

The Effect of Chief Operating Officer on Operational Efficiency: A Combined Stewardship and Upper Echelon Perspective

Abstract

This study investigates the impact of a Chief Operating Officer (COO)'s presence on operational efficiency, distinguishing two underlying motives for COO presence: organizational needs and CEO personal interests. Drawing on stewardship theory, we construct a stewardship index based on organization-related factors (e.g., firm size, age, life cycle). In contrast, a CEO personal index, grounded in upper echelons theory, captures CEO-related factors (e.g., power, experience). We find that the stewardship index is positively associated with operational efficiency, suggesting that COO presence driven by organizational needs enhances performance. Conversely, the CEO personal index is negatively associated with efficiency, indicating that COO presence driven by the CEO's self-interest may impair firm operations. Firms characterized by strong organizational motives and weak CEO personal motives exhibit the greatest efficiency gains. These findings highlight the importance of understanding the drivers of COO presence and provide new insights into its nuanced impact on operational efficiency.

KEYWORDS: CEO/COO duo; operational efficiency; upper echelon theory; stewardship theory; organizational demands; CEOs' personal attributes.

“Operational efficiency. It’s the holy grail of business success. Chief Operating Officers are charged with creating operations management systems that root out inefficient processes, lower operating expenses, reduce lead times, and increase profit margins.”

InterimExecs (2025)¹

“...the typology we’ve outlined makes it easy to see why *COOs* have been hard to investigate in any scientific sense. Even where studies have been done, it’s often impossible to draw useful lessons from them.”

Bennett and Miles (2006, p.75)

I. INTRODUCTION

Operational efficiency captures how efficiently firms can convert the input resources into outputs, i.e., how much revenue can be generated using a given level of inputs (e.g., cost of inventory, general and administrative expenses, fixed assets, operating leases, research and development expenditure, intangible assets, etc.) (Demerjian, Lev, and McVay 2012). Higher operational efficiency implies saved costs and increased productivity for revenue generation, which, in turn, improves earnings and cash flows (Fairfield and Yohn 2001; Nissim and Penman 2001; Greene and Segal 2004). Not surprisingly, operational efficiency is a key metric that investors and analysts rely on to assess firms’ current performance and forecast future performance (Cummins and Xie 2008; Soliman 2008; Baik, Chae, Choi, and Farber 2013). Therefore, it is important to understand factors that affect companies’ operational efficiency. Existent literature on determinants of operational efficiency suggests that operational efficiency can be affected not only by conventionally considered firm characteristics (such as firm age and size) but also novel factors such as internal control quality (Feng, Li, McVay, and Skaife 2015; Cheng, Goh, and Kim 2018), managerial ability (Demerjian et al. 2012), and macroeconomic conditions (Banker, Fang,

¹ <https://interimexecs.com/maximizing-operational-efficiency-expert-coos-offer-tips-for-improving-processes-and-productivity/>

and Mehta 2020). Extending this stream of literature, this study aims to examine the implications of the composition of the top management team, specifically the presence of a Chief Operating Officer (COO), on operational efficiency.

We focus on the COO because, within a top management team, it is primarily the COO's responsibility to improve and optimize operational efficiency (Ernst & Young 2014). The presence of a COO in a top management team, i.e., "CEO/COO duo", represents an organizational structure that splits a set of top-level executive responsibilities between a COO and a Chief Executive Officer (CEO). COOs are considered "the number two position" in the C-suite, oversee internal operations (Bennet and Miles 2006; Neilson 2015), and report to CEOs. Not every company has a COO, and it is subject to intensive debate whether having a COO delivers positive or negative outcomes. Proponents argue that having a COO frees up the CEO from day-to-day burdens and enables the CEO to focus more on strategy-level activities (Bass and Stogdill 1990), whereas critics view COOs as unnecessary or even counter-productive (Abelson 1999; Charan and Colvin 1999; Murray 2000). Despite the importance and controversy surrounding CEO/COO duos, academic research on this topic remains limited, and existing empirical evidence on the effects of having a COO is inconclusive and somewhat leans toward the negative side (Hambrick and Cannella 2004; Marcel 2009). Our study attempts to shed light on the impact of having COOs on operating efficiency using an integrated framework of stewardship theory and upper echelon theory.

Companies install COOs for various reasons, making it difficult to pinpoint the environments in which COOs succeed and to make proper inferences by comparing one COO with another (Bennett and Miles 2006). Although the specific rationale behind each COO presence is heterogenous, we propose categorizing these reasons into two broad types: to serve the needs of

the organization (e.g., accommodating firm growth, coping with financial distress, and managing organizational life cycle) or to meet the needs of the CEO (e.g., complementing the CEO's personal experience, knowledge, skills, or leadership style).² We acknowledge that neither organizational nor CEO personal motive alone can fully explain the rationale behind a COO's presence. It is plausible that the presence of most COOs is explained by a hybrid motive encompassing both organizational and personal factors. Thus, we argue that examining these dual motives together provides a more nuanced and comprehensive understanding of the phenomenon. We conjecture that the effect of COOs on operational efficiency can be contingent on these two different motives, drawing on stewardship theory and upper echelon theory.

Stewardship theory represents a sociological and psychological approach to governance that defines situations in which managers are stewards with motives aligned with the objectives of their principals. As a result, managers behave pro-organizationally instead of maximizing their individual utility functions (Donaldson and Davis 1991). Since a steward (top manager) is motivated to act in the best interests of their principals, agency-principal interest is not divergent but aligned (Donaldson and Davis 1991). Stewardship theory predicts that CEOs have COOs when there is an organizational need for one. As such, we expect COOs driven by organizational demands to be associated with improved operational efficiency due to the alignment of agency and principal interests.

The upper echelon theory suggests that the characteristics, backgrounds, and experiences of top executives have significant influence over corporate decisions, shaping a company's strategic direction and organizational outcomes (Hambrick and Mason 1984). The theory predicts that CEOs' personal attributes affect their decisions to appoint COOs. *Ex ante*, it is unclear

² We acknowledge that companies can also have a COO for other reasons, for example, to adapt to industry dynamism (Hambrick and Cannella 2004). Our empirical analyses control for industry fixed effects.

whether and how COOs appointed to fulfill CEOs' personal needs impact operational efficiency. To the extent that a CEO appoints a COO to maximize her own utility, the divergences between the agent's interest and principals' interest may arise, potentially hindering operational efficiency. Conversely, to the extent that a CEO appoints a COO to complement her limitation in expertise and experience, therefore bolstering the collective leadership capabilities, the presence of a COO may improve operational efficiency.

Our empirical analyses are based upon a sample of 13,829 firm-year observations with a COO and a control sample of 11,784 observations without a COO in the U.S. from 2004 to 2016. Since the specific motives behind a firm's decision to have a COO are not directly observable, we infer these motives based upon the strength of organizational or CEO-related factors in explaining the presence of COOs. Specifically, we create two motive indexes for each instance of COO presence: the organizational motive index (*ORGINDEX*) and the CEO personal motive index (*PERINDEX*). *ORGINDEX* measures the extent to which the COO presence is driven by organizational demand, whereas *PERINDEX* captures the extent to which the COO presence is driven by CEOs' personal needs.

To develop *ORGINDEX*, we estimate a determinant model of COO presence based on a comprehensive set of organizational factors capturing firm size, firm life cycle, age, financial distress, internal control deficiencies, and operational complexity. Our results show that larger and older firms, firms incurring losses, or firms engaging in mergers and acquisitions are more likely to have COOs. These results are consistent with the prediction of stewardship theory that CEOs are motivated to have COOs to achieve the objectives of the organization, such as managing a higher external workload in larger firms, overseeing larger-scale internal operations during rapid

expansion, or steering a firm through a turnaround from poor performance. *ORGINDEX* is calculated as the predicted probability of COO presence based upon these organizational factors.

To construct *PERINDEX*, we estimate a determinant model of COO presence based upon CEO attributes including CEO power, professional experience, and demographic characteristics. In line with the upper-echelon theory which posits that CEOs' personal and professional attributes can influence the appointment of COOs, we find that powerful CEOs (e.g., those who also serve as board chairs or are company founders) are more likely to have COOs. CEOs with extensive networks and those without institutional background (i.e., outside CEOs) are more likely to appoint a COO, but CEOs with prior experience serving as a COO are less likely to have a COO. Additionally, better-educated CEOs, female CEOs, and older CEOs are less inclined to have a COO. *PERINDEX* is calculated as the predicted probability of COO presence based upon these CEO-specific factors.

Next, to capture how efficiently a firm generates revenue relative to its industry peers, we use standardized percentile rank of firm efficiency scores based upon Data Envelop Analysis (DEA) following extant studies (Demerjian et al. 2012; Cheng et al. 2018). Meanwhile, to address functional form issues with observable characteristics that can affect both firms' decisions to have a COO and their operational efficiency, we use the entropy balancing procedure. Consistent with the prediction of stewardship theory, our results indicate that the organizational motive index (*ORGINDEX*) value is positively associated with operational efficiency. This result suggests that having a COO in response to organizational needs is pro-organizational behavior that helps firms improve operational efficiency and attain organizational objectives. Differently, we find that the CEO personal motive index (*PERINDEX*) is associated with lower operational efficiency,

suggesting that having a COO in response to a CEO's personal needs, on average, is the CEO's self-serving behavior that diverges from the best interest of shareholders, impairing firm operation.

Given that most COO appointments reflect a combination of organizational and CEO personal motives, we examine how these motives interact in influencing operational efficiency. We find that efficiency improves when organizational motives are strong and CEO personal motives are weak but declines when organizational motives are weak and CEO personal motives are strong. These interaction effects reinforce our main conclusion: COOs appointed in response to organizational needs enhance efficiency, whereas those driven by CEO personal motives tend to diminish it. Additional analyses find that the negative effect of CEO personal motives on efficiency is primarily driven by CEO power, rather than CEO demographics or professional experience. Lastly, we find that organizational motives are positively associated with several alternative performance metrics (such as inventory turnover, relative product market share in the industry, and employee productivity), while CEO personal motives are negatively associated with those performance outcomes.

