility	−0.262	−0.352	0.031	0.023	−0.224	−0.600	1.000				
Firm age	0.032	0.037	−0.118	0.199	0.033	−0.102	0.045	1.000			
Loss	−0.006	−0.014	0.072	−0.101	−0.445	0.079	−0.001	−0.060	1.000		
Lev	−0.004	0.046	−0.039	0.092	−0.008	−0.148	0.106	−0.012	0.035	1.000	
Tobin's Q	0.361	0.319	−0.353	0.095	0.554	0.400	−0.297	−0.064	0.016	−0.096	1.000

Note(s): This table presents Pearson correlations for the main study variables. All variables are as defined in Appendix 1
Source(s): Authors' own work

Table 3. Baseline regression results of OK on corporate investment inefficiency

Variables	Investment inefficiency (1)	Investment inefficiency (2)	Investment inefficiency (3)	Investment inefficiency (4)
Intercept	−0.004***	0.013	−0.003***	0.018**
	(0.001)	(0.008)	(0.000)	(0.008)
OKTA	*0.017***	*0.021***		
	(0.003)	*(0.004)*		
OKTC			*0.007***	*0.009***
			(0.001)	*(0.002)*
Size		−0.001**		−0.001**
		(0.000)		(0.000)
ROA		−0.000		−0.000
		(0.000)		(0.000)
Slack		0.010***		0.010***
		(0.003)		(0.003)
Tangibility		0.008***		0.008***
		(0.002)		(0.002)
Firm age		−0.001**		−0.002**
		(0.001)		(0.001)
Leverage		0.000		−0.000
		(0.000)		(0.000)
Tobin's Q		−0.000***		−0.000***
		(0.000)		(0.000)
Loss		−0.001		−0.001
		(0.001)		(0.001)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R^2 (%)	42.02	51.76	41.31	51.26
F-statistics (Wald)	24.07	25.65	25.07	27.86
p-value	(0.000)	(0.000)	(0.000)	(0.000)
Observations	5,160	4,909	5,150	4,902

Note(s): The table presents the results of baseline regressions that examine the impact of OK on investment inefficiency. The dependent variable is *investment inefficiency*, which captures deviation from optimal investment based on the residuals from the investment model. The main independent variable is OK, measured by either *OKTA*, the ratio of OK to total assets, or *OKTC*, which is the ratio of OK to total capital and is our independent variable. Control variables include *size*, *ROA*, *slack*, *tangibility*, *firm age*, *leverage*, *Tobin's Q*, and *Loss*. All variables are as defined in Appendix 1. Figures in parentheses are standard errors that are clustered at the firm level for heteroscedasticity. (***) (**) (*) significance at the (1%) (5%) (10%) levels
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investors anticipate that managers will choose to issue new securities when managers hold private information that they are overvalued (Chen *et al*., 2017).

High-OK firms could also be associated with overinvestment. The weakened information environment in high-OK firms could provide opportunities for managers to overinvest by selecting projects that fail to increase, or could erode, shareholder value. This is consistent with existing evidence that managers may overinvest when information asymmetries between firm insiders and outsiders are more pronounced, and therefore monitoring managerial investment is more costly and difficult (e.g. Richardson, 2006; Morellec and Schürhoff, 2011). Overinvestment could also occur in high-OK firms because managers accelerate investment to signal the strength of their human capital and management practices and, ultimately, that they are a "good firm" (Wang and Yu, 2023).

Table 4 presents the results. Overinvestment is represented by positive residuals from the optimal investment model, and second, underinvestment is captured by negative residuals. Concerning overinvestment, we observe a positive impact of OK on overinvestment for both

Table 4. Overinvestment and underinvestment

Variables	Overinvestment (1)	Underinvestment (2)	Overinvestment (3)	Underinvestment (4)
Intercept	0.017**	−0.018***	0.020**	−0.016***
	(0.008)	(0.005)	(0.008)	(0.005)
OKTA	*0.021***	*−0.007***		
	(0.005)	*(0.002)*		
OKTC			*0.007***	*−0.003***
			(0.002)	*(0.001)*
Control variables	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R^2 (%)	72.55	78.40	71.62	78.32
F-statistics (Wald)	5.18	46.24	5.04	46.50
p-value	(0.000)	(0.000)	(0.000)	(0.000)
Observations	1,914	2,896	1,914	2,890

Note(s): The table presents the results of regressions that examine how OK impacts the direction of deviations from efficient investment (investment inefficiency). The sample period is divided into two subsamples, *Overinvestment* and *Underinvestment*, based on positive (overinvestment) or negative residuals (underinvestment) from the investment model. *OKTA* is the ratio of OK to total assets. *OKTC* is the ratio of OK to total capital. The investment inefficiency is the deviation from the optimal investment and is computed as the residuals from the investment model. Control variables include *size*, *ROA*, *slack*, *tangibility*, *firm age*, *leverage*, *Tobin's Q*, and *Loss*. All variables are as defined in the Appendix 1. Figures in parentheses are standard errors that are clustered at the firm level for heteroscedasticity. (***) (**) (*) significance at the (1%) (5%) (10%) levels

Source(s): Authors' own work

measures of OK, with regression coefficients of 0.021 ($t = 3.92$) and 0.007 ($t = 3.51$) for *OKTA* and *OKTC*, respectively. With respect to underinvestment, we multiply the variable of underinvestment by −1 to facilitate its interpretation (following Chen *et al*., 2011). In contrast, the impact of OK on underinvestment is negative and significant, with regression coefficients of −0.007 ($t = -3.80$) and −0.003 ($t = -3.62$) for *OKTA* and *OKTC*. Thus, OK investments tend to increase deviations from optimal investment in terms of overinvestment and decrease the deviation for underinvestment.

6.2 CEO characteristics as moderating variables

In this section, we consider the role of several CEO traits as potential moderators (CEO gender, age, power, tenure, and CEO external directorships) of the relationship between OK and firm investment efficiency. The results are displayed in Table 5.

6.2.1 CEO gender. We first explore a potential moderating effect of CEO gender on the relationship between OK and investment efficiency. Prior literature documents that female CEOs are less likely to experience behavioral biases (such as overconfidence), which can distort investment decisions (Huang and Kisgen, 2013). Female CEOs are also more likely to engage in quality management practices, such as corporate governance, monitoring, and financial reporting (Adams and Ferreira, 2009; Jurkus *et al*., 2011), which improve the information environment and reduce agency conflicts, thus making it easier for the market to evaluate managerial investment choices. Given this, we predict that firms with higher OK and whose CEOs are female will make more efficient investments compared to high OK firms with male CEOs.

To examine the moderating impact of CEO gender, we constructed a dummy variable that takes one if the CEO is female and zero otherwise. The first column of Table 5 reports the results of the moderating role of CEO gender. For reasons of brevity, we restrict the analysis to our main measure of OK: *OKTA* [11]. The key interaction term, *OKTA* × *CEO gender*, is

Table 5. The moderating role of CEO gender, age, power, tenure, and external board seats

Variables	CEO gender (1)	CEO age (2)	CEO power (3)	CEO tenure (4)	CEO external directorships (5)
Intercept	0.062*	0.022***	0.019***	0.024***	0.023***
	(0.035)	(0.008)	(0.001)	(0.008)	(0.008)
OKTA	*0.045***	*0.008***	*0.007***	*0.006***	*0.008***
	(0.017)	*(0.002)*	*(0.000)*	*(0.001)*	*(0.002)*
CEO gender	−0.003*				
	(0.002)				
CEO age		0.001***			
		(0.000)			
CEO power			0.001***		
			(0.001)		
CEO tenure				0.001***	
				(0.000)	
CEO external directorships					0.001***
					(0.000)
*OKTA * CEO gender*	*−0.009****				
	(0.005)				
*OKTA * CEO age*		*−0.006****			
		(0.001)			
*OKTA * CEO power*			*−0.005****		
			(0.000)		
*OKTA * CEO tenure*				*−0.004****	
				(0.000)	
*OKTA * CEO external directorships*					*−0.006****
					(0.002)
Control variables	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
R^2 (%)	34.87	50.48	50.41	49.92	49.90
F-statistics (Wald)	6.32	21.63	23.51	25.63	22.70
p-value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	4,867	4,909	4,840	4,909	4,909

Note(s): This table presents the regression coefficients of the panel regression model. The dependent variable, *Investment inefficiency*, is the deviation from optimal investment and computed as the residuals from the investment model. *OKTA* is the ratio of organizational capital to total assets and is the independent variable of interest. *CEO gender* is the first moderator and is constructed as dummy variable that takes one if the CEO is female and zero otherwise. *CEO age* is the second moderator and is constructed as dummy variable that takes one if the CEO's age is above the sample median and zero otherwise. *CEO power* is the third moderator and is constructed as a dummy variable that takes the value of one if the CEO is also the chairman of the board of directors and zero otherwise. *CEO tenure* is the fourth moderator. It takes the form of a dummy variable equal to one if a CEO's tenure is above the sample median and zero otherwise. *CEO external directorships* is the fifth moderator, which is constructed as a dummy variable that takes a value of one if the number of external board membership seats of a CEO is above the sample median and zero otherwise. Control variables include *size*, *ROA*, *slack*, *tangibility*, *firm age*, *leverage*, *Tobin's Q*, and *Loss*. All variables are as defined in Appendix 1. Figures in parentheses are standard errors that are clustered at the firm level for heteroscedasticity. (***) (**) (*) significance at the (1%) (5%) (10%) levels

Source(s): Authors' own work

negative and significant at a 10% significance level (−0.009 with a t-value of −1.70). This finding supports our *a priori* prediction that CEO gender should act as a negative moderator of the relationship between organizational capital and investment inefficiency. In other words, firms with higher OK whose CEOs are female are associated with greater investment efficiency compared to those whose CEOs are male. Thus, our finding of greater investment

efficiency in firms that have higher OK and are run by female leaders adds support to international efforts to increase female representation in leadership positions in private firms — an important policy challenge in all countries.

