Endogenous Social Norms in the Boardroom

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Abstract

We develop a model in which undesirable actions by individuals within a group are influenced by an endogenous social norm, which is determined by the group members' individual incentives, personal norms of behavior, and responsiveness to the social norm. The model is used to structurally assess the influence of an endogenous norm on behavior in the corporate boardroom, specifically insider trading behavior. Our estimates suggest that the social norm is an economically significant determinant of board members' insider trading behavior. Furthermore, the estimated determinants of individuals' sensitivity to social norms are consistent with individual characteristics identified in antecedent moral reasoning literature. Overall, our findings suggest that endogenous social norms influence board member behaviors, and that organizational leaders have greater influence on norms.

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1 Introduction

Theories of moral reasoning assert that social norms determine, in part, how individuals make decisions involving an ethical dimension.[1] Within business organizations, social norms are thought to influence behavior by supplementing the extrinsic financial incentives determined by compensation contracts, internal control and monitoring systems, and regulatory and legal structures. Although multiple scholars have considered how to incorporate social norms into corporate decision making, empirical evidence of social norms within business organizations is somewhat scant.[2] We seek to provide some evidence by structurally assessing how social norms influence behavior in the corporate boardroom by examining insider trading behavior by corporate board members. Our objective in addressing this question is not only to assess the role of norms in influencing insider trading by board members, but also to provide some insight into whether social norms are likely to arise and be influential in boardrooms more broadly.

Our structural assessment is guided by a framework grounded in the premise that an individual wants to fit in with their social group, which causes them to conform to some degree to behaviors that the individual believes other group members would exhibit in the individual's particular circumstances. If individual perceptions of behavior align to some extent with actual behaviors, the premise implies that norms are inherently endogenous. In particular, each individual in the group is not only influenced by the behavior of others, but also influences the behavior of others. To model social norms as an endogenous construct, we employ a framework in the spirit of Fischer and Huddart (2008), which assumes that when individuals engage in undesirable behavior like insider trading, their decision to trade is tempered by two forces: direct costs and psychic costs (e.g., feelings of shame or guilt). The former are determined by financial, legal, or regulatory costs tied to potential accusations of misconduct. The latter costs are determined by a weighted average of

[1] Kohlberg and Kramer (1969) is generally credited with initially proposing a theory of moral development that explicitly considers a social norm as a determinant of behavior. According to Kohlberg and Kramer (1969), people at different stages of moral development differ in how much their social circle influences their moral reasoning and associated decisions.

[2] Studies incorporating social norms into corporate settings include Posner (2000), Smith (2003), Smith (2007), and Bicchieri (2005).

an individual's personal code of conduct, which we call personal costs, and an endogenous social norm, with the weight on the social norm reflecting the notion that individuals have varying degrees of sensitivity to a social norm.[3]

Using a sample of directors' trading activities during the 8-K trading gap (Cohen et al. (2015)), which is an up-to-four-business-day window between a material event occurring at a company and this event being reported publicly in an 8-K, individual characteristics associated with individual-level personal costs of undesirable behavior and sensitivity to social norms, and firm-8-K event-level characteristics expected to determine direct costs, we structurally estimate our model assuming that all board members are equally important to the determination of the social norm governing behavior. Under that assumption, we consider two specifications, one in which individual sensitivities to the social norm are constant across directors and another in which the sensitivity is a function of individual characteristics. The former estimate implies that, on average, the weight on the social norm is about 55% in the determination of the psychic cost. In the second specification, in which individuals vary in their sensitivity to social norms, the weight on the social norm is about 21% for an average director, and varies from about 15% to 27% between the 25th percentile and 75th percentile of the distribution. Furthermore, according to the estimates of the second specification, the social norm component comprises about 19–32% of the total cost of insider trading. In short, these estimates suggest that endogenous social norms play a material role in determining the insider trading behavior of board members.