This study contributes to two streams of literature. First, we contribute to research on operational efficiency. Although it is well-recognized in accounting literature that overall operational efficiency is a key determinant for profitability and cash flows (Fairfield and Yohn 2001; Nissim and Penman 2001; Baik et al. 2013), little is known about how the composition of top management teams affects operational efficiency besides commonly considered firm characteristics such as firm size and age. Among the few relevant studies, Demerjian et al. (2012) show that operational efficiency is an indicator of CEOs' ability. Buchheit, Reitenga, Ruch, and Street (2019) examine a sample of firms with Chief Financial Officers (CFOs) holding the role of

COO and find no evidence that CFO/COO duality adversely affects operations.³ Our study provides first-time, large-sample-based evidence that the presence of COOs affects operational efficiency, and its impact is incremental to other known determinants of operating efficiency .

Second, our study contributes to the scant research on COOs. Among the very few studies investigating the performance implication of having a COO, the seminal work by Hambrick and Cannella (2004) documents that firms with a COO financially underperform those without a COO. They further note two possible explanations for this adverse effect: either the CEO/COO duo is an inferior structural form that companies should not have started with, or it is a sign of a weak CEO lacking competence in leading the company. Without knowing the underlying cause of this adverse effect, it would be challenging for corporations to learn useful lessons from COO research to guide their decisions on top management team compositions/structure (Bennett and Miles 2006). Our study adopts a novel approach by distinguishing two primary motivations for having a COO: addressing organizational needs versus serving the personal interests of the CEO. We find that the organizational motive is positively associated with operational efficiency. In contrast, the CEO's personal motive is negatively associated with operational efficiency, and this negative effect is primarily driven by CEO power. In other words, the structural form of CEO/COO duos itself does not inherently lead to poor performance. COOs can deliver better performance if they are engaged for the right reasons: to fulfill organizational needs. In contrast, COOs whose presence is simply to cater to CEOs' needs produce unintended, harmful effects. Based on a holistic view combining stewardship theory and upper echelon theory to understand complex organizational structures (Davis, Schoeman, and Donaldson 1997), our results suggest that both theories are critical in

³ Buchheit, Reitenga, Ruch, and Street (2019) assess operational outcomes based upon future cash flows and return on assets.

understanding the performance implication of having a COO that differs in situations reflecting organizational demands versus CEOs' motives.

II. THEORY AND HYPOTHESES DEVELOPMENT

A firm's decision to appoint a COO is complicated. Most of the reasons behind the appointment can be classified into two broad types: to serve the needs of the organization (e.g., accommodating firm growth, coping with financial distress, or managing organizational life cycle) or to meet the needs of the CEO (e.g., complementing the CEO's personal experience, knowledge, skills, or leadership style). Stewardship theory predicts that COO presence serves the demand from organizations whereas upper echelon theory predicts COO presence complements CEOs' personal attributes. However, neither CEOs' stewardship nor personal motive alone can fully explain the rationale behind a COO's presence. Instead, the reasoning often intertwines both considerations, forming a hybrid motive. Thus, we argue that examining these two motives together provides a more nuanced and comprehensive understanding of the phenomenon, recognizing the relative importance of each motive may vary from one company to another. Next, we introduce two theories (the stewardship theory and the upper echelon theory) and pose our research hypotheses.

Theory

The Stewardship Theory

Stewardship theory defines situations in which managers, as stewards, are not motivated by individual goals, but their interests are aligned with those of their principals. Stewardship theorists assume a strong relationship between organizational success and the satisfaction of stewards. A pro-organizational steward is motivated to maximize shareholders' interests through firm performance, thereby satisfying their own utility function. Given executives struggle with operational complexity as a top barrier in the business world (The Economist Intelligence Unit 2018), a firm's number-one decision-maker (i.e., CEO) rationally strives to align the

organizational structure with situational demands by the firm; the better the alignment, the more beneficial to the organization. Therefore, based on stewardship theory, we conjecture that CEOs are motivated to have COOs only if doing so fulfills organizational needs and maximizes organizational performance.

The Upper Echelon Theory

The upper echelons theory posits that individual executives' characteristics and attributes, including educational background and career experience, influence important corporate decisions (Hambrick and Mason 1984; Carpenter, Geletkanycz and Sanders 2004). However, the impact of CEOs' expertise, career experience, and personal traits on COO hiring decision and related organizational outcomes, such as strategic decisions and firm performance, is still unsettled (Hambrick and Cannella 2004; Marcel 2009; Bennett and Miles 2006). Drawing upon upper echelon theory, we conjecture that the characteristics of CEOs, as the number-one decision-maker, influence COO hiring decisions. These attributes shape how CEOs perceive the need for additional leadership and structure within the company, affecting their preferences for top management team composition – preferences that may or may not align with the goal of maximizing shareholder values.

Hypotheses

The effect of having COOs on operational efficiency

In the framework of stewardship theory, managers are motivated to hire COOs when they believe doing so can maximize shareholders' interest. Some businesses inherently require more operational oversight than others (Bennett and Miles 2006). Internally, larger-scale operations and increased complexity (such as mergers and acquisition activities) mean more work for overseeing the day-to-day operations and ensuring proper implementation of strategies. Having a COO to oversee daily internal operations can relieve the CEO from daily mundane parts of the workload

and enable the CEO to focus on strategy formulation and external matters.⁴ As such, a COO appointed in response to high organizational task demands shares the workload with the CEO, potentially improving the outcome of both external and internal efforts. In addition, CEOs heavily rely on internal reports and information from various business units and functional areas for their decision-making. In large and complex companies, the volume of data can be overwhelming. Major organizational changes, such as rapid growth or restructuring, exacerbate the challenge of processing and analyzing such a large quantity of data. When a company has a COO, all business units—including supporting areas like information technology—report to the COO (Hambrick and Cannella 2004). The COO processes and analyzes data before presenting it to the CEO. By refining and streamlining information, the COO helps the CEO focus on key data, make timely decisions, and enhance operational efficiency. This role aligns with the organizational need for effective stewardship.⁵ Hence, we address the impact of COOs appointed in response to organizational needs on operational efficiency in our first hypothesis, stated as:

H1: Ceteris paribus, the presence of COOs driven by organizational demands is positively associated with firm operational efficiency.

On the other hand, in the framework of upper echelon theory, CEOs make COO hiring decisions based upon their personal needs. Ex ante, it is unclear how COOs appointed to fulfill CEOs' personal needs may impact operational efficiency. When a CEO appoints a COO primarily to maximize their own utility, conflicts may arise between the agent's interest and the principals' interest, potentially hindering operational efficiency. For example, some CEOs can over-commit

⁴ Examples of CEOs' external duties include lobbying, trade association leadership, and regular communications with outsiders (such as analysts, investors, regulators, and social media) (Hambrick and Cannella 2004; Zhang 2006).

⁵ The above prediction is not without tension. “Critics of the COO position primarily emphasize the drawbacks of the design itself” (Hambrick and Cannella 2004, p.976). Companies cannot benefit from a flawed structure even though their motives for using the structure are good. To the extent that the structural form of CEO/COO duos could be fundamentally flawed, having a COO will not be beneficial to performance despite a good, stewardship motive.

themselves to serving on other companies' boards to build personal networks, diverting time from managing their own companies, which may lead to the presence of a COO. For another example, a powerful CEO might appoint a COO not to address an organizational need, but to consolidate their authority and further strengthen their control over the company. Therefore, appointing a COO for the CEO's self-serving interest, in the absence of organizational demands, can be a wasteful resource allocation (given that COOs often are among the highest-paid executives), leading to inferior firm performance. Conversely, to the extent that a CEO appoints a COO to complement her limitation in expertise and experience and therefore enhancing collective leadership capabilities, the presence of a COO may improve operational efficiency. For example, a CEO who has limited experience in overseeing daily internal operations may decide to hire a COO with strong skills in overseeing internal matters. As a result, the CEO/COO duo can yield better operating results than the CEO alone. Taken together, we cannot predict the performance impact of COO presence in response to a CEO's personal needs. Accordingly, our next hypothesis explores the impact of COOs appointed in response to a CEO's personal needs on operational efficiency, stated as:

H2: Ceteris paribus, the presence of COOs driven by CEOs' personal motives is not associated with firm operational efficiency.

III. RESEARCH DESIGN AND DATA

We conduct empirical analyses in two steps. First, we estimate two determinant models for COO presence: the stewardship motive model which utilizes organizational factors to explain the likelihood of COO presence, and the CEO personal motive model using CEO attributes to explain COO presence. Based upon the two determinant models, we create two motive indexes for each instance of COO presence: the organizational motive index (*ORGINDEX*) and the CEO personal

motive index (*PERINDEX*). Second, we test the association of the two indexes with operational efficiency.

COO Presence Determinant Model: Stewardship Motives

According to the stewardship theory, firms hire COOs to fulfill organizational demands. We estimate the following probit regression model to investigate the organization-related factors associated with the likelihood of COO presence:

$$\begin{aligned}
 Prob(COO)_{i,t} = & \alpha_0 + \alpha_1 SIZE + \alpha_2 GROWTH + \alpha_3 MATURE_{it} + \alpha_4 SHAKEOUT_{it} \\
 & + \alpha_5 DECLINE_{it} + \alpha_6 LNAGE_{it} + \alpha_7 LOSS_{it} + \alpha_8 FCF_{it} + \alpha_9 ICMW_{it} \\
 & + \alpha_{10} MA_{it} + \alpha_{11} FOREIGN_{it} + \alpha_{12} CONCENTRATION_{it} + \alpha_{13} LEVERAGE_{it} \\
 & + YearFE + Industry + \varepsilon_{it}
 \end{aligned} \tag{1}$$

In Equation (1), the dependent variable is the probability of COO presence, where *COO* equals one if firm *i* has a COO in year *t*, and zero otherwise. We utilize a set of firm-level characteristics (including firm size, firm life cycle, firm age, financial distress, internal control deficiencies, mergers and acquisitions, etc.) to explain the presence of COOs due to such demands, as elaborated below.