6.2.2 CEO age. Next, we consider a potential moderating role for CEO age. Prior literature documents several reasons why younger CEOs could be associated with lower investment efficiency compared to older peers. First, given that a CEO's current performance determines her future employment opportunities, younger CEOs with longer career paths tend to have greater career concerns and may invest less and more efficiently (Yim, 2013). Yet, if younger CEOs choose to increase investments in OK to improve their outside career options, this would also be expected to increase information asymmetries associated with intangible asset investments. Accordingly, younger CEOs leading firms with higher OK may be more likely to underinvest because of exacerbated career concerns. Similarly, younger CEOs in high-OK firms could also overinvest relative to older CEOs to signal their talents and capabilities to the market and other external stakeholders (Xie, 2015). Both reasons lead us to predict that CEO age should negatively moderate the relationship between OK and investment efficiency. In other words, we conjecture that firms with higher OK whose CEOs are older tend to have more efficient investments compared to high OK firms with younger CEOs.

To examine the moderating effect of CEO age, we construct a dummy variable that takes one if CEO age is above the sample median and zero otherwise. The second column of Table 5 reports the results. We find that the interaction term *OKTA* × *CEO age* is negative and significant at a 1% significance level (−0.006 with a t-value of −4.17). This finding supports our prediction that CEO age serves as a negative moderator of the relationship between OK and investment inefficiency.

6.2.3 CEO power. Here we explore the potential moderating effect of CEO power on the relationship between OK and investment efficiency. Existing literature suggests that powerful CEOs are more prone to behavioral biases, especially overconfidence, and that this can distort investment efficiency (Aktas *et al.*, 2019; Chowdhury *et al.*, 2023). For example, Chowdhury *et al.* (2023) find that powerful CEOs are associated with reduced investment efficiency and that this is attributable to a tendency to overinvest. Similarly, Aktas *et al.* (2019) find that powerful CEOs (those who hold duality of the CEO and chairperson positions in the firm) are more likely to invest inefficiently by overinvesting in low-growth opportunity business segments at the expense of investing in market segments with high growth opportunities. Therefore, since powerful CEOs are prone to overestimating their ability as well as the probability of success associated with their strategic choices, we expect powerful CEOs to make less efficient investments (e.g. Han *et al.*, 2016).

To test this prediction, we construct a dummy variable that takes one if the CEO is also the chairperson of the board of directors and zero otherwise (Aktas *et al.*, 2019). The third column of Table 5 reports the result. Interestingly, we observe that the interaction term *OKTA* × *CEO power* is negative and significant at the 1% significance level (−0.005 with a t-value of −4.69). Therefore, this finding does not support our prediction that CEO power tends to be a positive moderator of the relationship between OK and investment inefficiency. Instead, it infers that firms with higher OK and powerful CEOs make more efficient (i.e. less *inefficient*) investment decisions. This result may be attributed to the fact that power may improve a CEO's ability to leverage higher OK to ensure the firm works effectively towards organizational objectives. For example, holding dual CEO and chairperson roles may enable them to take prompt decisions in times of uncertainty and thus enhance the responsiveness of the firm to external environmental changes. Moreover, another reason stems from the fact that powerful CEOs tend to have fewer career concerns due to their influence and control over the board, thereby mitigating CEOs' natural risk aversion– especially given the presence of heightened informational asymmetries associated with OK investments (Eisfeldt and Papanikolaou, 2013).

6.2.4 CEO tenure. Next, we consider a moderating effect of CEO tenure, a proxy for career experience (Adams, 2005), on the relationship between OK and investment efficiency.

Consistent with agency theory, existing literature generally supports the idea that long-tenured CEOs make less efficient investments and are more prone to self-maximizing decisions that erode shareholder value (Hope and Thomas, 2008), with recent evidence finding that long tenured CEOs are associated with lower firm values and profitability (Hope and Thomas, 2008; Brochet *et al*., 2021). Such findings are consistent with the idea that long tenure reflects higher agency costs. One reason being that over time CEOs gain more structural power and influence over the board of directors and firm resources, which helps explain why long-tenured CEOs are less likely to be dismissed for poor performance (Dikolli *et al*., 2014). Long-tenured CEOs have also been shown to prefer the status quo and to be associated with less risky investment policies (Weng and Lin, 2014). For example, they are less likely to initiate strategic change (Weng and Lin, 2014) and to respond aggressively to external threats to the firm's environment (Hambrick and Mason, 1984). Thus, they may underinvest in positive NPV projects from the perspective of shareholders. Moreover, they could overinvest in certain types of investments, such as acquisitions.

Based on this discussion, we expect tenure to be positively associated with investment inefficiency. Yet we posit that longer tenure in higher OK firms to be associated with improve investment efficiency. One important reason relates to a reduction in information asymmetries and agency costs in higher OK firms, attributable to more knowledge regarding managerial ability. Specifically, OK can promote greater informational disclosures by managers, which help mitigate information asymmetries and reduce agency costs, thereby reducing the likelihood that managerial investment choices deviate from shareholder objectives (Goel *et al*., 2004; Chemmanur *et al*., 2009; Attig and El Ghoul, 2018; García-Sánchez and García-Meca, 2018). Moreover, in high-OK firms, longer tenure may allow CEOs to better leverage the value of OK to produce more efficient investments. One reason being that with tenure, managers gain more opportunities to learn and gain valuable firm-specific knowledge, which could improve decision-making quality and increase the value of human capital (Leng and Pan, 2023). Possibly reflecting these arguments, Cain and McKeon (2016) find that long-tenured CEOs are associated with more completed merger and acquisition deals yet lower firm risk. Consequently, we conjecture that tenure interacts with OK to reduce investment inefficiency.

To examine the moderating impact of CEO tenure on the relationship between OK and investment efficiency, we include a dummy variable that takes one if the CEO tenure is above the sample median and zero otherwise. Column 4 of Table 5 reports the results of the moderating role of CEO tenure. As predicted, we first find that the singular effect of *CEO tenure* is positive and highly significant, which indicates that tenure is associated with reduced investment efficiency. Importantly, the interaction term of interest *OKTA* × *CEO tenure* is negative and significant at the 1% significance level (−0.004 with a t-value of −4.33), which supports our conjecture that firms with higher OK whose CEOs are long-tenured make less inefficient (more efficient) investments. Taken together, since we find that tenure is individually positively associated with investment inefficiency yet the interaction with OK serves to reduce investment inefficiency, our test in this section provides support for the information asymmetry channel. An important takeaway is that OK investments can be valuable from the perspective of shareholders when long-tenured managers are given the scope to leverage OK and wider firm resources in firm environments with higher information disclosures to outsiders, which serve to offset potential agency costs, including a tendency for managers to make self-maximizing decisions (Hope and Thomas, 2008).

6.2.5 CEO connections through external directorships. This section explores the potential moderating effect of CEOs outside directorships on the relationship between OK and investment efficiency. Outside directorships provide CEOs with important social and professional connections, which could allow them access to valuable and unique resources that help improve their job performance (Geletkanycz and Boyd, 2011). Outside directorships may also increase the visibility of CEOs in the executive labor market and, thus, increase their outside career opportunities, thereby mitigating career concerns (Fahlenbrach *et al*., 2010). This could mitigate the tendency of CEOs to underinvest. Yet, from an agency cost

perspective, external directorships could be associated with reduced investment efficiency if they increase the busyness of the CEO and divert their attention from running their own firm efficiently (Mutlu *et al*., 2021). Given the tension in the existing literature, we are agnostic with regards to which direction the moderating effect of CEO directorships on the relationship between OK and investment efficiency will take.

To examine a moderating effect for CEOs' external directorships, we construct a dummy variable that equals one if the number of external board membership seats a CEO holds is above the sample median and zero otherwise. From column 5 of Table 5, it can be observed that the interaction term *OKTA* × *CEO external directorships* is negative and significant at the 1% significance level (−0.006 with a t-value of −3.16). Thus, we find support for the notion that firms with higher OK and whose CEOs have more external board seats tend to make less inefficient (more efficient) investments. This result is consistent with the arguments that external board seats facilitate access to unique resources and can mitigate career concerns that could be associated with suboptimal investment choices.