In addition to our broad estimates suggesting that social norms are material determinants of insider trading behavior, the results in the second specification suggest that males, directors who have spent more time with the firm, executive directors, directors who sit on more boards, and Millennial-generation directors are less sensitive to social norms, which is consistent with some antecedent research on determinants of individuals' sensitivity to social norms.[4] Furthermore, our

[3]Multiple studies (e.g., Gilligan (1982), Trevino (1986), Rothbart et al. (1986), Ford and Lowery (1986), Gilligan and Attanucci (1988)) that build on Kohlberg's theory of moral reasoning have found that individuals generally do adhere to the norms of their social groups, and the degree of individuals' sensitivity to social norms varies with demographic, educational, or contextual characteristics.

[4]For example, multiple studies (e.g., Gilligan (1982), Rothbart et al. (1986), Ford and Lowery (1986), Gilligan and Attanucci (1988)) suggest that females are more sensitive to social norms, Blau (1960) provides evidence that

estimates suggest that females, members of the Greatest and Millennial generations (as opposed to the Baby Boomer, Gen X, and Silent generations) demonstrate higher personal costs, which are also roughly consistent with findings in some antecedent studies.[5]

Finally, we extend the framework to allow a focal leader, the CEO, to have a greater weight in the determination of the norm, which is motivated by a notion of a tone at the top (Hermalin and Weisbach (1998); Adams and Ferreira (2007); Baldenius et al. (2014); Morse et al. (2011); Shivdasani and Yermack (1999); Coles et al. (2014); Fracassi and Tate (2012); Hwang and Kim (2009); Cohen et al. (2012); Graham et al. (2020); Khanna et al. (2015); Bruynseels and Cardinaels (2014); Carcello et al. (2011); Lisic et al. (2016); Cassell et al. (2018); Adams et al. (2010)). Estimates of this alternative setting in multiple specifications suggest that directors who hold the title of CEO do not appear to have an economically larger influence, compared to other directors, on the formation of their boards' norms.

Our study contributes to a large literature in economics regarding social norms or peer effects as determinants of individual behaviors. Given our focus on a smaller social group and an endogenous norm, our study is closely related to the peer effects literature in economics. That literature postulates that an individual's behavior is influenced by their peers' behavior, which is not substantively different from individuals being influenced by their beliefs about how their peers would behave if placed in the individual's circumstances. Peer effects have been studied fairly extensively as determinants of educational performance and health-related behaviors.[6] Our study contributes to this literature by considering another setting where peer effects might arise – a corporate boardroom. In addition, we employ a structural estimation approach, as opposed to employing reduced-form

newcomers in a group are more sensitive to the group's norms, and Weber (2017) and Weber and Elm (2018) provide evidence that Millennials exhibit a stronger personal orientation in ethical decision making.

[5]For example, Borkowski and Ugras (1998) and McCabe et al. (1991) provide evidence that females have, on average, different moral codes than males. Giuliano and Spilimbergo (2014), Malmendier and Nagel (2011), and Malmendier et al. (2011) provide evidence that the economic period of one's formative years is associated with their perspectives for economic decisions later in life, and individuals from the Greatest Generation and Millennials experienced periods with financial crises that followed periods of more freewheeling markets.

[6]Well-known studies of peer effects in educational performance include Sacerdote (2001), who exploits random roommate assignment at Dartmouth, and Carrell et al. (2009), who exploit exogenous squadron assignment at the U.S. Air Force Academy. In the context of health-related and other risky behaviors, see, e.g., Gaviria and Raphael (2001), Christakis and Fowler (2007), and Card and Giuliano (2013). Sacerdote (2011) provides a comprehensive review.

regressions, which is utilized in virtually all of the peer effects empirical literature.[7] Our structural approach allows us to extract a finer estimate of the weight individuals place on the social norm, which is achieved in part by estimating the theoretical determinants of the psychic cost of trading in our framework, the personal cost and the social norm. Whether our estimates reflect the construct in the theoretical framework is subject to potentially similar critiques as those leveled at reduced-form studies, however.[8] We address such critiques when discussing the adaptation of our formal model for empirical estimation.

Another large relevant stream of literature concerns trading by insiders (see Bainbridge (1998) for one of the earliest overviews of the issue). Numerous studies in Law, Finance, and Accounting have documented instances of insider trading. We enrich their evidence by estimating the importance of another potential determinant of corporate directors' insider trading decisions – social norms in a boardroom.