Hambrick and Cannella (2004) argue that large firms' internal operations are more complex due to a larger scale. Outside the organizations, CEOs in large firms deal with more external matters in response to their firm's visibility, such as lobbying and trade association leadership. Large firms' abundant external and internal workload increases CEOs' demand for COOs. Accordingly, we expect that COO presence is positively associated with firm size (*SIZE*) measured as the natural logarithm of a firm's total assets. Companies are evolving entities with distinct phases in their life cycle resulting from shifts in strategy choices, resource allocations, and operational capabilities over time (Dickinson 2011). Gort and Klepper (1982) identify five life

cycle stages: introduction, growth, maturity, shake-out, and decline.⁶ Our model includes four firm life cycle stage variables: growth, mature, shakeout, and decline, with the introduction stage as the baseline. Following Dickinson (2011), we measure firm life cycle stages based on the predicted signs of cash flows from operating, investing, and financing activities. We expect that firms in the stage of growth and maturity, relative to other stages, are in higher demand for COOs because firms in these two stages expand the business significantly until reaching the maximum. In addition, older firms have established reputations and more developed relationships with society and community, translating to more external matters for the CEOs. Internally, the older a firm, the more likely it will experience operation-related demand for a COO. Therefore, we expect that COO presence is positively associated with firm age (*LNAGE*).

The demand for a COO can be higher when companies are in difficult situations that can benefit from an "extra pair of hands" to help turn around.⁷ We utilize three variables to capture firms' financial difficulties: *LOSS* equals one if a firm has a negative net income and zero otherwise, *FCF* equals one if a firm's free cash flow is not negative and zero otherwise (*FCF* is an inverse measure for financial difficulties), and *LEVERAGE* is the ratio of long-term liability to total assets. In addition, prior research suggests that ineffective internal controls reduce firms' operational performance (Feng, Li, McVay, and Skaife 2015; Cheng, Goh, and Kim 2018). Along this line, we expect that firms with internal control material weaknesses are more likely to have a COO to improve operational efficiency.

⁶ Dickinson (2011, p.1971) describes Gort and Klepper's (1982) definitions of five life cycle stages as follows: "(1) introduction where an innovation is first produced; (2) growth where the number of producers increases dramatically; (3) maturity where the number of producers reaches a maximum; (4) shake-out where the number of producers begins to decline; and (5) decline where there is essentially a zero net entry."

⁷ According to an example illustrated by Bennett and Miles (2006), Larry Ellison, the then-CEO at Oracle, hired Ray Lane (who became Oracle's COO in 1996) to turn around the deeply troubled sales, which Lane did by contributing to a tenfold increase in sales and a threefold increase in net profits.

We expect the need for a COO to increase along with the complexity of a firm's operation. For instance, in companies that are active in mergers and acquisitions (M&A), CEOs need to devote a significant amount of time to assessing opportunities and strategic reasons for such M&A activities (Sherman 2011). Having a COO can relieve CEOs from overseeing internal operations and even share some of the workload involved in M&A activities, enhancing the likelihood of success. We use three variables to capture the complexity of a firm's operation: *MA*, an indicator variable for M&A activities, *FOREIGN*, an indicator variable for *FOREIGN* transactions, *CONCENTRATION*, and the Herfindahl index for business segment concentration within a firm as an inverse measure of complexity. We also include year fixed effects to control for time-specific trends for COO presence and industry fixed effects to control for unobserved, time-invariant industry characteristics that affect COO presence. Detailed descriptions of the variables are provided in Appendix A.

COO Presence Determinant Model: CEO Personal Motives

Upper echelon theory suggests that CEOs make COO hiring decisions based upon their personal attributes and professional experiences. To understand the impact of CEO personal motives on COO presence, we estimate the following probit regression model:

$$\begin{aligned}
 Prob(COO)_{i,t} = & \alpha_0 + \alpha_1 CEOCHAIR_{it} + \alpha_2 CEOSHROWN_{it} + \alpha_3 FOUNDERCEO_{it} + \\
 & \alpha_4 COOPTION_{it} + \alpha_5 CEONW_{it} + \alpha_6 CEOMULTIBOARD_{it} + \\
 & \alpha_7 OUTSIDECEO_{it} + \alpha_8 CEOCCOO_{it} + \alpha_9 CEOLNAGE_{it} + \\
 & \alpha_{10} WOMENCEO_{it} + \alpha_{11} CEOELITE_{it} + \alpha_{12} CEOMBA_{it} + YearFE + \\
 & Industry FE + \varepsilon_{it}
 \end{aligned} \tag{2}$$

In equation (2), the dependent variable is the probability of COO presence. The independent variables represent potential CEO-related determinants of COO presence across several dimensions: CEO power, demographics, and professional experience.

The first category of CEOs' personal motive variables focuses on CEO power. Ex ante, the effect of CEO power on a firm's COO appointment is unclear. On the one hand, a powerful CEO may prefer to maintain direct oversight of operations rather than delegate those responsibilities to another executive, reducing the need for a COO. On the other hand, a powerful CEO may prefer to have a COO to free up the CEO from day-to-day burdens, enabling the CEO to focus more attention on strategy, opportunities, and threats existing in the external environment (Bass and Stogdill 1990). Additionally, having a COO can also reduce a CEO's accountability if specific operational goals and outcomes are not achieved. We use four variables to measure CEO power: CEO duality (*CEOCHAIR*), CEO ownership (*CEOSHROWN*), founder CEO (*FOUNDERCEO*), and CEOs' influence on boards (*COOPTION*). The first variable, CEO duality (*CEOCHAIR*), equals one if the CEO is also the chairman of the board, and zero otherwise. A CEO is more powerful when they are also the leader of the board (Donaldson and Davis, 1991; Yeh and Woidtke, 2005). The second CEO power variable is *CEOSHROWN*, which equals the percentage of shares owned by the CEO relative to the total shares outstanding. A CEO's significant ownership stake in the company strengthens their decision-making power (Jensen and Meckling 1976) and influence over corporate governance. Our third CEO power variable, *FOUNDERCEO*, equals one if the CEO is the founder of the company, and zero otherwise. As the founder of the company, the CEO has an established reputation for their vision and deep understanding of the company's mission and values, enabling them to maintain control over major decisions (Certo et al. 2001; Wasserman, 2006; Fahlenbach 2009). Our last measure for CEO power, *COOPTION*, equals the fraction of board members appointed after the current CEO took office. Although technically independent, co-opted directors are more likely to align with the CEO who appointed them, increasing CEO power (e.g., Coles et al. 2014; Zaman et al. 2021).

The second category of CEOs' personal motives variables captures CEO professional experience, including CEO network size, CEO board experience, outside CEO, and CEO experience as a COO. The CEO network variable, *CEONW*, captures the CEO's network size based on overlaps through employment, education, and other activities. To the extent that well-connected CEOs often have access to a broader pool of candidates which helps in identifying and recruiting talent (El-Khatib, Fogel, and Jandik 2015), CEO network size can be positively associated with COO appointment. Next, the CEO's board experience variable, *CEOMULTIBOARD*, equals one if the CEO serves on three or more boards, and zero otherwise. Although multiple directorships potentially can generate benefits by accumulating valuable experience, expertise, reputation, and connections, and bringing in needed resources that benefit the company (e.g., Booth and Deli 1996; Field et al., 2013), they also reduce the time a CEO can devote to internal matters, potentially increasing the need for a COO. *OUTSIDECEO* equals one if the CEO is hired from outside of the company, and zero otherwise. Compared to a CEO promoted from within, an outside CEO is less familiar with firm-specific operation and corporate culture, increasing the need for a COO (Hambrick and Cannella 2004). Finally, the variable *CEOCCOO* equals one if the CEO has prior experience as a COO, and zero otherwise. A CEO with previous work experience as a COO is more familiar with monitoring internal matters, reducing the need for a COO (Hambrick and Cannella 2004).

The third category of CEO variables we examine is CEO demographic attributes, including age, gender, and education. The CEO age variable, *CEOLNAGE*, equals the natural logarithm of the CEO's age. The CEO gender variable, *WOMENCEO*, is an indicator variable for female CEOs. It has been widely documented in the accounting and finance literature that executives' age and gender affect various business and reporting outcomes (e.g., Adhikari, Agrawal, and Malm 2019;

Dezsö and Ross 2012; Faccio, Marchica, and Mura 2016; Palvia, Vahamaa and Vahamaa 2015).

It is unclear ex-ante how CEO age and gender would affect COO appointment. For instance, research indicates that female CEOs tend to be less risk-taking than their male counterparts, but it is challenging to predict how this difference in risk appetite affects their decision regarding COO appointments. Female CEOs might prefer to manage internal matters themselves to ensure daily operations align with strategic goals, or they may view having an additional executive as a safer approach. We utilize two variables for CEO education: *CEOELITE* and *CEOMBA*. *CEOELITE* is an ordinal value of 3 if the CEO received both an undergraduate and postgraduate degree from an elite institution, 2 if the CEO received one degree from an elite institution, 1 if the CEO has a formal higher education degree, and 0 if the CEO does not have a formal higher education degree. *CEOMBA* equals one if the CEO has an MBA degree, and zero otherwise. Prior research provides evidence that education is an indicator of executives' competence which contributes to firm success (Jalbert, Furumo, and Jalbert 2010). We expect a better-educated CEO to be more capable of managing internal matters by themselves, thus reducing the need to appoint a COO.

Organizational Motive Index and CEO Personal Motive Index

Since a CEO's motive to hire a COO is not directly observable, we infer it based upon the relative strengths of CEO versus organizational attributes in explaining the presence of a COO. The estimation of Equations (1) and (2) produces the predicted probability of a firm having a COO based upon organizational needs and CEO attributes, respectively. Based on these predicted values, we create two motive indexes: 1) Organizational motive index (*ORGINDEX*), and 2) CEO personal motive index (*PERINDEX*). Specifically, we define *ORGINDEX* as the predicted probability of having a COO that model (1) assigns to each observation with $COO = 1$ based upon firm-related variables:

$$ORGINDEX_{it} = \text{Pr.}(COO_{it} = 1 | \text{ORG}) = \Phi(Z_{\text{ORG}}) \quad (3)$$

Where $\Phi(\cdot)$ represents the cumulative distribution function of the standard normal distribution; Z_{ORG} is calculated by multiplying the appropriate vector of the estimated model coefficient with each firm-year's vector of firm-related variables.

Similarly, we define $PERINDEX$ as the predicted probability of having a COO that model (2) assigns to each observation with $COO = 1$ based upon CEO-related variables:

$$PERINDEX_{it} = \text{Pr.}(COO_{it} = 1 | \text{PER}) = \Phi(Z_{\text{PER}}) \quad (4)$$

Where $\Phi(\cdot)$ represents the cumulative distribution function of the standard normal distribution; Z_{PER} is calculated by multiplying the appropriate vector of the estimated model coefficient with each firm-year's vector of CEO-related variables.