6.3 Economic channels

So far, we have shown that OK is associated with both under- and overinvestment. In this section, we consider, in *corporate governance*, *information environment* and *CEO career concerns*, several viable economic channels through which the negative impact of OK on investment efficiency may be conveyed. Doing so allows us to better identify whether the agency theory perspective or information asymmetry argument drives our main findings. We discuss each in turn and present the results in Table 6. To conserve space, we restrict the tabulated output to our main OK measure: *OKTA*.

6.3.1 Corporate governance. The fields of accounting and finance have long established that the issues of asymmetric information and agency costs can result in significant distortions away from efficient corporate investment (Jensen, 1986; Agrawal and Knoeber, 1996; Chen *et al*., 2021) and that corporate governance serves as an important mechanism to mitigate their effects by improving the alignment of manager and shareholder interests (e.g. Chen *et al*., 2021). Therefore, in this section we consider a potential moderating effect for firm-level corporate governance, which allows us to further explore whether the agency theory perspective drives our main findings.

Empirical studies are informative as to how corporate governance arrangements influence corporate investment efficiency. Chen and Chen (2017) demonstrate that firms with stronger internal and external governance mechanisms (i.e. those with more independent and less busy boards, more performance-tied executive compensation, better audit quality, greater institutional ownership, and stronger shareholder rights) make more efficient investments. Similarly, Chen *et al*. (2021) find that good firm governance is a necessary condition for increased corporate disclosure of project-specific investments to have a positive impact on future investment efficiency, while Rajkovic (2020) finds that boards with greater power in the hands of independent directors and larger boards are associated with more efficient investment. Relatedly, Regier (2023) presents indirect evidence consistent with the notion that stronger overall firm corporate governance, which implies higher levels of monitoring, is associated with more efficient investment. Specifically, they show that an exogenous shock to the duration of executive compensation contracts (towards a long-term focus) can act as a partial substitute to weak corporate governance arrangements, leading to an increase in investment efficiency. Two further studies do not consider governance in isolation but instead combined ESG performance. Bilyay-Erdogan *et al*. (2024) examine the impact of European firms combined ESG scores on investment efficiency and show that higher ESG performance mitigates overinvestment; furthermore, they find it reduces underinvestment but only in firms with higher information asymmetries.

Based on this discussion, we anticipate that firms with both high OK as well as strong corporate governance arrangements will make more efficient investments because effective

Table 6. Economic channels

Panel A: Corporate governance and board attributes

Variables	Corporate governance (1)	Board size (2)	Board independence (3)	Board gender diversity (4)
Intercept	0.018***	0.012**	−0.028**	0.025**
	(0.018)	(0.016)	(0.033)	(0.050)
OKTA	*0.009****	*0.014****	*0.007****	*0.005****
	(0.001)	*(0.002)*	*(0.011)*	*(0.026)*
Corporate governance	0.023***			
	(0.048)			
Board size		−0.044**		
		(0.058)		
Board independence			−0.008***	
			(0.037)	
Board gender diversity				−0.024**
				(0.087)
*OKTA * CG*	*−0.031****			
	(0.000)			
*OKTA * Board size*		*−0.265****		
		(0.003)		
*OKTA * Board independence*			*−0.709****	
			(0.001)	
*OKTA * Board gender diversity*				*−0.087***
				(0.031)
Control variables	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R^2 (%)	43.29	41.05	29.95	37.51
F-statistics (Wald)	17.58	24.85	26.97	29.49
p-value	(0.000)	(0.000)	(0.000)	(0.000)
Observations	4,846	4,764	4,808	4,819

Panel B: Other economic channels

Variables	Information environment (1)	CEO career concerns (2)	R&D intensity (3)
Intercept	0.059**	0.026***	0.005**
	(0.038)	(0.014)	
OKTA	*0.065****	*0.015****	*0.027***
	(0.019)	*(0.006)*	*(0.052)*
Information environment	0.173***		
	(0.032)		
CEO career concerns		0.039***	
		(0.015)	
R&D intensity			−0.094**
			(0.082)
*OKTA * Information*	*−0.011****		
	(0.018)		
*OKTA * CEO career concerns*		*0.013****	
		(0.028)	
*OKTA * R&D*			*0.044****
			(0.071)

(*continued*)

Table 6. Continued

Panel B: Other economic channels

Variables	Information environment (1)	CEO career concerns (2)	R&D intensity (3)
Control variables	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
R^2 (%)	39.40	44.25	47.98
F-statistics (Wald)	9.41	24.94	22.07
p-value	(0.000)	(0.000)	(0.000)
Observations	4,865	4,914	4,902

Note(s): This table presents economic channels analyses through which the effect of OK on investment inefficiency are conveyed. The dependent variable, *Investment inefficiency* is the deviation from optimal investment and is computed as the residuals from the investment model. *OKTA* is the ratio of organizational capital to total assets and is our main independent variable. Panel A shows results for a corporate governance channel that relates to overall firm governance quality (*Corporate governance*), which is captured by a dummy variable equal to one if the "G" pillar score (based on the ESG data from the LSEG database) for a firm is above the sample median and zero otherwise, as well as several board attributes: *Board size* is a dummy variable that equals one if a firm has an above median board size and zero otherwise; *Board independence* is a dummy variable equal to one if a firm has above the median proportion of independent directors and zero otherwise. *Board gender diversity* is a dummy variable equal to one if a has above the median proportion of female directors on the board and zero otherwise. In Panel B, *Information environment* is a dummy variable equal to one if the quality of corporate disclosure is above the sample median and zero otherwise (disclosure quality is based on stock price synchrony as detailed in Section 6.3.2). *CEO career concerns* is constructed as a dummy variable equal to one if a firm's headquarters is in a state adopting the Inevitable Disclosure Doctrine (IDD) and zero otherwise. *R&D intensity* is a dummy variable that equals one if a firm is a member of an intensive R&D industry and zero otherwise (intensive R&D industries are telecommunications, cable, electronics, pharmaceuticals, chips, computer/peripherals, software, wireless/internet, satellite, tech retail, tech blue chips, and networking, which are identified based on 3-digit SIC codes). Control variables in both panels include *size*, *ROA*, *slack*, *tangibility*, *firm age*, *leverage*, *Tobin's Q*, and *Loss*. All remaining variables are as defined in Appendix 1. Figures in parentheses are standard errors that are clustered at the firm level for heteroscedasticity. (***) (**) (*) significance at the (1%) (5%) (10%) levels

Source(s): Authors' own work

corporate governance mechanisms should typically result in closer alignment of manager and shareholder interests.

In Table 6 Panel A we test this conjecture and examine the moderating effect of corporate governance on the relationship between OK and investment efficiency. We do so by following recent studies (e.g. Regier, 2023) in first focusing on a firm's overall corporate governance pillar score by collecting the "G" pillar of ESG from the LSEG (formerly Refinitiv) database. This pillar contains three subcategories, namely, shareholders, management, and corporate social responsibility strategy, and measures the efficacy of corporate governance arrangements in terms of board structure, board functions, shareholder rights, compensation policies, vision, and strategy. We then create a dummy variable for corporate governance, *CG* that equals 1 if the "G" score for a firm is above the sample median and zero otherwise. In Column 1 of Table 6 we then interact this variable with OK (*OKTA* × *CG*) and observe a negative and statistically significant coefficient on the interaction term at a 1% level (coefficient = −0.031). Therefore, this result supports the prediction that firms with higher OK and strong corporate governance tend to have less inefficient (more efficient) corporate investments compared to those with weaker corporate governance. This finding adds credence to the idea that good governance is a necessary condition for substantial OK investments to lead to increases in investment efficiency.

Second, in order to provide a more comprehensive analysis of the impact of corporate governance on the relationship between OK and investment efficiency, In Panel A of Table 6 we also examine the impact of specific board characteristics on the abovementioned relationship. Specifically, in addition to "CEO power" (or CEO duality) discussed in section 6.2.3, we examine the moderating influence of three board characteristics, namely, board size, board independence, and board gender diversity on the relationship between OK and investment efficiency. We do so, using similar interactive terms between each of the three board attributes with OK. We first observe that *OKTA* × *Board size* is negative and statistically significant at the 1% level, which we argue is consistent with prior findings that larger boards are more effective monitors and are associated with improved investment efficiency (e.g. Rajkovic, 2020). Similarly, in columns 3 and 4, we find that the coefficients for *OK* × *Board independence* and *OKTA* × *Board gender diversity* are both similarly negative and highly significant. We consider that the finding for *OKTA* × *Board independence* provides support for prior literature (e.g. Rutherford and Buchholtz, 2007; Musteen *et al*., 2010; Chang *et al*., 2017), which suggests that independent directors play an important positive role in alleviating agency conflicts by improving the monitoring quality. Put differently, less independent boards are less willing to challenge CEOs and other top executives, which increases the scope for managers to pursue behaviors and make decisions not compatible with shareholder objectives, resulting in lower investment efficiency. Further, the finding for *OK* × *Board gender diversity* is consistent with earlier findings in the literature (e.g. Upadhyay and Zeng, 2014) that firms with more gender diversity tend to enjoy better information environments due to better monitoring, which we show results in higher investment efficiency.