Finally, we contribute to the extensive empirical literature on boardroom diversity. Previous studies have examined how diversity on various dimensions impacts corporations' social performance (Hafsi and Turgut (2013)), corporate governance and financial performance (Campbell and Mínguez-Vera (2008), Adams and Ferreira (2009), Kang et al. (2022)), and innovation (Deore et al. (2021)). We demonstrate another potentially important effect of diversity, individual influences on a social norm, which can constrain or foster directors' undesirable behavior.

2 A Model of Undesirable Activity with Social Norms

The model employed for our structural analysis considers social norms as an endogenous construct, which, in equilibrium, are determined by individual group members' personal traits (i.e., their per-

[7] Structural approaches to estimating peer effects are relatively rare. Brock and Durlauf (2001) provide a foundational structural framework for discrete-choice models with social interactions. Calvó-Armengol et al. (2009) structurally estimate a network-based model linking individual outcomes to Katz–Bonacich centrality, and Boucher et al. (2024) structurally estimate a general model of peer effects that nests the linear-in-means, spillover, and conformist models as special cases. Card and Giuliano (2013) also estimate a structural bivariate discrete-choice model of peer effects among adolescent best-friend pairs.

[8] See for example, Angrist (2014)

sonal costs and their sensitivities to social norms) and incentives (i.e., their direct costs). Our formalization of social norms is grounded in the premise that individuals have innate preferences to adhere to the norms established by peers within their organization and that the strength of those preferences to conform varies across individuals. Such innate preferences might be evolutionary in nature, in the sense that individuals who are connected to social groups might fare better than those who are not.[9] Because of our empirical setting, insider trading by board members, we focus on a norm that influences an undesirable action from an organization's or society's perspective, as opposed to a norm that influences a desirable action.

2.1 Model

Consider an organization with N individuals. Each individual i in the organization can engage in an undesirable action or not. If i chooses to engage in the undesirable action, they incur a cost $c + (1 - \omega_i)\, p_i + \omega_i s_i$ where c represents direct costs imposed by the organization, regulators, or a court on all individuals, $(1 - \omega_i)\, p_i > 0$ represents individual-specific psychic cost of violating one's personal norm of behavior, $\omega_i s_i$ represents individual-specific costs associated with violating a perceived norm of behavior established by i's organization's social norm, and $\omega_i \in [0, 1)$ represents i's weighting of the personal versus social norm. In our primary model, the norm $s_i > 0$ is determined by the average anticipated behaviors of i's peers within the organization.

If i decides to take an undesirable action, they obtain a net benefit, b_i, which is determined by their circumstances. Those circumstances are uncertain a priori and determined by the realization of some random variable with support $\mathbb{R}_{++}$. In our empirical setting, if an individual trades on their inside information, the net benefit represents the expected return from trading, which includes the financial return, the value of resources obtained by that financial return, and/or the value of the personal satisfaction the individual gains from making a successful trade all net of costs determined by their individual specific circumstances such as their role in the organization (e.g., internal lead-

[9] Our premise is an established one in the social psychology literature, and has been employed in the framework of moral development of Kohlberg and Kramer (1969) and the locus of control construct of Rotter (1966).

ership role or an external independent director role) and/or their ability to access information upon which to trade. Given the cost of the undesirable action, it follows that an individual i will engage in the undesirable action if and only if

$$b_i > c + (1 - \omega_i)\, p_i + \omega_i s_i. \tag{1}$$

Hence, i's decision is defined by a threshold $b_i = \beta_i$ that satisfies

$$\beta_i = c + (1 - \omega_i)\, p_i + \omega_i s_i \tag{2}$$

such that i undertakes a level of undesirable action if and only if $b_i > \beta_i$. Hence, individual i is less likely to take the undesirable action (e.g., trade on inside information) if the direct cost, c, is greater, if the personal cost, p_i, is greater, and if the social norm, s_i, is more stringent. Furthermore, the i is more likely to engage in the undesirable action if they are more (less) sensitive to the social norm and that norm imposes more (less) psychic costs on them than their personal code of conduct (i.e., personal cost).