Both $ORGINDEX$ and $PERINDEX$ have values ranging from 0 to 1, with higher values indicating a stronger motive in each dimension. For firms without a COO, we assign a value of 0.

COO Performance Model

To investigate whether the performance implication of COO presence varies between organizational motives and CEO personal motives, we use the following pooled ordinary least squares (OLS) regression:

$$EFFRANK_{i,t+1} = \alpha_0 + \alpha_1 ORGINDEX_{it} + \alpha_2 PERINDEX_{it} + Controls + Industry FE + Year FE + \varepsilon_{it} \quad (5)$$

In Equation (5), the dependent variable is $EFFRANK$, measuring operational efficiency of firm i in year $t+1$. Following Cheng et al. (2018), $EFFRANK$ is the standardized percentile rank of firm efficiency score at the industry level (using the Fama-French industry classification)(Fama

and French 1997).⁸ A firm's efficiency score captures its efficiency in generating revenues relative to its most efficient industry peer based upon Data Envelop Analysis (DEA).⁹ The measure is obtained on Professor Peter Demerjian's website.

Our primary variables of interest are *ORGINDEX* (organizational motive index) and *PERINDEX* (CEO personal motive index). A positive coefficient on *ORGINDEX* (*PERINDEX*) is consistent with the notion that having a COO in response to organizational needs (CEO personal motives) improves operational efficiency. Conversely, a negative coefficient indicates it reduces operational efficiency. To mitigate the concern of reverse causality that firms with efficiency issues may hire COOs, we measure the *ORGINDEX* (*PERINDEX*) at year t, one-year lagging behind the efficiency measure. We control all the CEO- and organizational-related variables from Equations (1) and (2) because factors at the CEO and organizational level can influence firm performance.

We estimate Equation (5) using entropy balancing (EB) sample. Firms with a COO may be systematically different from firms without a COO because the decision to have a COO is voluntary. The EB procedure reweights covariates to mitigate the influence that systematic, observable differences between the treatment (COO=1) and control (COO=0) groups can have on the association between the COO presence and operational performance (Hainmueller 2012).

⁸ As explained by Cheng et al. (2018), the standardized percentile ranking variable at the industry level controls for the significant variation of the raw efficiency score values across industries. We conduct a sensitivity analysis using the raw efficiency score and our results hold (see related discussion in Section 5).

⁹ The efficiency score is estimated using one output and seven inputs. The output variable is Revenue, the primary source of earnings and cash flows generated from firms' operating activities. Inputs to generate revenue include net property, plant, and equipment; net operating leases; net research and development expenses; purchased goodwill; other intangible assets; cost of goods sold; and selling, general and administrative expenses. These inputs capture managers' choices in the revenue-generating process (Demerjian et al. 2012). The score has a value ranging from zero to one, with one (zero) representing the most (least) efficient firm.

Sample Selection and Data

Starting with all publicly traded firms in the intersection of *Compustat* and *BoardEx* from 2004 to 2016, we exclude observations with missing data on operational efficiency and other required variables. We also exclude financial institutions (SIC 6000-6999) and regulated industries (SIC 4400-4999).¹⁰ The resulting final sample consists of 25,613 observations, including 13,829 observations with a COO and 11,784 observations without a COO.¹¹ We obtain financial data from *Compustat*, CEO- and COO-related data from *BoardEx*, and internal control quality data from *Audit Analytics*. Table 1 shows the percentage of firms with a COO and without a COO by year. Fifty-four percent of firm-year observations have a COO in our overall sample, and this rate remains stable across years during our sample period.

IV. RESULTS

Regression Results

Estimation Results of COO Presence Determinant Models

Panel A of Table 2 presents the results of the firm-related factors influencing *COO* presence. Firm size (*SIZE*) is significantly positive ($\beta = 0.095$, $p < 0.01$), consistent with large firms' CEOs bearing abundant external and internal workloads, increasing demand for COOs. Firms in growth (*GROWTH*) and mature (*MATURE*) stages are more likely to have COOs. Firms experiencing loss (*LOSS*) are more likely to appoint a COO ($\beta = 0.073$, $p < 0.05$); conversely, firms with more free cash flow (*FCF*) are less likely to have a COO ($\beta = -0.077$, $p < 0.01$). These results suggest that the demand for a COO is higher (lower) when companies are (not) in financial

¹⁰ Demerjian et al. (2012) argue that financial services firms have a unique asset structure, which requires a different calculation of firm operational efficiency. In addition, firms in utility industries are also excluded because of their regulated output prices.

¹¹ We code officers as COOs if they hold the title of Chief Operating Officer, Chief of Operations, Executive Vice President of Operations, Vice President of Operations, President of Operations, Senior Vice President-Operations, and Executive Vice President-Operations. We exclude officers with additional unrelated titles to operating functions (e.g., President of Marketing) and officers that oversee sub-operating units and geographical regions. We exclude firm-year observations for which COOs also serve as Chief Financial Officer (CFO) or Chief Executive Officer (CEO) from the sample.

distress. Among the operational complexity variables, firms with merger and acquisition activities (MA) are more likely to have a COO ($\beta = -0.045$, $p < 0.10$), suggesting the need for a COO to share workload induced by the expansion. Firms with foreign transactions (*FOREIGN*) are less likely to have a COO ($\beta = -0.06$, $p < 0.01$)¹² and concentrated firms (*CONCENTRATION*) are more likely to have a COO ($\beta = 0.293$, $p < 0.01$).¹³

Panel B of Table 2 presents the results of the CEO-related factors influencing COO presence. Among the CEO power variables, CEO duality (*CEOCHAIR*) and founder CEOs (*FOUNDERCEO*) are positively associated with the likelihood of COO presence ($\beta = 0.299$, $p < 0.01$; $\beta = 0.088$, $p < 0.01$), suggesting a powerful CEO is more likely to have a COO. Among the CEO experience variables, outside CEOs (*OUTSIDECEO*) are more likely to have a COO ($\beta = 0.068$, $p < 0.01$), consistent with the idea that CEOs from outside the organizations may lack the institutional knowledge required to oversee internal matters. CEO network size (*CEONW*) is positively associated with COO presence ($\beta = 0.076$, $p < 0.01$), consistent with the notion that well-connected CEOs have better access to talent pools. In contrast, CEOs with prior experience as COOs (*CEOOCOO*) are less likely to need a COO, suggesting that their experience may reduce the necessity for an additional operational leader. Among the CEO demographic attributes, two measures of CEO education (*CEOELITE*, *CEOMBA*) are negatively associated with COO presence (($\beta = -0.029$, $p < 0.05$; $\beta = -0.055$, $p < 0.01$), suggesting better-educated CEOs are more capable of managing internal matters on their own, reducing the need for COOs. CEO age (*CEOLNAGE*) is negatively associated with COO presence ($\beta = -0.157$, $p < 0.01$). Finally, female

¹² It is possible that firms engaged in international operations delegate operational responsibilities to subsidiary leadership rather than relying on a COO at the headquarters level.

¹³ A COO may be necessary for a concentrated firm to manage key operational areas such as logistics, supply chain, production, or other key operational areas if the firm relies on large-scale production processes for a single product or a small set of products.

CEOs (*WOMENCEO*) are associated with a lower likelihood of COO presence ($\beta = -0.281$, $p < 0.01$).

Panel C of Table 2 presents the results when both firm-related and CEO-related factors are considered simultaneously. Among the firm-related variables, *SIZE*, *GROWTH*, *MATURE*, *LOSS*, *FCF*, *MA*, *FOREIGN*, and *CONCENTRATION* remain significant. Among CEO-related variables, *CEOCHAIR*, *FOUNDERCEO*, *CEONW*, *OUTSIDECEO*, *CEOCOO*, *CEOINAGE*, *WOMENCEO*, and *CEOMBA* continue to be significant. Taken together, these results suggest that a firm's decision to appoint a COO is driven by a combination of the CEOs' stewardship motives to meet organizational needs and their personal motives to complement their own experience. For our study purpose, we derive indexes to disentangle the two motives following the approach introduced in Section III. The calculation of *ORGINDEX* (organizational motive index) uses coefficient values reported in Panel A of Table 2, and the calculation of the *PERINDEX* (CEO personal motive index) uses coefficient values reported in Panel B of Table 2.

Descriptive statistics

Table 3, Panel A provides descriptive statistics for variables used in Equation (5) for testing our research hypotheses. The mean value for *EFFRANK* (raw, unranked efficiency score *EFF*) is 0.593 (0.327). The mean values for *ORGINDEX* and *PERINDEX* are 0.305 and 0.314, respectively, indicating that the average predicted probability of having a COO based on firm-related (CEO-related) characteristics is about 30.5% (31.4%). Panel B of Table 3 compares the mean differences in control variables between firms with and without a COO, both before and after the entropy balancing (EB) procedure. Most organizational (CEO-related) variables are significantly different between firms with a COO and those without a COO, highlighting the importance of using the EB procedure to control these attribute differences for the investigation COO's performance implication. After the EB, there is no significant difference in means for firm

and CEO characteristic variables between firm-year with and without a COO, suggesting EB effectively achieves a sufficient balance between the two groups.

Table 4 presents the correlation matrix for the variables used in the analysis. Both the organization motive index (*ORGINDEX*) and CEO personal motive index (*PERINDEX*) are positively correlated with the efficiency measure (*EFF_RANK*). We note that these positive correlations are univariate, and multivariate analyses that control for firm and CEO attributes will provide more reliable inferences.

Regression Results

Table 5 presents the regression results examining the effect of COO presence on operational efficiency, differentiating between organizational motives (*ORGINDEX*) and CEO personal motives (*PERINDEX*) using EB sample. Column (1) presents the results using firm-related variables as controls, Column (2) presents the results by using CEO-related variables as controls, and Column (3) presents the results by using both firm-related and CEO-related variables as controls. In all three analyses, the coefficient on *ORGINDEX* is positive and statistically significant, providing support that COO presence driven by organizational motives enhances operational efficiency. Specifically, in Column (3), the coefficient on *ORGINDEX* is 0.049 ($p < 0.01$). Economically speaking, one standard deviation increase in the organizational motive index (*ORGINDEX*) corresponds to a 2.43% increase in firm operational efficiency percentile rank (*EFFRANK*) relative to the sample average.¹⁴ These results support the first hypothesis.