6.3.2 Information environment. Next, we develop a proxy for the information environment within the firm. Prior literature finds that improved disclosure quality enhances the overall information environment of the firm (Byard and Shaw, 2003) by reducing information asymmetries between management and shareholders, and, in turn, agency costs (Brown and Hillegeist, 2007). Consistent with this, several studies find that increases in disclosure quality are associated with a lower cost of firm capital (Lambert *et al*., 2007), increased analyst coverage (Sundgren *et al*., 2018), improved market liquidity (Heflin *et al*., 2005), and ultimately more efficient corporate investments (Biddle and Hilary, 2006; Gomariz and Ballesta, 2014; Chen *et al*., 2021, 2023). Conversely, improved disclosure may not necessarily translate into improved investment efficiency. For example, Dutta and Nezlobin (2017) find that while improved disclosure of a firm's future capital stock can reduce managerial incentives to underinvest, improved disclosures of a firm's future cash flows can increase the incentives for managers to under- or overinvest. Although we acknowledge that increases in the quality of information disclosure may not always be associated with more efficient corporate investment (Dutta and Nezlobin, 2017), the general consensus in the literature is that informationally transparent firms make more efficient investments. Therefore, we conjecture that firms with high-OK and with high levels of disclosure quality will make more efficient (less inefficient) corporate investments.

We define the information environment as the total quantity of idiosyncratic information about a firm made available to investors (Biddle *et al*., 2009; Myers and Majluf, 1984; Zhang, 2006). Firm-specific information may be provided by the firm through mandated or voluntary disclosures, market intermediaries such as analysts and the media, and investors. It is spread through public and private channels, as well as price discovery. Although price-based measurements do not identify the source, route, or content of such information, they capture the whole of the information in the environment (Piotroski *et al*., 2015). The quality of information disclosure has been a key focus of post-Enron and post-GFC regulatory endeavors to enhance financial market stability, quality, and efficiency. In this vein, as discussed earlier within Section 2, the Dodd–Frank Act of 2010 and the Sarbanes–Oxley Act of 2002 aim to determine the main ingredients of quality corporate disclosure to safeguard investors by enhancing the reliability and accuracy of corporate disclosures with respect to firms' financing, operating, and investing activities (Goldstein and Yang, 2017). SOX, particularly

Section 404, imposed stricter financial reporting and internal control requirements, mandating that management and external auditors evaluate internal control effectiveness. This enhanced governance and transparency improved investment efficiency by curbing managerial opportunism (Aubert and Grudnitski, 2014). Chen *et al.* (2023) emphasize that disclosing material weaknesses in internal controls fosters stakeholder monitoring, thereby boosting financial reporting quality and investment decisions. Section 201, which restricted internal audit outsourcing, had mixed effects, with Lu and Sapra (2009) finding it negatively influenced audit quality and investment efficiency. The Dodd-Frank Act of 2010 further shaped investments, as Du and Heo (2022) show its whistleblowing provisions neutralized political corruption's adverse effects on firm investment.

To test the information environment channel, we follow prior literature (e.g. Roll, 1988; French and Roll, 1986) in measuring the quality of the information environment based on stock price synchronicity. This is computed based on how closely ae firm's stock moves in tandem with the market. More precisely, stock price synchronicity is measured by a mix of firm-specific, industry, and market-wide information available about the firm using stock return synchronization (measured as the R^2 value from a regression of firm returns on market and industry returns), where a lower R^2 reflects stock prices with more firm-specific information. Thus, substantial firm-specific return variation indicates that stock prices closely represent fundamental values and the level of stock market efficiency. In accordance with Fernandes and Ferreira (2009), we contend that stock return innovations linked to common variables or market returns are sources of systematic risk. We collect monthly stock price data from the Eikon DataStream for the 12 years from January 2009 to December 2020 and compute risk by regressing stock returns against market and industry returns. Thus, we use the market model to determine stock price synchrony by projecting a stock's excess return on the market and industry for each firm-year, as shown:

$$r_{j,t} = \alpha_j + \beta_1 r_{m,t} + \beta_2 r_{I,t} + e_{j,t} \tag{5}$$

where $r_{j,t}$ is the monthly return of stock j, $r_{m,t}$ is the monthly market return calculated on a value-weighted basis, $r_{I,t}$ is the monthly industry return. To deal with the bounded nature of R^2, we take a logit-transformation of R^2 and define stock price synchronicity, *Sync*, as follows.

$$Sync = log \frac{1 - R2}{R2} \tag{6}$$

We then create a dummy variable, *Information environment*, set equal to one if a firm's disclosure quality (based on the stock price synchrony estimates) is above the sample median and zero otherwise. We then interact *Information quality* with our main OK measure(s). (*OKTA* × *Information environment*). The results of this test are shown in Column 1 of Table 6 Panel B. The interaction term is negative and statistically significant at the 1% level (coefficient = −0.011), which infers that firms with higher OK and with higher disclosure quality (i.e. a better information environment) tend to make more efficient (less inefficient) corporate investments compared to those with lower disclosure quality. Therefore, consistent with earlier literature (e.g. Aubert and Grudnitski, 2014), this finding supports the idea that the information environment is one channel through which the negative effect of OK on corporate investment efficiency is conveyed.

6.3.3 CEO career concerns. In this section, we question whether a CEO's career concerns serve to moderate the effect of OK on corporate investment efficiency. To do so, we focus on exogenous decisions by US state-level courts to implement, or otherwise, the Inevitable Disclosure Doctrine (IDD). This is a specific piece of legislation which can strengthen the protection of firm trade secrets [12]. Specifically, IDD serves to enhance the legal protection of firms' trade secrets within that state by preventing executives and other valuable employees from working for a firm's key competitors, even if they are headquartered in a non-adopting

state. Effectively, IDD increases the value of a firm's OK, including human capital (Chen *et al*., 2021; Jiang *et al*., 2024), while simultaneously reducing the outside job opportunities of executives and other valuable employees, which exacerbates managerial career concerns (Li *et al*., 2022; Ali *et al*., 2019). In our setting IDD facilitates a further empirical test that helps to isolate the channel through which OK impacts investment efficiency.

The impact of IDD on the relationship between OK and corporate investment efficiency is uncertain. On one hand, since IDD increases the value of OK and limits employees outside employment opportunities, IDD may mitigate the negative impact of OK on investment efficiency. An important reason is that IDD provides stronger incentives for executives to increase managerial efforts and more closely align their decision-making and investment choices with shareholder objectives – thereby reducing agency problems (Jiang *et al*., 2024). Broadly consistent with this, Na (2020), employing the rejection of IDD as a positive shock to CEOs' job mobility, finds that rejection of the IDD by US state courts increases the likelihood that shareholders vote against management afterward, which is suggestive that investors perceive that the risk of rent extraction by executives increases with higher external job mobility. More specifically, Jiang *et al*. (2024) find that IDD is associated with an increase in US firms' investment efficiency. On the other hand, the negative impact of OK on corporate investment efficiency may be stronger in IDD states. Heightened career concerns stemming from a reduction in outside employment opportunities could lead to an increase in agency costs, whereby executives may become more risk-averse, forgoing potentially valuable investment opportunities and becoming overtly focused on short-term targets, resulting in suboptimal investment (especially underinvestment) (Chen *et al*., 2023).

To consider the moderating effect of CEO career concerns, in Table 6 Column 2, we employ the state adoption of IDD as our proxy for CEO mobility. We construct a dummy variable, *CEO career concerns*, equal to 1 if a firm's headquarters is located in a state that adopts IDD by year *t* and 0 otherwise [13], and then create and include an interaction term between OK and CEO career concerns (*OKTA* × *CEO career concerns*). We find that *OKTA* × *CEO career concerns* is positive and statistically significant at the 1% level (coefficient = 0.013), which supports the notion that high OK firms in which CEOs suffer from higher career concerns, based on labor mobility, (i.e. IDD states) tend to make less efficient corporate investments. This is consistent with the latter arguments that IDD results in higher agency costs between managers and shareholders since IDD intensifies managerial career concerns, which promotes risk aversion and suboptimal investment (Chen *et al*., 2023). Thus, career concerns positively moderate the negative effect of OK and corporate investment efficiency.

Finally, we also produce analyses based on Table 4 where overinvestment (positive deviations from expected investment) and underinvestment (negative deviations from expected investment) are the dependent variables separately. To conserve space the results are untabulated. Concerning underinvestment, we find a positive and statistically significant coefficient of the interaction term (*OKTA* × *IDD*) at the 1% level (coefficient 0.104). Concerning overinvestment, we find a statistically insignificant coefficient of the abovementioned interaction term. This is consistent with our prediction that career concerns tend to affect the underinvestment component of investment efficiency only (Chen *et al*., 2022).