To endogenize the organization's social norm, and characterize the equilibrium solely in terms of exogenous variables, we assume the norm faced by individual i is the average threshold they anticipate for their peers in the organization. Hence, we endogenize the norm by implicitly assuming that individuals are influenced by their beliefs about how others in their organization will behave in similar circumstances and, as is common in formal models, assume those beliefs must be equilibrium consistent (i.e., what individuals believe about the behavior of others is consistent with the equilibrium behavior of others). Modeling the social norm as an equally weighted average of individual behaviors is arguably a reasonable one for a board of directors in the sense that board members are likely to view each other as a group of equal peers, as opposed to a hierarchy in which a select few are deemed to be in charge. With that said, in an extension we allow for the possibility that one individual, a focal leader, can have greater weight.

Let a $\hat{}$ over a threshold denote a conjecture for that threshold. Substituting in a conjecture for

the average threshold for i's peers, $\frac{\sum_{j\in\Omega, j\neq i}\hat{\beta}_j}{N-1}$, in for s_i in expression (2) yields i's threshold as a function of their conjecture of their peers' thresholds:

$$\beta_i = c + (1-\omega_i)\, p_i + \omega_i \frac{\sum_{j\in\Omega, j\neq i}\hat{\beta}_j}{N-1} \tag{3}$$

In equilibrium, $\hat{\beta}_j = \beta_j$ for all j and that observation, coupled with rearranging the above equation, implies that the equilibrium value for β_i satisfies

$$\beta_i = c + (1-\omega_i)\, p_i + \frac{N}{N-1}\omega_i \frac{\sum_{j\in\Omega, j\neq i}\beta_j}{N} \tag{4}$$

or

$$\beta_i \;=\; \frac{(N-1)}{(N-1+\omega_i)}\left(c + (1-\omega_i)\, p_i\right) + \frac{N\omega_i}{(N-1+\omega_i)}\bar{\beta} \tag{5}$$

where $\bar{\beta} = \frac{\sum_{j\in\Omega}\beta_j}{N}$ is the average threshold for all individuals in the organization, which we refer to as the organization's social norm.

To solve for the equilibrium $\overline{\beta}$, we divide both sides of equation (5) by the number of individuals in the organization:

$$\frac{\beta_i}{N} \;=\; \frac{1}{N}\frac{(N-1)}{(N-1+\omega_i)}\left(c + (1-\omega_i)\, p_i\right) + \frac{1}{N}\frac{N\omega_i}{(N-1+\omega_i)}\bar{\beta} \tag{6}$$

$$\;=\; \frac{1}{N}\psi_i + \frac{1}{N}\chi_i\bar{\beta}, \tag{7}$$

where $\psi_i = \frac{N-1}{N-1+\omega_i}\left(c + (1-\omega_i)\, p_i\right)$ and $\chi_i = \frac{N\omega_i}{N-1+\omega_i}$. Summing these equations across all individuals in the organization implies that the equilibrium $\overline{\beta}$ must satisfy

$$\overline{\beta} = \bar{\psi} + \bar{\chi}\bar{\beta} \tag{8}$$

where $\bar{\psi} = \frac{\sum_{j \in \Omega} \psi_j}{N}$ and $\bar{\chi} = \frac{\sum_{j \in \Omega} \chi_j}{N}$. Solving for $\bar{\beta}$ yields

$$\overline{\beta} = \frac{\bar{\psi}}{1 - \bar{\chi}}. \tag{9}$$

To provide some intuition regarding the organization's social norm, $\overline{\beta}$, we consider some comparative statics. First, the social norm, $\overline{\beta}$, is increasing in each individual i's common cost, c, and personal cost, p_i, which directly increases i's threshold by increasing the cost of the undesirable activity, and indirectly increases all group members' thresholds through the social norm mechanism. Furthermore, note that, if we allow N to be infinitely large so that each individual has an arbitrarily small impact on the social norm, the equilibrium social norm satisfies $\overline{\beta} = \frac{c + \overline{(1-\omega)p}}{1 - \bar{\omega}}$, where $c + \overline{(1-\omega)p}$ is the average individual-specific direct and personal cost, $c + (1 - \omega_i)\, p_i$, and $\bar{\omega}$ is the average sensitivity to the social norm, ω_i. This observation provides, perhaps, a clearer depiction of the comparative statics intuition just described.