In contrast, *PERINDEX* has a significant negative coefficient in all three regressions, suggesting that COO presence driven by CEO personal motives impairs operational efficiency. Specifically, in Column (3), the coefficient on *PERINDEX* is -0.048 ($p < 0.01$). Economically, one

¹⁴ We derive the economic significance using the following calculation: $\beta_1 * (\text{one standard deviation in } \text{ORGINDEX}) / \text{mean } \text{EFFRANK} = 0.049 * 0.294 / 0.593 = 2.43\%$. Economic significance reported subsequently is calculated using the same method.

standard deviation increase in CEO personal motive index (*PERINDEX*) corresponds to a 2.52% decrease in the firm operational efficiency percentile rank (*EFFRANK*) relative to the sample average. These results reject the null form of H2.

In terms of control variables, operational efficiency is higher among larger firms (*SIZE*), growth firms (*GROWTH*), firms with more free cash flows (*FCF*), firms with more leverage (*LEVERAGE*), firms with founder CEOs (*FOUNDERCEO*), firms with well-connected CEOs (*CEONW*), founder CEOs (*FOUNDERCEO*), firms with outside CEOs (*OUTSIDECEO*), and firms with higher operational efficiency in the prior year (*LEFFRANK*). Operational efficiency is lower among loss firms (*LOSS*), firms at declining stages (*DECLINE*), and firms with internal control material weakness (*ICMW*).

Taken together, our results indicate that COO performance implications vary by CEO stewardship versus CEO personal motives underlying the COO presence. Having COOs improves (reduces) operational efficiency when they are hired to respond to organizational needs (CEOs' personal needs).

Additional Analyses

Interaction Effect Between Organizational Index and CEO Personal Index on Operational Efficiency.

In practice, the presence of a COO is often influenced by a combination of organizational needs and CEO personal motives, rather than by either factor in isolation. While our primary analysis results document the contrasting effects of organizational motives (*ORGINDEX*) and CEO personal motives (*PERINDEX*) on operational efficiency, analyzing their interaction provides deeper insight into how these two drivers jointly influence firm performance. To this end, we conducted an additional analysis focusing on the interaction between these two motives. Specifically, we group firm-year observations into four subgroups based on tercile splits of *ORGINDEX* and *PERINDEX* for firms with COOs, with values in the top (bottom) tercile

considered as high (low). *HIGH_ORG_HIGH_PER* represents observations with high values in both; *HIGH_ORG_LOW_PER* represents observations with high *ORGINDEX* value but low *PERINDEX* value; *LOW_ORG_HIGH_PER* represents observations with low *ORGINDEX* and high *PERINDEX*; and *LOW_ORG_LOW_PER* represents observations with low values in both indexes.¹⁵ We re-estimate Equation (5) using these interaction indicators in place of *ORGINDEX* and *PERINDEX*. Related results are presented in Table 6. The coefficient for *HIGH_ORG_LOW_PER* is positive and significant ($\beta = 0.018$, $p < 0.05$), indicating that COOs appointed to address organizational needs are particularly effective in enhancing operational efficiency when CEO personal motives are weak. While our main analysis establishes the average positive effect of organizational motives, the interaction results highlight that such efficiency gains are most pronounced when CEO personal influence is limited. In contrast, *LOW_ORG_HIGH_PER* exhibits a negative and significant coefficient ($\beta = -0.012$, $p < 0.05$), suggesting that COOs appointed primarily due to CEO personal motives—absent strong organizational need—are associated with reduced operational efficiency. This deepens our main finding by showing that personal motives are especially detrimental when not grounded in organizational demands. The coefficient for *HIGH_ORG_HIGH_PER* is not statistically significant, suggesting that when both organizational and personal motives are strong, the benefits of organizational intent may be offset by the countervailing effects of CEO personal motives. Lastly, *LOW_ORG_LOW_PER* also shows no significant association with efficiency, implying that in the absence of strong motivations from either source, the COO's presence has a minimal impact on operational performance.¹⁶ Taken together, our findings suggest that COOs enhance

¹⁵ Observations falling in the middle tercile of either index were excluded from the analysis to enhance the power of the test.

operational efficiency most when appointed to meet clear organizational needs and when CEOs' personal motives are limited.

Decomposing CEO Personal Motives

Our main analysis reveals that CEO personal motives (*PERINDEX*) impair operational efficiency. As discussed in Section 3.2, we estimate CEO personal motives based on factors in three categories: CEO power, demographics, and professional experience. In this section, we delve deeper to investigate which category of CEO characteristics drives the negative effect observed. Using a similar method to the construction of *PERINDEX*, we compute the predicted probability of firms having a COO based on measures of CEO power only (*CEOCHAIR*, *CEOSHROWN*, *FOUNDERCEO*, and *COOPTION*), CEO experience only (*CEONW*, *CEOMULTIBOARD*, *OUTSIDECEO*, *CEOOCOCOO*), and CEO demographic characteristics only (*CEOLNAGE*, *WOMENCEO*, *CEOELITE*, *CEOMBA*). These probabilities are used to construct three component indices: the CEO Power Index (*POWERINDEX*), the CEO Experience Index (*EXPINDEX*), and the CEO Demographic Index (*DEMOINDEX*). For firms without a COO, the predicted probability is set to 0. We then re-estimate Equation (5) by replacing *PERINDEX* with three component indices. The regression results, presented in Table 7, show that *POWERINDEX* is significantly and negatively associated with *EFFRANK* ($p < 0.10$) while *EXPINDEX* and *DEMOINDEX* are insignificant. The analysis reveals that the negative impact of CEO personal motives on operational efficiency is primarily driven by CEO power. Concentrated CEO power may lead to a COO presence that serves personal agendas rather than organizational needs, ultimately undermining firm performance. *ORGINDEX* remains significantly positive, consistent with our main finding reported in Table 5.

Alternative Measures of Performance

Our main analyses use *EFFRANK*, a ranked variable at the industry level, to account for the significant variation in efficiency scores across industries. To assess the robustness of our findings, we first replicate the analysis using the raw efficiency score (*EFF*), which is a continuous variable ranging from zero to one. Results, presented in Panel A of Table 8, are consistent with our main findings. We further utilize alternative measures of operational performance that capture specific input and output dimensions. Specifically, we examine input-related operational outcomes from the Demerjian et al. (2012) model, including inventory turnover (*INVTURN*), operating lease turnover (*OPLTURN*), fixed assets turnover (*FIXTURN*), the ratio of goodwill impairments over assets (*IMPAIR*), the ratio of sales, general and administrative expense over sales (*SGA*), and patent activity (*PATENT*) (see Imdieke et al. 2023). In addition, we use an output-related performance metric, relative product market share (*RMS_REV*), at the industry level, as discussed in Imdieke et al. (2023). Lastly, we use employee productivity (*EMP_P*) as an additional indicator of efficiency, following Baik et al. (2013). Detailed variable definitions are provided in Appendix A. Related results are provided in Panel B of Table 8. *ORGINDEX* is significantly and positively associated with inventory turnover (*INVTURN*), employee productivity (*EMP_P*), and relative product market share (*RMS_REV*). In contrast, *PERINDEX* is significantly and negatively associated with inventory turnover (*INVTURN*), employee productivity (*EMP_P*), and relative product market share (*RMS_REV*). These results corroborate with our main conclusion that the presence of COOs motivated by organizational demands (CEOs' personal needs) is associated with higher (lower) operating efficiency.

V. CONCLUSION

This study examines the effect of the presence of a Chief Operating Officer (COO) on operational efficiency. Operational efficiency is a key metric that investors and analysts rely on to

assess firms' performance and success. As a "second in command" position and one of the C-suite's critical roles in a constantly changing business world (EY 2014), the primary responsibility of a COO is to optimize operational efficiency. However, the challenges that researchers face in COO research have long been recognized, and the performance implication of COO presence is inconclusive (Bennett and Miles 2006). This study adopts a novel approach to examine the performance implication of COO presence by distinguishing two primary motivations for having a COO: addressing organizational needs or serving the personal interests of the CEO.

Drawing on stewardship theory, we develop a stewardship index (*ORGINDEX*) that captures the strength of organization-related factors in explaining the presence of COOs. Using upper echelon theory, we develop a CEO personal index (*PERINDEX*) capturing the strength of CEO-related factors in explaining the presence of COOs. We find that *ORGINDEX* is positively associated with operational efficiency, indicating that having a COO in response to organizational needs contributes positively to operational outcomes. Differently, *PERINDEX* is negatively associated with operational efficiency, suggesting that having a COO in response to a CEO's personal needs can impair efficiency. These results hold across alternative performance measures.

Additional analysis finds that the negative effect of *PERINDEX* is primarily driven by CEO power rather than CEO demographic attributes or professional experience. Furthermore, COOs driven by organizational needs are particularly effective at enhancing operational efficiency when the CEO's personal motives are weak, whereas COOs driven by the CEO's personal motives are especially detrimental when not supported by genuine organizational needs.

Overall, our results indicate that both stewardship theory and upper echelon theory provide valuable insights into the presence of COOs, with contrasting performance implications depending on whether the motivation is organizational or personal. Our paper contributes to understanding

the influence of the complex CEO/COO duo structural form on firm operational efficiency by integrating these two theories. Our findings indicate that the duo structure itself is neither inherently positive nor negative; what appears to be critical is whether the underlying motivation aligns with organizational needs or stems from the CEO's personal interests. These findings may offer practical implications for the board of directors in advising CEOs on top management team composition and for investors and other stakeholders in assessing the role of COOs in specific contexts.