6.3.4 R&D intensity. Organizational knowledge plays an increasingly essential role, and knowledge distribution has emerged as a crucial resource in post-industrial societies. Because of the speed and intensity of change, more knowledge is necessary, which must be obtained at an increasing rate. In the absence of market stability, it is becoming more difficult to maintain long-held competitive advantages. Conventionally, investing in R&D has been considered a vital strategy for reaching high technological potential and hence innovation and economic growth, as well as the primary source of a firm's competitive advantage. Given its impact on several crucial outcomes, research has attempted to understand the underlying causes of this strategic decision (i.e. investment in R&D) (Scoresby *et al*., 2021; Coluccia *et al*., 2020). Firms with intensive R&D investments tend to have greater information asymmetry, since investors

are often unable to correctly interpret the complex information provided and hence the real value of such investments (Fernandez *et al*., 2011). Furthermore, corporations tend to withhold considerable information about R&D efforts to safeguard their plans for producing new products and services from competitive imitation (Baxamusa *et al*., 2015; Baruffaldi *et al*., 2024). Therefore, we expect firms with intensive R&D investments to experience greater information asymmetry and, in turn, lower investment efficiency.

To examine the moderating role of R&D intensity on the relationship between OK and investment efficiency, we create a dummy variable that takes one if a firm is a member of intensive R&D industries and zero otherwise. According to Kwon and Yin (2015) and Ahmed and Alhadabb (2020), the intensive R&D industries are telecommunications, cable, electronics, pharmaceuticals, chips, computer/peripherals, software, wireless/internet, satellite, tech retail, tech blue chips, and networking, which are identified based on 3-digit SIC codes. Then, we create an interaction term *OKTA* × *R&D* intensity. We report the results in the last column of Table 6. The findings show that the coefficient of the interaction term *OK* × *R&D intensity* is positive and statistically significant at the 1% level (0.044 with a t-value of 4.56). This is consistent with our prediction and suggests that firms with intensive R&D experience greater information asymmetry and, in turn, lower investment efficiency.

6.4 Sensitivity and robustness analysis

In this section, we present a battery of robustness tests to support our baseline results by providing evidence that the results are not sensitive to the nature of products firms' produce, different time periods, as well as alternative estimation methods and measures of investment efficiency. Again, to conserve space we restrict the analyses to our main OK measure: *OKTA*.

6.4.1 The nature of products. While prior literature finds that there is substantial intra-industry heterogeneity in firms' intangible assets, firms in certain industries are known to invest more in intangible assets than others (Gu and Lev, 2001; Arrighetti *et al*., 2014). As such, the impact of OK on corporate investment inefficiency may differ due to heterogeneity in how OK investments influence firm disclosures and managerial behavior between industries. Therefore, an important test is whether our main findings hold for both industries characterized by high intangible asset investments and those with lower investments. To implement this test, we sort firm industries based on their expected investment levels in intangible assets and create two subsamples based on the nature of products firms produce, based on the industrial SIC two-digit code. The first subsample comprises industries that produce tangible products such as agriculture (01–09), mining (codes 10–14), construction (15–17), and manufacturing (20–39), whereas the second subsample consists of industries that produce intangible products such as transportation (40–49), wholesale trade (50–51), retail trade (52–59), finance, insurance, and real estate (60–67), and services (70–89) (Gu and Lev, 2001; Arrighetti *et al*., 2014).

As shown in Table 7, the results for both subsamples show a positive and significant impact of OK on investment inefficiency for both subsamples. More precisely, our findings show a coefficient of 0.005 for the tangible goods subsample, which is statistically significant at the 5% level. Similarly, our findings show a coefficient of 0.006 for the intangible services subsample, which is statistically significant at the 1% level. Moreover, direct comparison of the coefficient estimates reveals we obtain the same result for both tangible and intangible product industries. Thus, our main findings are not sensitive to the nature of products (i.e. more tangible vs less tangible asset industries).

6.4.2 Different time periods. In this subsection we rerun our main analyses after splitting the sample period into two equal five-year subperiods, 2009 to 2014 and 2015 to 2020, in order to test the stability of our results over time. Aside from being the half-way point of our sample, the year-end of 2014 represents a natural point for splitting the sample period because the year 2015 corresponded with a significant shift in monetary policy in the US. In particular, the US Federal Reserve raised interest rates for the first time since 2006 and then continued to do so for several years after, thereby impacting borrowing costs and corporate investment. Our findings,

Table 7. Sensitivity analysis based the nature of products, time periods and company beta

Variables	Nature of products		Different time periods		Company beta	
	Tangible goods (1)	Intangible services (2)	2009–2014 (3)	2015–2020 (4)	Above median (5)	Below median (6)
Constant	0.021***	0.014***	0.017***	0.009**	0.020***	0.015***
	(0.006)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
OKTA	*0.005***	*0.006****	*0.006****	*0.008****	*0.004****	*0.008****
	(0.002)	*(0.001)*	*(0.002)*	*(0.002)*	*(0.004)*	*(0.004)*
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R^2	17.59	21.84	14.85	35.18	30.76	22.33
F-statistics (Wald)	239.67	247.82	201.44	1100.09	210.28	287.10
p-value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	2,792	2,748	2,120	2,793	2,460	2,453

Note(s): The table displays sensitivity analyses of the impact of OK on investment inefficiency based on several subsamples. First, we split the sample equally into two subsamples based on the degree of tangible or intangible products or services firms produce ((e.g. a subsample of industries that produce more tangible assets: agriculture (01–09), mining (10–14), construction (15–17), manufacturing (20–39)), and those that produce more intangible assets ((transportation (40–49), wholesale trade (50–51), retail trade (52–59), finance, insurance, and real estate (60–67), and services (70–89)). Second, we report regression estimates where the sample period is divided into two equal subperiods from 2009 to 2014, and from 2015 to 2020 to test whether the effect of OK on investment inefficiency holds over time. The last two columns report regression estimates where the sample is split based on the company beta into above median and below median subsamples, given that the relationship between OK and investment efficiency may vary based on firm risk. Figures between parentheses are standard errors. ***, **, and * refer to 1%, 5%, and 10% significance levels, respectively. Definitions of variables are as presented in Appendix 1

Source(s): Authors' own work

presented in columns 2 and 3 of Table 7, show that the impact of OK on investment inefficiency is significant and positive, supporting the baseline results. Specifically, the regression coefficient for *OKTA*, based on analysis of the period 2009–2014, is 0.006 (t = 3.72), while for the second subperiod, 2015–2020, the regression coefficient is 0.008 (t = 4.16) [14].

6.4.3 Alternative estimation methods. To ensure our results are robust to the use of different estimators, in Table 8 we reanalyze the effect of OK on investment inefficiency using several alternative estimation techniques and repeat our main analyses for *OKTA*. First, in column 1, the Weighted least squares (WLS) estimator is used to capture the heterogeneity across various industries. The findings illustrate a statistically significant and positive impact of OK on investment inefficiency at the level of 1% (coefficient = 0.011). Second, in column 2, we employ Petersen (2009) two-way clustering to capture the cross-sectional and time series dependence. We observe a statistically significant and positive impact of OK on investment inefficiency at the level of 5% (coefficient = 0.034). Third, in column 3, the Newey-West is employed to capture heteroscedasticity and autocorrelation. We again see a statistically significant and positive impact of OK on investment inefficiency at the level of 1% (coefficient = 0.026). Fourth, in column 4, the Tobit estimator is employed to mitigate issues stemming from censored investment data. Consistent with the results for the previous alternative estimators, we find a statistically significant and positive impact of OK on investment inefficiency at the level of 5% (coefficient = 0.034). Therefore, the results in this section demonstrate that our main results are robust to several alternative estimation techniques.