To conclude the model characterization, we use the equilibrium norm, $\overline{\beta}$, to fully characterize each individual i's equilibrium threshold:

Proposition 1 *An individual i will engage in an undesirable activity if and only if:*

$$b_i > \frac{N-1}{N-1+\omega_i} \left(c + (1 - \omega_i)\, p_i\right) + \frac{N\omega_i}{N-1+\omega_i} \frac{\bar{\psi}}{1 - \bar{\chi}} \tag{10}$$

Individuals with higher personal psychic costs of the undesirable activity (higher p_i), individuals in an organization with greater costs of the undesirable activity, c, and individuals in an organization with a stronger social norm, $\frac{\bar{\psi}}{1-\bar{\chi}} = \frac{\sum_{j \in \Omega} \frac{N-1}{N-1+\omega_j} (c + (1-\omega_j) p_j)}{N - \sum_{j \in \Omega} \frac{N\omega_j}{N-1+\omega_j}}$, will be less inclined to engage in the undesirable activity.

The effect of an individual's sensitivity to the social norm, ω_i, on their equilibrium undesirable activity is more nuanced. At a high level, the individual is less (more) likely to engage in the undesirable activity as their sensitivity ω_i increases if the social norm is meaningfully higher (lower)

than their own personal norm.[10] This result is intuitive: if an individual's personal code of conduct is less (more) stringent than that of an average group member, higher sensitivity to the group norm will deter (foster) the individual's undesirable behavior.

2.2 Empirical Setting and Model Adaptation for Estimation

We apply our model to consider how social norms affect board members' behavior, specifically insider trading behavior. Insider trading by board members is considered an undesirable activity because it adversely impacts investor perceptions of corporate governance and market fairness and, accordingly, is discouraged by firms policies (e.g., blackout periods) and insider trading laws. Nonetheless, antecedent studies suggest that some board members still engage in insider trading without regulatory or legal consequences.[11] Because firm level and regulatory policing do not appear to fully constrain insider trading, we conjecture that the decision to trade is also likely to be influenced by a board member's ethical compass, which would be potentially influenced by norms of behavior that are endogenous to the board.

To identify opportunities for insider trading by board members, we follow Cohen et al. (2015) and use board of directors' trading activities during the 8-K trading gap. Starting from 2004, a public company is required to file an 8-K form within four business days after a material event has occurred. This formulation implies that, for any material event, there exists an up to a four-business-day period, the 8-K trading gap, when the company's board members, or at least a subset of them, have inside information and the associated profitable trading opportunities. Cohen et al. (2015) document that insiders earn, on average, a systematic abnormal return of 42 basis points per trade during the 8-K trading gap, and, as noted above, that these trades do not lead to adverse regulatory or legal consequences.

Estimating the direct costs, c, the personal costs, p_i, and the sensitivity to a social norm, ω_i, at

[10] The exact condition for $\frac{d\beta_i(\omega_i)}{d\omega_i} > 0$ is $\frac{\bar{\psi}}{1-\bar{\chi}} > \frac{c}{N} + p_i$. We derive this condition in Appendix 10.1.

[11] See, for example, Jaffe (1974), Finnerty (1976), Seyhun (1986), Aboody and Lev (2000), Lakonishok and Lee (2001), Jeng et al. (2003), Ravina and Sapienza (2010), Jagolinzer et al. (2011), Cohen et al. (2012), Cohen et al. (2015), and Goergen et al. (2019).

the individual level is challenging for two reasons. First, because of the model's linear structure, the parameters cannot be identified separately. Second, estimating individual-level parameters requires a sample with sufficient individual-level variation in behavior.

Instead of estimating individual-level costs and sensitivities to social norms directly, we augment the model by assuming that these parameters are functions of individual- and/or firm-level characteristics. The cost c represents exogenously imposed costs and therefore depends on firm-level characteristics. The cost p_i captures the individual's own code of conduct and is therefore modeled as a function of demographic and background characteristics. Finally, we model sensitivity to social norms as a function of individual-level and contextual characteristics.