During the preparation of this work, the authors used ChatGPT in order to improve readability. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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Table 1. Sample**Panel A: Sample selection**

Sample selection (2004-2016)	
Firm-years from the intersection of Compustat and Boardex	130,518
Missing operational efficiency variable	(61,755)
Missing firm-related variables	(23,492)
Missing CEO-related variables	(17,790)
Exclude financial services industries & regulated industries (SIC 6000- 6999; 4000-4999)	(1,868)
Final sample (firm-years)	25,613

Panel B: Sample distribution of firms with a COO by year

Year	COO=1	COO =0	Total	% of Obs. with COO =1
2004	1,325	1,069	2,394	55%
2005	1,276	998	2,274	56%
2006	1,244	969	2,213	56%
2007	1,221	967	2,188	56%
2008	1,157	928	2,085	55%
2009	1,091	879	1,970	55%
2010	1,038	854	1,892	55%
2011	990	869	1,859	53%
2012	992	866	1,858	53%
2013	933	875	1,808	52%
2014	924	881	1,805	51%
2015	880	879	1,759	50%
2016	758	750	1,508	50%
Total	13,829	11,784	25,613	54%

Table 2. Regression Results on the Probability of COO Presence Based on Firm-Related Factors and CEO-Related Factors.

Panel A. Results based on Firm-Related Factors

Dependent Variable = COO	
VARIABLES	Firm-Related Factors
SIZE	0.095*** (18.866)
GROWTH	0.133*** (3.885)
MATURE	0.096*** (2.724)
SHAKEOUT	0.038 (0.974)
DECLINE	0.047 (1.146)
LNAGE	-0.090** (-2.353)
LOSS	0.073*** (3.373)
FCF	-0.077*** (-3.173)
ICMW	-0.004 (-0.104)
MA	0.067*** (3.155)
FOREIGN	-0.053*** (-2.909)
CONCENTRATION	0.293*** (4.999)
LEVERAGE	0.009 (0.779)
Constant	-0.104 (-0.634)
Year FE	Yes
Industry FE	Yes
Observations	25,613
Pseudo R2	0.0407

Panel B: Results based on CEO-Related Factors

Dependent Variable = COO	
VARIABLES	CEO-Related Factors
CEOCHAIR	0.299*** (14.238)
CEOSHROWN	-0.003 (-1.423)
FOUNDERCEO	0.088*** (3.401)
COOPTION	0.024 (0.522)
CEONW	0.076*** (10.387)
CEOMULTIBOARD	0.006 (0.289)
OUTSIDECEO	0.068*** (3.428)
CEOCOO	-0.061** (-2.492)
CEOLNAGE	-0.157** (-2.206)
WOMENCEO	-0.281*** (-5.810)
CEOELITE	-0.029** (-2.076)
CEOMBA	-0.055*** (-2.595)
Constant	1.734*** (4.998)
Year FE	Yes
Industry FE	Yes
Observations	25,613
Pseudo R2	0.0931

Panel C. Results based on Firm-related and CEO-related factors

Dependent Variable = COO	
VARIABLES	Firm-Related and CEO-Related Factors
SIZE	0.096*** (16.134)
GROWTH	0.143*** (4.080)
MATURE	0.103*** (2.843)
SHAKEOUT	0.048 (1.199)
DECLINE	0.053 (1.256)
LNAGE	0.061 (1.459)
LOSS	0.057** (2.531)
FCF	-0.073*** (-2.926)
ICMW	0.006 (0.167)
MA	0.043** (1.976)
FOREIGN	-0.051*** (-2.714)
CONCENTRATION	0.271*** (4.855)
LEVERAGE	0.009 (0.880)
CEOCHAIR	0.271*** (12.720)
CEOSHROWN	-0.000 (-0.183)
FOUNDERCEO	0.077*** (2.931)
COOPTION	0.005 (0.101)
CEONW	0.035*** (4.501)
CEOMULTIBOARD	-0.019 (-0.877)
OUTSIDECEO	0.063*** (3.056)
CEOOCOO	-0.086*** (-3.501)
CEOLNAGE	-0.147** (-2.003)
WOMENCEO	-0.239*** (-4.958)
CEOELITE	-0.016

CEOMBA	(-1.157)
	-0.038*
Constant	(-1.759)
	0.913**
	(2.519)
Year FE	Yes
Industry FE	Yes
Observations	25,613
Pseudo R2	0.104

Notes: This table provides regression results on the probability of COO presence based on firm-related factors and CEO-related factors. Panel A provides results based on firm-related factors. Panel B provides results based on CEO-related factors. Panel C provides results based on both firm- and CEO-related factors. See Appendix A for variable definitions. *, **, and *** represent two-tailed significance levels at 10%, 5%, and 1%, respectively. For each variable, the coefficient estimate (t-statistics) is reported in the top (bottom) row.

Table 3. Descriptive Statistics for Variables Used in Hypotheses Testing**Panel A. Full Sample**

Variable	N	Mean	Std.	25%	50%	75%
EFF_RANK	25,613	0.593	0.265	0.400	0.600	0.800
EFF (raw)	25,613	0.327	0.169	0.228	0.274	0.370
COO	25,613	0.540	0.498	0.000	1.000	1.000
ORGINDEX	25,613	0.305	0.294	0.000	0.393	0.579
PERINDEX	25,613	0.314	0.311	0.000	0.381	0.576
SIZE	25,613	6.313	2.056	4.903	6.353	7.715
GROWTH	25,613	0.279	0.449	0.000	0.000	1.000
MATURE	25,613	0.456	0.498	0.000	0.000	1.000
SHAKEOUT	25,613	0.099	0.299	0.000	0.000	0.000
DECLINE	25,613	0.062	0.241	0.000	0.000	0.000
LNAGE	25,613	1.976	0.472	1.609	1.946	2.398
LOSS	25,613	0.326	0.469	0.000	0.000	1.000
FCF	25,613	0.702	0.457	0.000	1.000	1.000
ICMW	25,613	0.049	0.217	0.000	0.000	0.000
MA	25,613	0.198	0.399	0.000	0.000	0.000
FOREIGN	25,613	0.346	0.476	0.000	0.000	1.000
CONCENTRATION	25,613	0.803	0.666	0.547	1.000	1.000
LEVERAGE	25,613	0.508	0.748	0.301	0.472	0.637
CEOCHAIR	25,613	0.230	0.421	0.000	0.000	0.000
CEOSHROWN	25,613	1.358	4.653	0.000	0.000	0.687
FOUNDERCEO	25,613	0.136	0.343	0.000	0.000	0.000
COOPTION	25,613	0.125	0.321	0.000	0.000	0.000
CEONW	25,613	6.214	1.402	5.313	6.405	7.270
CEOMULTIBOARD	25,613	0.216	0.412	0.000	0.000	0.000
OUTSIDECEO	25,613	0.242	0.428	0.000	0.000	0.000
CEOCOO	25,613	0.144	0.351	0.000	0.000	0.000
CEOLNAGE	25,613	4.167	0.131	4.078	4.174	4.263
WOMENCEO	25,613	0.030	0.172	0.000	0.000	0.000
CEOELITE	25,613	1.011	0.688	1.000	1.000	1.000
CEOMBA	25,613	0.215	0.410	0.000	0.000	0.000

Panel B. Differences in Means Between Groups with and without a COO

Before Entropy Balancing

	COO = 1		COO = 0		
	N	Mean	N	Mean	Mean Diff.
SIZE	13,829	6.527	11,784	6.062	0.465***
GROWTH	13,829	0.296	11,784	0.259	0.038***
MATURE	13,829	0.462	11,784	0.449	0.013**
SHAKEOUT	13,829	0.093	11,784	0.107	-0.014***
DECLINE	13,829	0.056	11,784	0.069	-0.013***
LNAGE	13,829	1.959	11,784	1.996	-0.037***
LOSS	13,829	0.313	11,784	0.342	-0.029***
FCF	13,829	0.705	11,784	0.699	0.006
ICMW	13,829	0.049	11,784	0.050	-0.001
MA	13,829	0.210	11,784	0.185	0.025***
FOREIGN	13,829	0.327	11,784	0.369	-0.041***
CONCENTRATION	13,829	0.823	11,784	0.780	0.043***
LEVERAGE	13,829	0.510	11,784	0.505	0.005
CEOCHAIR	13,829	0.272	11,784	0.179	0.093***
CEOSHROWN	13,829	1.436	11,784	1.267	0.169***
FOUNDERCEO	13,829	0.146	11,784	0.125	0.022***
COOPTION	13,829	0.187	11,784	0.051	0.136***
CEONW	13,829	6.270	11,784	6.149	0.120***
CEOMULTIBOARD	13,829	0.226	11,784	0.205	0.020***
OUTSIDECEO	13,829	0.251	11,784	0.233	0.018***
CEOCOO	13,829	0.137	11,784	0.153	-0.016***
CEOLNAGE	13,829	4.169	11,784	4.165	0.004**
WOMENCEO	13,829	0.025	11,784	0.037	-0.012***
CEOELITE	13,829	1.007	11,784	1.015	-0.008
CEOMBA	13,829	0.209	11,784	0.221	-0.012**

After Entropy Balancing

	COO =1	COO =0	
	Mean	Mean	Mean Diff.
SIZE	6.527	6.527	0.000
GROWTH	0.296	0.296	0.000
MATURE	0.462	0.462	0.000
SHAKEOUT	0.093	0.093	0.000
DECLINE	0.056	0.056	0.000
LNAGE	1.959	1.959	0.000
LOSS	0.313	0.313	0.000
FCF	0.705	0.705	0.000
ICMW	0.049	0.049	0.000
MA	0.210	0.210	0.000
FOREIGN	0.327	0.327	0.000
CONCENTRATION	0.823	0.823	0.000
LEVERAGE	0.510	0.510	0.000
CEOCHAIR	0.273	0.273	0.000
CEOSHROWN	1.436	1.436	0.000
FOUNDERCEO	0.146	0.146	0.000
COOPTION	0.187	0.187	0.000
CEONW	6.270	6.270	0.000
CEOMULTIBOARD	0.226	0.226	0.000
OUTSIDECEO	0.251	0.251	0.000
CEOCOO	0.137	0.137	0.000
CEOLNAGE	4.169	4.169	0.000
WOMENCEO	0.025	0.025	0.000
CEOELITE	1.007	1.007	0.000
CEOMBA	0.209	0.209	0.000

Notes: Panel A provides descriptive statistics for variables used in Equation (5). Panel B compares the mean differences of variables between groups with and without COO before and after entropy balancing. See Appendix A for variable definitions. *, **, and *** represent two-tailed significance levels at 10%, 5%, and 1%, respectively.