6.4.4 Alternative measures of investment efficiency. A potential concern is that the main study findings may be sensitive to the measure of investment efficiency used. To mitigate this

Table 8. Alternative estimators

Variables	WLS (1)	Petersen (2009) (2)	Newey–West (3)	Tobit (4)
Constant	0.016***	0.014***	0.028***	0.025***
	(0.007)	(0.010)	(0.001)	(0.003)
OKTA	*0.011***	*0.034***	*0.026***	*0.034***
	(0.001)	*(0.001)*	*(0.004)*	*(0.017)*
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Adj. R^2	53.75	50.05	51.29	53.12
F-statistic	30.06		28.21	
p-value	(0.000)		(0.000)	
Observations	4,913	4,925	4,920	4,919

Note(s): The table displays the results of regressions of the effect of OK on investment inefficiency using four different estimators, namely, WLS, Petersen (2009), Newey-West, and Tobit. Figures between parentheses are standard errors. ***, **, and * refer to 1%, 5%, and 10% significance levels. Definitions of all variables are as presented in Appendix 1

Source(s): Authors' own work

possibility, in Table 9 we re-estimate our baseline model for *OKTA* but using four alternative measures of investment inefficiency. First, in column 1 we construct a dummy variable, *Above or below*, which equals one if a firm has above median sample investment efficiency and zero otherwise. Second, in column 2, we estimate investment efficiency based on Biddle *et al.* (2009), who assume that investment is a function of growth opportunities only. Third, in column 3, we adopt the approach of Chen *et al.* (2011) who themselves base their approach on

Table 9. Alternative measures of investment inefficiency

Variables	Above or below (1)	Biddle *et al.* (2009) (2)	Chen *et al.* (2011) (3)	Richardson (2006) (4)
Constant	0.008***	0.022***	0.014**	0.025*
	(0.009)	(0.012)	(0.007)	(0.019)
OKTA	*0.024***	*0.023***	*0.032***	*0.030***
	(0.003)	*(0.008)*	*(0.006)*	*(0.002)*
Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R^2	46.35	59.06	52.02	41.65
F-statistics	20.21	36.25	24.84	31.69
p-value	(0.000)	(0.000)	(0.000)	(0.000)
Observations	4,913	4,911	4,929	4,925

Note(s): The table reproduces the main regression estimates using several alternative measures of investment inefficiency, namely, Above or below, Biddle *et al.* (2009), the absolute value of Chen *et al.* (2011) and Richardson (2006). Above or below is a dummy variable equal to one if a firm as a firm takes it is above median sample investment efficiency and zero otherwise. Biddle *et al.* (2009)'s measure is constructed as investment is a function of growth opportunities only. Chen *et al.* (2011)'s measure is constructed as investment as a function of opportunities and revenue growth. Richardson (2006)'s measure is constructed as investment as a function of growth opportunities and other firm characteristics (leverage, firm age, firm size, cash, stock returns, historical firm investments, industry-fixed effects, and year-fixed effects). Figures between parentheses are standard errors. ***, **, and * refer to 1%, 5%, and 10% significance levels, respectively. All other variables are as defined in Appendix 1

Source(s): Authors' own work

Biddle *et al*. (2009) but consider investment to be a function of growth opportunities and revenue growth. Fourth, in column 4, we estimate investment efficiency based on the approach of Richardson (2006), who argues that investment is a function of growth opportunities and other firm characteristics (e.g. leverage, firm age, firm size, cash, stock returns, historical firm investments, industry fixed effects, and year fixed effects). In all cases, we continue to find a positive and statistically significant effect of OK on corporate investment inefficiency. Therefore, our main findings are not sensitive to the method used to estimate investment efficiency.

6.5 Mitigating remaining endogeneity concerns

Our main methodological approach, which incorporates regressions with both firm and year-fixed effects, allows us to address issues with dynamic endogeneity, according to which current realizations of explanatory variables are correlated with previous realizations of the dependent variable (Abdallah *et al*., 2015). However, despite the inclusion of granular fixed effects in all estimations, it is still plausible that our results may be biased because of omitted factors if the strict exogeneity assumptions of the fixed-effects estimator are not met (Abdallah *et al*., 2015). Moreover, panel regression estimates cannot rule out the possibility that firms with higher-level inefficient investments may also be expected to invest more in OK. In other words, there could be an issue with simultaneity, whereby levels of OK investment in firms and investment efficiency are jointly determined, or there could be reverse causality because firms that invest more in OK may have lower levels of investment efficiency.

To address these remaining concerns, we repeat our main analyses in full using both the 2SLS and system-GMM estimators. Furthermore, we also present results for an entropy-balanced sample. Motivated by prior studies, our preferred instrument for the 2SLS analysis is industry-level growth uncertainty (Carlin *et al*., 2012; Hasan and Cheung, 2018; Li *et al*., 2018; Francis *et al*., 2021). Based on these studies, we estimate *industry-level growth uncertainty* as the three years of firm-level standard deviations of sales growth, and then we compute the industry average of the estimated firm-level standard deviations. We similarly argue that industry-level growth uncertainty is a suitable instrument in our setting. On one hand, it meets the relevant condition and is plausibly exogenous because firms in high-technology sectors face considerable obsolescence risk, which may lead firms operating in dynamic environments to divest their OK (Carlin *et al*., 2012). We therefore anticipate that industry-level growth uncertainty will have a negative influence on firm OK. On the other hand, the chosen instrument meets the exclusion condition since it is difficult to argue that industry-level growth uncertainty has any direct influence on an individual firm's investment efficiency.

We begin by discussing the results of 2SLS analyses, which are presented in columns 1 to 4 of Table 10. Columns (1) and (3) present the first stage regression results for each OK measure (*OKTA* and *OKTC*, respectively), which provide support for our instrumental variable choice. Specifically, we find that the endogenous variable, OK, is significantly and strongly related to the instrumental variable. Additionally, the under-identification test of the Kleibergen-Paap rk LM statistic is significant at 1% (p-value <1%) and the weak instrument test of the Cragg-Donald Wald F-statistic gives values of 9.60 and 9.44, which are both larger than the recommended critical Stock and Yogo (2005) value of 8.96. Columns (2) and (4), in the same table, exhibit the coefficients for the second stage of the 2SLS regressions for *OKTA* (column 2) and *OKTC* (column 4). Importantly, these results help confirm the validity of our main findings since they confirm the positive and significant relation between OK and investment inefficiency, with coefficients of 0.060 (t = 2.65) and 0.035 (2.67), respectively. Finally, in columns 5 and 6 of Table 10, we proceed to show the regression results for system-GMM regressions, which allow us to capture the dynamics of corporate behavior (e.g. corporate investment policy), following Dang *et al*. (2015) and Flannery and Hankins (2013). Column 5 displays the result for *OKTA* and column 6 *OKTC*. In both cases, we again observe a positive

Table 10. 2SLS and system-GMM estimations

Variables	(2SLS) 1st stage (1)	2nd stage (2)	(2SLS) 1st stage (3)	2nd stage (4)	(System-GMM) (5)	(System-GMM) (6)
Intercept	0.782***	0.045	1.414***	0.040	4.353	0.064
	(0.207)	(0.017)	(0.391)	(0.017)	(7.984)	(0.359)
Industry-level growth uncertainty	−0.001 ***		−0.002***			
	(0.000)		(0.000)			
OKTA		*0.023***			*0.052***	
		(0.005)			*(0.006)*	
OKTC				*0.016***		*0.013***
				(0.005)		*(0.003)*
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,913	4,913	4,906	4,906	4,031	4,025
Under-identification test:						
Kleibergen-Paap rk LM statistic	9.73		11.55			
p-value	(0.000)		(0.000)			
Weak identification test:						
Cragg-Donald Wald F statistic	44.92		29.83			
Stock and Yogo (2005) critical value (10% maximal IV size)	16.38		16.38			
Hansen J-statistics	Exactly identified		Exactly identified			
p-value	(0.0000)		(0.0000)			
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
AR(2)					−0.662	−0.753
p-value					(0.508)	(0.452)
Sargan					13.424	15.050
p-value					(0.570)	(0.448)

Note(s): This table presents 2SLS and system-GMM estimates for the effect of OK on investment inefficiency. 2SLS estimates are presented first in columns 1–4. The first stage 2SLS regression outputs are reported in column (1) for the first OC measure (*OKTA*) and column (3) for the second measure (*OKTC*). The second stage results are shown in columns 2 (*OKTA*) and 4 (*OKTC*). System-GMM estimates results are shown in columns 5 and 6 for *OKTA* and *OKTC*, respectively. For the system-GMM, the Sargan test statistics is the test statistics of overidentifying restrictions for the validity of instruments, and AR(2) is a test for autocorrelation indifferences. Additionally, for the system-GMM regressions, we add the second lag of the dependent variable as a control variable to control for the persistence of investment inefficiency. For the 2SLS regressions, we follow extant literature (Li *et al*., 2018; Hasan and Cheung, 2018; Carlin *et al*., 2012) and employ *industry-level growth uncertainty* as an instrumental variable. For both 2SLS and system-GMM models, *OKTA* is the ratio of OK to total assets, while *OKTC* is the ratio of OK to total capital. *INV* represents investment inefficiency or the deviation from the optimal investment and is computed as the residuals from the investment model. The control variables include *Size*, *ROA*, *Slack*, *Tangibility*, *Firm age*, *Leverage*, *Tobin's q*, and *Loss*. All remaining variables are defined according to Appendix 1. Figures in parentheses are standard errors that are clustered at the firm level for heteroscedasticity. (***) (**) (*) significance at the (1%) (5%) (10%) levels
Source(s): Authors' own work

and highly significant relationship between OK and investment inefficiency, thereby adding further credence to our main findings.

Finally, a remaining concern is that there may still be potential selection bias on observables and functional form misspecification, which could undermine the validity of the main findings. To address this, we follow best practice in employing entropy balancing to address these concerns (Hainmueller, 2012). As argued by Colak *et al*. (2021), entropy balancing

performs better than propensity score matching (PSM) because it produces more reliable estimates, maintains the entire dataset, and reduces the discretion of researchers.

Using this method, we split the sample into treatment (firms with above-median *OKTA* or *OKTC*) and control groups (firms with below-median *OKTA* or *OKTC*). The entropy balancing procedure effectively ensures covariates are balanced between treatment and control groups through a reweighting process that matches observations from both groups in terms of mean, skewness, and standard deviation (Hainmueller, 2012; Colak *et al*., 2021). Appendix C presents the results of the balancing procedure, which infers that the procedure results in effective matching of treatment and control group observations. After implementing the entropy balancing procedure, in Table 11 we reestimate our baseline results based on the matched sample and continue to find that the impact of OK on investment inefficiency is positive and significant at a 1% level.

7. Summary and conclusion

Prior accounting literature on corporate investment focuses on the role of accounting disclosure and quality in influencing corporate investment (Biddle and Hilary, 2006; Biddle *et al*., 2009; Chen *et al*., 2011; Gomariz and Ballesta, 2014; Laux and Ray, 2020). This paper represents a first attempt in the literature to directly examine the impact of OK on corporate investment efficiency. In doing so, we also complement a recent interdisciplinary literature on the importance of OK for various firm strategic choices and outcomes (Lev *et al*., 2009; Carlin *et al*., 2012; Hasan and Cheung, 2018; Attig and Cleary, 2014; Boguth *et al*., 2022; Provaty *et al*., 2024).

Using data on US-listed firms from 2009 to 2020, our main findings demonstrate that OK is associated with greater corporate investment inefficiency, which we show takes the form of both underinvestment and overinvestment. Furthermore, additional analyses expand on the emerging literature by revealing a negative relationship between organizational knowledge (OK) and firm investment efficiency, particularly in firms where CEOs wield greater power and face fewer career concerns, while female-led firms mitigate this effect (Attig and Cleary, 2014; Hasan *et al*., 2021).

Table 11. Entropy balancing estimates

	Entropy balancing	
	OKTA	OKTC
Variables	(1)	(2)
Constant	0.101	0.089
	(0.074)	(0.062)
OKTA	*0.003****	
	(0.000)	
OKTC		*0.003****
		(0.001)
Controls	Yes	Yes
Firm FE	Yes	Yes
Year FE	Yes	Yes
R^2 (%)	39.55	38.02
F-statistics	16.53	16.61
p-value	(0.000)	(0.000)
Observations	4,909	4,902

Note(s): The table reports the entropy balancing estimates. Appendix 3 shows the result of the entropy balancing procedure. *OKTA* refers to the ratio of organizational capital to total assets. *OKTC* refers to the ratio of organizational capital to total capital. We include in the estimation all main control variables (i.e. *size*, *ROA*, *slack*, *tangibility*, *firm age*, *leverage*, *Tobin's Q*, and *Loss*). All variables are as defined in Appendix 1. Figures in parentheses are standard errors that are clustered at the firm level for heteroscedasticity. (***) (**) (*) significance at the (1%) (5%) (10%) levels

Source(s): Authors' own work

The results are robust to addressing endogeneity concerns surrounding the relationship between OK and corporate investments using several methods, including, throughout our analyses, firm and year fixed effects and, in further tests, alternative estimators including system-GMM, 2SLS, and entropy balancing.

Our results can be interpreted from the perspective of agency theory, whereby managers may suboptimally invest because of heightened informational asymmetries surrounding OK that make it more difficult and costly for shareholders to monitor and evaluate managerial investment choices (Richardson, 2006; Morellec and Schürhoff, 2011). Consequently, managers may invest suboptimally because of heightened career concerns as investors choose to rely more extensively on the outcome of managers' project choices as indicators of managerial ability, which could lead to overinvestment in short-term projects and underinvestment in longer-term projects (Kim *et al*., 2021). From a practical perspective, we provide valuable insights for corporate governance practices and policies aimed at improving managerial oversight. Specifically, our main findings underscore a need for firms to address inherent agency conflicts and information asymmetries associated with intangible assets like OK, which can distort investment decisions. This is especially crucial for industries that have significant intangible assets, including human capital. An important implication being that stronger governance quality is required to offset the impact of OK on investment efficiency. In this respect, our findings also support the importance of female leadership, since we find that in high OK environments, female managers are less prone to biases that distort investments, thereby supporting global policy initiatives to boost female representation in corporate leadership (Huang and Kisgen, 2013). Furthermore, our findings speak to the ongoing debate and challenges regarding measuring and reporting OK and other intangible assets both in the US and worldwide. In particular, they infer that enhancing transparency around intangible assets could reduce informational asymmetries, with positive implications for firm investment decisions.

Finally, our study is not without limitations, which present opportunities for future research. First, although we argue our findings should be generalizable to other contexts, as we discussed in Section 2, we acknowledge that US GAAP is associated with significant differences compared to international accounting standards regarding the treatment of intangibles (such as ASC 730 compared to IAS 38 under IFRS) as well as in terms of relevant regulations that impact firm investment. Thus, it would be interesting for future researchers to examine whether our findings differ in international settings; such investigations would provide valuable feedback to national and international standard setters. With this in mind, it would also be valuable to re-examine the relationship between OK and corporate investment efficiency in less developed countries and in countries with different cultural and institutional backgrounds, in order to provide greater contextual insights into the impact of OK on investment efficiency. Second, we base our main analysis on the period 2009 to 2020 and do not consider the period of the COVID-19 pandemic or beyond (with the exception of additional unreported robustness tests, available on request, and reported in footnote 14, which consider the period 2009 to 2023). However, pandemic-induced uncertainty likely increased information asymmetries and resulted in cautious investment behavior, including reductions in intangible investments, as firms struggled to align investment decisions with long-term growth opportunities (Baker *et al*., 2020). Therefore, it would be interesting for future researchers to explore the effect of OK on investment efficiency to consider this more recent period. Third, while we present robust evidence regarding how OK is related to corporate investment efficiency, there are many governance channels that could also play a role in mitigating or intensifying the negative relationship between OK and firm investment. For example, our paper opens up rich avenues for researchers to explore other firm governance channels, such as the role of the board of directors and the role of different institutional owners, as potential positive moderators of the negative relationship between OK and corporate investment efficiency we identify. Third, the future research agenda could also seek to reconcile the negative impact of OK on investment efficiency we identify with evidence that higher OK firms engage in more tax avoidance, which can increase firm value (Hasan *et al*., 2021). Finally, future research could investigate the impact of investments in other kinds of intangible assets (e.g. brand capital,

patents, R&D activities, and customer relations) on investment decisions, including investment efficiency, to add to understanding regarding the implications of intangible asset investments on corporate investment. Although beyond the scope of the present paper, we consider that such investigations could provide useful feedback to standard setters regarding the factors that harm or enhance the efficiency of firms' investment.

Notes

1. OK represents the largest intangible productive firm asset, accounting for as much as 40% of the contribution of all intangible assets in generating firm cash flows (Atkeson and Kehoe, 2005) and up to 34% of total capital (Corrado and Hulten, 2010).
2. According to Johnson *et al*. (2021), the challenges of reporting intangible assets also include (1) the recognition timeliness, (2) the volatility of earnings, (3) the analyst reaction to relevant announcements, and (4) the use of discretion in the reporting is prone to opportunistic behavior.
3. For a comprehensive review of this literature, we refer the reader to Roychowdhury *et al*. (2019).
4. As Danielova *et al*. (2023) explain, the extent of labor market frictions is likely to play a role since OK is a unique form of intangible capital whereby it comprises both firm-specific elements as well as the labor inputs of key employees, who could choose to leave the firm and thus have a share of cash flow rights.
5. We focus on the period following the 2008 global financial crisis to mitigate any impact of the crisis on corporate investments in intangible assets and the efficiency of corporate investments (Orhangazi, 2019).
6. We follow recent closely related literature in including the financial and utilities sectors within our main sample (e.g. Shao *et al*., 2013; Gomariz and Ballesta, 2014). Nevertheless, in unreported tests available upon request, we repeat our main analyses (presented in Table 4) excluding these sectors and obtain comparable results.
7. A critical issue influencing the efficiency of corporate investments (Chen *et al*., 2004; Chan *et al*., 2013; Martin *et al*., 2017),
8. Nevertheless, as we report in Footnote 14, we also run additional analyses, available on request, for the period 2009 to 2023 based on the S&P 500 sample.
9. For purposes of robustness, in unreported results available upon request, we also rerun our baseline model (Equation (4)) using the random effects estimator, whereby the random effects models follow the same basic specification but with the exclusion of fixed effects. We then reproduce the results from Table 4 and find that the results remain quantitatively similar.
10. In unreported tests available upon request, we rerun our baseline models but for firms in the S&P 1500 rather than the S&P 500. We find that the negative effect of OK on investment efficiency continues to hold.
11. Results are also available on request for our second OK measure, *OKTC*, which is comparable in both statistical significance and magnitude.
12. Trade secrets, which include private and valuable business information, represent a substantial proportion of a firm's intangible assets (Chen *et al*., 2021).
13. Appendix 2 details the legal cases of precedent-setting adopting or rejecting the IDD.
14. In unreported tests, available upon request, we also show the results for *OKTC*, which are very similar. Furthermore, we rerun our baseline models for the S&P 500 from 2009 to 2023 (7,274 observations) to check the robustness of our results to the inclusion of the COVID-19 pandemic period. We find that the negative effect of OK on investment efficiency continues to hold.