Table 4 Correlations among Variables Used in Hypotheses Testing

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	
1	EFF_RANK	1																											
3	ORGINDEX	0.12	1																										
4	PERINDEX	0.06	0.47 ⁺	1																									
5	SIZE_	0.58	0.21	0.11	1																								
6	GROWTH	0.08	0.08	0.05	0.07	1																							
7	MATURE	0.18	0.03	0.01	0.23	-0.57	1																						
8	SHAKEOUT	-0.02	-0.04	-0.03	-0.06	-0.21	-0.30	1																					
9	DECLINE	-0.20	-0.05	-0.04	-0.22	-0.16	-0.24	-0.09	1																				
10	LNAGE_	0.04	-0.07	-0.08	0.15	-0.06	0.13	-0.02	-0.06	1																			
11	LOSS	-0.37	-0.06	-0.04	-0.41	-0.10	-0.30	0.05	0.29	-0.03	1																		
12	FCF	0.33	0.01	-0.00	0.34	-0.00	0.43	0.00	-0.32	0.09	-0.49	1																	
13	ICMW	-0.03	-0.01	-0.00	-0.02	0.01	-0.04	0.02	0.02	-0.07	0.05	-0.03	1																
14	MA	0.07	0.06	0.03	0.13	0.25	-0.12	-0.06	-0.08	-0.01	-0.08	0.08	0.01	1															
15	FOREIGN	0.12	-0.08	-0.07	0.16	-0.00	0.02	0.03	-0.03	0.10	-0.03	0.08	0.03	0.03	1														
16	CONCENTRATION	-0.04	0.06	0.04	-0.10	-0.00	-0.06	-0.00	0.06	-0.02	0.07	-0.09	0.02	-0.03	-0.03	1													
17	LEVERAGE	-0.02	0.01	0.01	-0.01	-0.02	-0.01	-0.02	0.04	0.03	0.07	-0.01	0.01	-0.00	-0.01	-0.01	1												
18	CEOCHAIR	0.07	0.11	0.19	0.11	-0.00	0.05	-0.01	-0.04	-0.05	-0.08	0.06	-0.00	0.03	-0.02	-0.02	0.01	1											
19	CEOSHROWN	0.07	0.02	0.03	0.07	0.02	0.04	0.01	-0.04	0.06	-0.09	0.08	0.01	0.01	0.01	0.00	-0.03	0.12	1										
20	FOUNDERCEO	0.01	0.03	0.05	-0.05	0.06	-0.09	0.00	0.02	-0.05	0.04	-0.08	0.00	-0.00	0.01	0.04	-0.04	0.13	0.22	1									
21	COOPTION	-0.06	0.20	0.43	-0.06	0.03	-0.04	-0.01	0.01	-0.07	0.04	-0.05	0.00	0.01	-0.04	0.03	-0.00	0.06	0.00	0.06	1								
22	CEONW	0.24	0.06	0.05	0.39	-0.01	0.02	0.02	-0.01	0.07	-0.01	0.07	0.01	0.04	0.14	-0.05	0.03	0.01	-0.03	-0.09	-0.08	1							
23	CEOMULTIBOARD	0.07	0.04	0.04	0.16	0.02	0.02	-0.01	-0.02	-0.00	-0.03	0.04	-0.01	0.05	0.03	-0.01	0.03	0.12	0.01	-0.04	0.01	0.17	1						
24	OUTSIDECEO	-0.00	0.02	0.04	-0.03	0.05	-0.08	-0.01	0.02	-0.09	0.08	-0.09	-0.01	0.01	0.01	0.03	-0.01	-0.11	0.01	0.11	0.05	0.08	0.02	1					
25	CEOOCOO	0.04	-0.01	-0.04	0.11	-0.02	0.07	-0.01	-0.02	0.15	-0.05	0.06	-0.01	0.00	0.02	-0.04	0.00	-0.10	-0.05	-0.13	-0.04	0.02	-0.02	-0.13	1				
26	CEOOLNAGE	-0.01	0.02	0.03	-0.04	-0.02	0.06	0.00	-0.01	-0.20	-0.09	0.07	-0.01	-0.03	-0.05	-0.03	-0.00	0.21	0.05	0.01	0.04	-0.22	0.09	-0.10	-0.10	1			
27	WOMENCEO	-0.01	-0.03	-0.05	-0.00	-0.02	0.00	0.01	-0.00	0.02	0.01	0.01	0.00	-0.03	-0.03	-0.00	0.00	-0.05	-0.00	-0.02	-0.02	0.06	0.02	-0.00	-0.02	-0.06	1		
28	CEOELITE	0.08	-0.01	-0.02	0.12	-0.01	-0.03	0.02	0.02	0.02	0.03	-0.01	0.02	0.02	0.09	-0.02	0.01	-0.02	-0.04	-0.02	-0.03	0.46	0.08	0.05	-0.00	-0.12	0.04	1	
29	CEOMBA	0.05	-0.02	-0.03	0.08	-0.00	0.02	0.01	-0.02	0.02	-0.01	0.04	0.01	0.00	0.03	-0.02	0.02	-0.03	-0.04	-0.08	-0.03	0.30	0.03	0.03	0.00	-0.08	0.01	0.29	1

Notes: This table provides correlations among variables in Equation (5). See Appendix A for variable definition. *, **, and *** represent two-tailed significance levels at 10%, 5%, and 1%, respectively. +Correlation between ORGINDEX and PERINDEX is based on COO-only sample.

Table 5 Regression Results on the Effect of COO Presence on Operation Efficiency by Differentiating Organizational Motives and CEO Personal Motives

DV = EFF_RANK	(1) Organization-Related Controls	(2) CEO-Related Controls	(3) Both Organization- and CEO- Related Controls
ORGINDEX	0.023** (2.070)	0.202*** (11.919)	0.049*** (2.666)
PERINDEX	-0.021** (-2.286)	-0.186*** (-10.407)	-0.048** (-2.548)
SIZE	0.032*** (31.793)		0.030*** (26.908)
GROWTH	0.025*** (4.118)		0.024*** (4.000)
MATURE	0.008 (1.383)		0.009 (1.454)
SHAKEOUT	0.003 (0.425)		0.003 (0.407)
DECLINE	-0.025*** (-3.248)		-0.025*** (-3.273)
LNAGE	-0.018*** (-2.794)		-0.010 (-1.506)
LOSS	-0.055*** (-15.557)		-0.057*** (-15.772)
FCF	0.032*** (8.140)		0.033*** (8.537)
ICMW	-0.019*** (-3.080)		-0.019*** (-3.070)
MA	-0.004 (-1.163)		-0.004 (-1.159)
FOREIGN	-0.001 (-0.293)		-0.001 (-0.424)
CONCENTRATION	-0.002 (-0.470)		-0.002 (-0.505)
LEVERAGE	0.008** (2.170)		0.009** (2.221)
CEOCHAIR		0.020*** (5.687)	0.004 (1.197)
CEOSHROWN		-0.001*** (-2.988)	-0.000 (-0.458)
FOUNDERCEO		0.010** (2.466)	0.014*** (3.569)
COOPTION		-0.005 (-0.889)	-0.003 (-0.492)
CEONW		0.015*** (12.381)	0.004*** (2.941)
CEOMULTIBOARD		0.004 (1.071)	-0.005* (-1.677)
OUTSIDECEO		0.006* (2.170)	0.007** (2.221)

CEOCOO		(1.709)	(2.233)
	0.005		-0.006*
	(1.314)		(-1.760)
CEOLNAGE	0.010		-0.017
	(0.875)		(-1.642)
WOMENCEO	-0.017**		0.001
	(-2.376)		(0.138)
CEOELITE	-0.006***		-0.000
	(-2.685)		(-0.012)
CEOMB	-0.006*		-0.003
	(-1.938)		(-1.064)
LAG_EFFRANK	0.520***	0.654***	0.517***
	(74.408)	(108.496)	(74.000)
Constant	0.068***	0.130**	0.128***
	(3.388)	(2.534)	(2.601)
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Observations	25,613	25,613	25,613
R-squared	0.584	0.531	0.585

Notes: This table provides OLS regression results on the effect of COO presence on operation efficiency by differentiating organizational motives and CEO personal motives using entropy balancing sample. The results also hold when using Tobit regression. See Appendix A for variable definition. *, **, and *** represent two-tailed significance levels at 10%, 5%, and 1%, respectively. For each variable, the coefficient estimate (t-statistics) is reported in the top (bottom) row.

Table 6. Interaction Effect Between Organizational Index and CEO Personal Index on Operational Efficiency

DV = EFF_RANK	
VARIABLES	
HIGH_ORG_HIGH_PER	-0.010 (-1.577)
HIGH_ORG_LOW_PER	0.018** (1.973)
LOW_ORG_HIGH_PER	-0.012** (-1.975)
LOW_ORG_LOW_PER	0.005 (1.368)
Constant	0.127** (2.532)
Control Variables	Yes
Lagged DV	Yes
Year FE	Yes
Industry FE	Yes
Observations	24,044
R-squared	0.586

Notes: This table presents OLS regression results examining the interaction effect between the organizational motive index and the CEO personal motive index on operational efficiency (EFF_RANK). Four subgroups were created using tercile splits of ORGINDEX and PERINDEX for firms with COOs (COO=1): HIGH_ORG_HIGH_PER (firms in the top tercile of organizational index and top tercile of personal index), HIGH_ORG_LOW_PER (top tercile of organizational index and bottom tercile of personal index), LOW_ORG_HIGH_PER (bottom tercile of organizational index and top tercile of personal index), and LOW_ORG_LOW_PER (bottom tercile of organizational index and bottom tercile of personal index). Observations in the middle terciles of organizational and personal index are excluded from the analysis. Non-COO firms (COO=0) are assigned a value of 0 for all subgroup variables. *, **, and *** represent two-tailed significance levels at 10%, 5%, and 1%, respectively. For each variable, the coefficient estimate (t-statistics) is reported in the top (bottom) row.