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Appendix 1

Table A1. Definitions of variables

Variables	Definitions
Investment inefficiency	Is computed as the deviations or residuals from the optimal investment model. The model regresses a firm's capital investments on Tobin's q, sales growth, and operating cash flows (for more details, see section 5.2)
OKTA	Is the organizational capital and measured as the ratio of organizational capital to total assets (for more details see section 5.3)
OKTC	Is the organizational capital and measured as the ratio of organizational capital to total capital
Size	Is measured as the natural log of annual market capitalization
Leverage	Is measured as the ratio of total debt (short term + long term) to total capital
ROA	Represents the return on assets and is measured as the ratio earnings before interest and taxes to total assets
LOSS	Is measured as a dummy variable that takes a value of one if a firm's income before extraordinary items is negative and zero if it is not
TOBIN'S Q	Is measured the market-to-book equity ratio
Firm age	Is calculated as the number of years since the company listed in the stock market
Slack	Is measured as the ratio of cash holdings (cash and cash equivalents) to total assets
Tangibility	Is measured as the ratio of property, plant, and equipment to total assets
CEO gender	Is measured as a dummy variable that takes one if the CEO is female and zero otherwise
CEO age	The age of the CEO in years
CEO power	Is captured by a dummy variable that takes a value of one if the CEO is also the chairman of the board of directors and zero otherwise
CEO tenure	Is measured as is the number of years a CEO has occupied the CEO position in a company
CEO external directorships	Is measured as the number of external board membership seats occupied by a CEO
Industry-level growth uncertainty	Is our preferred instrumental variable (IV). To construct our IV, we first compute the three-years of firm-level standard deviations of sales growth. Then, we calculate the industry average of the estimated firm-level standard deviations based on the 4-digits SIC code. This definition is consistent with the prior literature (e.g. Carlin *et al*., 2012; Francis *et al*., 2021), which also considers that firms in highly volatile industries tend to divest their OK investment
Information environment	Is captured by stock return synchronization, which is measured as the R^2 value from a regression of firm returns on market and industry returns
CEO career concerns	CEO career concerns is a dummy variable equal to one if a firm's headquarters is located in a state that adopts the inevitable disclosure doctrine (IDD) by year t and zero otherwise. Appendix B lists the legal cases of precedent-setting adopting or rejecting the IDD
Corporate governance	The "G" governance pillar of ESG from the LSEG (formerly Refinitiv) database. Following Agnese *et al*. (2023) and Gyönyör and Horváth (2024), we employ this pillar to capture the firm corporate governance quality. This pillar contains three subcategories, namely, shareholders, management, and corporate social responsibility strategy, which capture the relative strength of firms in terms of board structure, board functions, shareholder rights, compensation policies, vision, and strategy

Note(s): The table defines the variables used in this study
Source(s): Authors' own work

Appendix 2

Table A2. Legal cases of precedent-setting adopting or rejecting the inevitable disclosure doctrine (IDD)

State	Precedent-setting case(s)	Date	Decision
AR	Southwestern Energy Co. v. Eickenhorst, 955 F. Supp. 1078 (W.D. Ark. 1997)	March 18, 1997	Adopt
	Cellco Partnership v Langston, No. 4:09CV00928JMM (W.D. Ark. 2009)	December 11, 2009	Reject
CA	Whyte v Schlage Lock Co., 101 Cal. App. 4th 1443 (2002)	September 12, 2002	Reject
CT	Branson Ultrasonics Corp. v. Stratman, 921 F. Supp. 909 (D. Conn. 1996)	February 28, 1996	Adopt
DE	E.I. duPont de Nemours & Co. v. American Potash & Chem. Corp., 200 A.2d 428 (Del. Ch. 1964)	May 5, 1964	Adopt
FL	Fountain v. Hudson Cush-N-Foam Corp., 122 So. 2d 232 (Fla. Dist. Ct. App. 1960)	July 11, 1960	Adopt
	Del Monte Fresh Produce Co. v. Dole Food Co. Inc., 148 F. Supp. 2d 1326 (S.D. Fla. 2001)	May 21, 2001	Reject
GA	Essex Group Inc. v. Southwire Co., 501 S.E.2d 501 (Ga. 1998)	June 29, 1998	Adopt
	Holton v. Physician Oncology Servs., LP. No. S13A0012, 2013WL 1859294 (Ga. 2013)	May 20, 2013	Reject
IL	Teradyne Inc. v. Clear Communications Corp., 707 F. Supp. 353 (N.D. 111. 1989)	February 9, 1989	Adopt
IN	Ackerman v. Kimball Int'l Inc., 652 N.E.2d 507 (Ind. 1995)	July 12, 1995	Adopt
IA	Uncle B's Bakery v. O'Rourke, 920 F. Supp. 1405 (N.D. Iowa. 1996)	April 1, 1996	Adopt
KS	Bradbury Co. v. Teissier-duCros, 413 F. Supp. 2d 1203 (D. Kans. 2006)	February 2, 2006	Adopt
MA	Bard v. Intoccia, US Dist. LEXIS 15,368 (D. Mass. 1994)	October 13, 1994	Adopt
	US Elec. Servs.V. Schmidt, Civil Action No. 12–10845-DJC (US Dist. CT. for the Dist. of Mass. 2012)	May 14, 2012	Reject
MD	LeJeune v. Coin Acceptors, Inc., 381 Md. 288 (Md. 2004)	May 13, 2004	Reject
MI	Allis-ChalmersManuf. Co. v. Continental Aviation & Eng. Corp., 255 F. Supp. 645 (E.D.Mich. 1966)	February 17, 1966	Adopt
	CMI Int'l, Inc. v. Intermet Int'l Corp., 649 N.W.2d 808 (Mich. Ct. App. 2002)	April 30, 2002	Reject
MN	Surgidev Corp. v. Eye Technology Inc., 648 F. Supp. 661 (D.Minn. 1986)	October 10, 1986	Adopt
MO	H&R Block Eastern Tax Servs. Inc. v. Enchura, 122 F. Supp. 2d 1067 (W.D. Mo. 20 0 0)	November 2, 2002	Adopt
NC	Travenol Laboratories Inc. v. Turner, 228 S.E.2d 478 (N.C. Ct. App. 1976)	June 17, 1976	Adopt
	RCR Enterprises, LLC v. McCall, WL 7591977 (N.C. Super Ct. Dec. 19, 2014)	October 2, 2014	Reject

Note(s): The table presents the legal cases of precedent-setting adopting or rejecting the inevitable disclosure doctrine (IDD)
Source(s): Canil *et al*. (2023, p. 1750)

Appendix 3

Table A3. Entropy balancing estimates of the matched samples

Variable	Treat Mean	Variance	Skewness	Control Mean	Variance	Skewness
Before weighting						
Size	16.57	1.409	0.3898	16.96	1.046	0.3435
ROA	0.6737	4.975	0.6838	0.126	8.655	−0.0119
Slack	0.1161	0.0204	1.84	0.1542	0.0243	1.539
Tangibility	0.6546	0.0608	−0.5331	0.6262	0.0443	−0.3122
Firm age	2.943	0.6451	−1.5300	3.015	0.5594	−1.712
Leverage	43.79	5.887	0.7926	42.91	8.732	1.178
Tobin's Q	1.030	1.7167	3.771	2.508	3.4312	2.023
Loss	0.0567	0.0535	3.832	0.0447	0.0428	4.401
After weighting						
Size	16.57	1.409	0.3898	16.57	1.409	0.3898
ROA	0.6737	4.975	0.6838	0.6737	4.975	0.6838
Slack	0.1161	0.0204	1.84	0.1161	0.0204	1.84
Tangibility	0.6546	0.0608	−0.5331	0.6546	0.0608	−0.5331
Firm age	2.943	0.6451	−1.5300	2.943	0.6451	−1.5300
Leverage	43.79	5.887	0.7926	43.79	5.887	0.7926
Tobin's Q	1.030	1.7167	3.771	1.030	1.7167	3.771
Loss	0.0567	0.0535	3.832	0.0567	0.0535	3.832

Note(s): The table reports the output of the entropy balancing procedure, before and after weighting. The entropy balancing procedure is based on salient firm attributes, which are the control variables in this study (i.e. *size*, *ROA*, *slack*, *tangibility*, *firm age*, *leverage*, *Tobin's Q*, and *Loss*). All variables are as defined in Appendix 1
Source(s): Authors' own work

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