Table 7. Additional Analysis by Decomposing CEO Personal Motives

DV = EFF_RANK	
VARIABLES	
POWERINDEX	-0.044* (-1.769)
EXPINDEX	-0.035 (-0.518)
DEMOINDEX	-0.036 (-0.546)
ORGINDEX	0.115*** (2.935)
Constant	0.118** (2.419)
Control Variables	Yes
Lagged DV	Yes
Year FE	Yes
Industry FE	Yes
Observations	25,613
R-squared	0.585

Notes: This table presents regression results that decompose CEO personal motives into three components: CEO power (*POWERINDEX*), CEO experience (*EXPINDEX*), and CEO demographics (*DEMOINDEX*). Variable definitions are provided in Appendix A. *, **, and *** denote two-tailed significance levels of 10%, 5%, and 1%, respectively. For each variable, the coefficient estimate (t-statistics) is reported in the top (bottom) row.

Table 8. Additional Analyses based upon Alternative Efficiency Measures**Panel A. Analyses using the Continuous Efficiency Score Measure**

VARIABLES	EFF
<i>ORGINDEX</i>	0.025* (1.802)
<i>PERINDEX</i>	-0.026* (-1.943)
Constant	-0.121*** (-3.087)
Control Variables	Yes
Lagged DV	Yes
Year FE	Yes
Industry FE	Yes
Observations	25,613
R-squared	0.486

Panel B. Analyses using Other Measures of Efficiency

VARIABLES	(1) INVTURN	(2) OPLTURN	(3) FIXTURN	(4) IMPAIR	(5) SG&A	(6) PATENT	(7) EMP_P	(8) RMS_REV
<i>ORGINDEX</i>	0.466*** (2.759)	0.232 (1.258)	0.253 (1.474)	-1.186 (-0.826)	-0.132 (-1.023)	0.269 (0.739)	0.686*** (2.633)	0.189** (2.094)
<i>PERINDEX</i>	-0.481*** (-2.796)	-0.202 (-1.039)	-0.254 (-1.526)	0.313 (0.221)	0.167 (1.220)	-0.386 (-1.008)	-0.637*** (-2.609)	-0.199** (-2.184)
Constant	1.066*** (2.631)	1.120** (2.333)	1.919*** (4.788)	-3.146 (-0.765)	0.289 (0.827)	-0.284 (-0.290)	1.893*** (4.032)	0.987*** (4.624)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lagged DV	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,123	18,686	21,074	622	20,230	8,005	19,288	20,834
R-squared	0.846	0.803	0.858	0.401	0.896	0.645	0.813	0.932

Notes: This table presents regression results using alternative efficiency measures. Panel A reports the results of the continuous efficiency measure (EFF), while Panel B presents results based on several other alternative measures of operational efficiency, including inventory turnover (INVTURN), operating lease turnover (OPLTURN), fixed asset turnover (FIXTURN), impairments (IMPAIR), selling, general, and administrative expenses (SGA), patent counts (PATENT), employee productivity (EMP_P), and relative product market share at the industry level (RMS_REV). Variable definitions are provided in Appendix A. *, **, and *** denote two-tailed significance levels of 10%, 5%, and 1%, respectively. For each variable, the coefficient estimate (t-statistics) is reported in the top (bottom) row.

Appendix A. Variable Definitions

Variable Name	Definition	Source
Variables used in the main analysis		
EFFRANK	= The standardized percentile rank of EFF at the industry level for fiscal year t+1. EFF is a firm efficiency score (ranging from 0 to 1) based on the Data Envelopment Analysis (DEA). It is estimated using one output of revenue (SALE) and seven inputs: net PP&E, cost of goods sold, selling, general and administrative expense, capitalized operating leases, capitalized R&D, purchased goodwill and other intangibles.	Prof. Peter Demerjian's website
COO	= A dummy variable that equals 1 if firm i in year t has a COO, 0 otherwise	BOARDEX
ORGINDEX	= The predicted probability that a firm has a COO based on firm-related factors, calculated using coefficient estimates for Equation (1) presented in Table 2 Panel A. Observations without COO take the value of 0.	
PERINDEX	= The predicted probability that a firm has a COO based on CEO-related factors, calculated using coefficient estimates for Equation (2) presented in Table 2 Panel B. Observations without COO take the value of 0.	
SIZE	= Natural logarithm of market value of equity.	COMPUSTAT
LOSS	= A dummy variable that equals 1 if a firm has a negative net income, 0 otherwise.	COMPUSTAT
GROWTH	= A dummy variable that equals 1 if a firm has positive operating cash flow from operating activities, negative cash flow from investing activities and positive cash flow from financing activities, 0 otherwise.	COMPUSTAT
MATURE	= A dummy variable that equals 1 if a firm has positive cash flow from operating activities, negative cash flow from investing activities, and negative cash flow from financing activities, 0 otherwise.	COMPUSTAT
SHAKEOUT	= A dummy variable that equals 1 if a firm has negative cash flow from operating, investing, and financing activities or both positive cash flow from operating, investing and financing activities, or positive cash flow from operating and investing activities and negative cash flow from financing activities, 0 otherwise.	COMPUSTAT
DECLINE	= A dummy variable that equals 1 if a firm has negative cash flow from operating activities and positive cash flow from investing activities, 0 otherwise.	COMPUSTAT
ICMW	= A dummy variable that equals 1 if a firm reports a material weakness in ICFR, 0 otherwise.	AUDIT ANALYTICS
FOREIGN	= A dummy variable that equals 1 if a firm reports a nonzero value for foreign currency adjustment, 0 otherwise.	COMPUSTAT
FCF	= A dummy variable that equals 1 if a firm's free cash flow is not negative, 0 otherwise.	COMPUSTAT
LEVERAGE	= The ratio of long-term liabilities to total assets.	COMPUSTAT
MA	= A dummy variable that equals 1 if a firm has a merger and acquisition, 0 otherwise.	COMPUSTAT
LNAGE	= Natural logarithm of the number of years a firm has appeared in the Compustat database.	COMPUSTAT
CONCENTRATION	= Herfindahl index for business segment concentration, measured as the square of the ratio of individual business segments sales to total sales, summed across all business segments.	BOARDEX
CEOCHAIR	= A dummy variable that equals 1 if a firm has a CEO who also serves as chairman of the board, 0 otherwise.	EXECUCOMP
CEOSHROWN	= Ratios of shares owned by the CEO to shares outstanding (item SHROWN_TOT_PCT in Execucomp). Missing values are treated as zero.	
FOUNDERCEO	= A dummy variable that equals 1 if a firm has a CEO who is also the founder of the company, 0 otherwise.	
CEOMULTIBOARD	= A dummy variable that equals 1 if a firm has a CEO who serves on three or more boards of directors, 0 otherwise.	BOARDEX
COOPTION	= The number of appointed directors after the CEO appointment scaled by board size. Co-opted board members are those who were appointed after the CEO of the company took office, whereas non-co-opted members are those who were appointed before the CEO's appointment. Missing values are set to 0.	BOARDEX

<i>OUTSIDECEO</i>	= A dummy variable that equals 1 if a firm has a CEO who is promoted from outside of the company, 0 otherwise.	BOARDEX
<i>CEOCOO</i>	= A dummy variable that equals 1 if a firm has a CEO who used to work as a COO prior to the CEO appointment, 0 otherwise.	BOARDEX
<i>CEO_ELITE</i>	= Ordinal value of 3 if the CEO received an undergraduate and postgraduate degree from an elite institution, 2 if the CEO received one degree from an elite institution, 1 if the CEO has a formal higher education degree, and 0 if the CEO does not have a formal higher education degree. Elite institutions are listed in Bedford et al. (2023).	BOARDEX
<i>CEOMB</i> A	= A dummy variable that equals 1 if a firm has a CEO who obtained an MBA degree prior to the CEO appointment, 0 otherwise.	BOARDEX
<i>WOMENCEO</i>	= A dummy variable that equals 1 if a firm has a female CEO, 0 if a firm has a male CEO.	BOARDEX
<i>CEOLNAGE</i>	= Natural logarithm of the age of the CEO.	BOARDEX
<i>CEONW</i>	= CEO's network size, measured as the number of overlaps through employment, education, and other activities.	BOARDEX

Additional variables used in other analyses

<i>HIGH_ORG_HIGH_PER</i>	= Firms in the top tercile of organizational index and top tercile of personal index. Non-COO firms (COO=0) are assigned values of 0.	
<i>HIGH_ORG_LOW_PER</i>	= Firms in the top tercile of organizational index and bottom tercile of personal index. Non-COO firms (COO=0) are assigned values of 0.	
<i>LOW_ORG_HIGH_PER</i>	= Firms in the bottom tercile of organizational index and top tercile of personal index. Non-COO firms (COO=0) are assigned values of 0.	
<i>LOW_ORG_LOW_PER</i>	= Firms in the bottom tercile of organizational index and bottom tercile of personal index. Non-COO firms (COO=0) are assigned values of 0.	
<i>CEOPOWER</i>	= The predicted probability that a firm has a COO based on CEO power factors (CEOCHAIR, CEOSHROWN, FOUNDERCEO, COOPTION), calculated using probit regression. Observations without COO take the value of 0.	
<i>CEOEXP</i>	= The predicted probability that a firm has a COO based on CEO experience factors (CEONW, CEOMULTIBOARD, OUTSIDECEO, CEOOO), calculated using probit regression. Observations without COO take the value of 0.	
<i>CEODEMO</i>	= The predicted probability that a firm has a COO based on CEO demographic factors (CEOQNAGE, WOMENCEO, CEOELITE, CEOMB), calculated using probit regression. Observations without COO take the value of 0.	
<i>INVTURN</i>	= The yearly decile rank of inventory turnover ratio, measured as the COGS/average inventory.	COMPUSTAT
<i>OPLTURN</i>	= The yearly decile rank of sales over net operating leases, measured as the discounted present value of the next five years of required operating lease.	COMPUSTAT
<i>FIXTURN</i>	= The yearly decile rank of sales over average property, plant and equipment.	COMPUSTAT
<i>IMPAIR</i>	= The yearly decile rank of goodwill impairment before tax over total assets.	COMPUSTAT
<i>SG&A</i>	= The yearly decile rank of general and administrative expenses over sales.	COMPUSTAT
<i>PATENT</i>	= The yearly decile rank of number of patents filed.	US Patent by WRDS
<i>RMS</i>	= The yearly decile rank of a firm's relative product market share measured as firm sales divided by median industry sales.	COMPUSTAT
<i>EMP_P</i>	= The yearly decile rank of employee productivity, measured as sales divided by number of employees.	COMPUSTAT