Formally, we set

$$c_{ft} = \exp\left(\Lambda_c' Z_{ft}^c\right), \quad p_{ift} = \exp\left(\Lambda_p' Z_{ift}^p\right), \quad \omega_{ift} = \sigma\left(\Lambda_\omega' Z_{ift}^\omega\right),$$

where $\exp()$ is the exponential function, $\sigma()$ is the sigmoid function, i indexes directors, f indexes firms, and t indexes 8-K events at firm f, ${Z_{ft}^c}' = [z_{1,ft}^c, z_{2,ft}^c, \ldots, z_{n,ft}^c]$ is a vector of characteristics that reflect common exogenously imposed costs of engaging in insider trading, $\Lambda_c' = [\lambda_{1c}, \lambda_{2c}, \ldots, \lambda_{nc}]$ is a vector of coefficients on the characteristics in Z_{ft}^c, ${Z_{ift}^p}' = [z_{1,ift}^p, z_{2,ift}^p, \ldots, z_{n,ift}^p]$ is a vector of characteristics capturing an individual's costs of engaging in insider trading coming from their own ethical standards and reasoning, $\Lambda_p' = [\lambda_{1p}, \lambda_{2p}, \ldots, \lambda_{np}]$ is a vector of coefficients on the characteristics in Z_{ift}^p, ${Z_{ift}^\omega}' = [z_{1,ift}^\omega, z_{2,ift}^\omega, \ldots, z_{n,ift}^\omega]$ is a vector of characteristics that depict an individual's sensitivity to a social norm, and $\Lambda_\omega' = [\lambda_{1\omega}, \lambda_{2\omega}, \ldots, \lambda_{n\omega}]$ is a vector of coefficients on the characteristics in Z_{ift}^ω. We use exponential transformations for c_{ft} and p_{ift} to ensure that both types of cost are non-negative and make ω_{ift} the sigmoid function to ensure that the sensitivity to social norms lies between 0 and 1. We suppress f and t in prose when unambiguous.

The factors employed to capture the institutional determinants of the net direct costs of insider trading, c, include firm size and industry, which reflect differences in governance practices and regulatory attention across those two dimensions. In addition, we include a year fixed effect to

capture variation in enforcement regimes across time. We also include a fixed effect for each 8-K item to capture the fact that different types of events likely exhibit differences regarding the extent to which insider trade is scrutinized.

The individual characteristics we employ to capture the personal costs of insider trading, p_i, and sensitivity to a social norm, ω_i are suggested by theories and evidence in the Psychology, Ethology, and Management literature. The factors determining an individual's personal costs of insider trading include gender, professional training, generation, and whether a board member was largely raised in the United States. We include gender because experimental findings in Borkowski and Ugras (1998) and McCabe et al. (1991) suggest that women's and men's moral judgment may differ significantly. Professional designations are included because of research suggesting that moral decision-making is influenced by differences in educational backgrounds and training (see, for example, McCabe et al. (1991), Hiltebeitel and Jones (1992) and Eynon et al. (1997)). The inclusion of a board member's generation is motivated by studies in psychology showing persistent differences in moral reasoning and standards across different generations (Strauss and Howe (1991), Strauss and Howe (1997), Malmendier and Nagel (2011), Malmendier et al. (2011), Marquis and Tilcsik (2013), Giuliano and Spilimbergo (2014), Hannikainen et al. (2018), Friesen (2019)). Finally, we distinguish between U.S. and non U.S. raised board members because Western and non-Western cultures are thought to differ in how they perceive morality (e.g., Buchtel et al. (2015), Graham et al. (2016)).

Individual characteristics used to estimate a board member's sensitivity to the social norm include gender, professional training, generation, whether the board member was raised in the U.S., time the board member has been employed by the firm, the number of other company boards the board member serves on, and the board member's position at the firm. Gender is included because prior studies suggests two, admittedly countervailing, reasons why female directors may exhibit more or less sensitivity to a board-level norm. More specifically, men are generally more concerned with justice and individual rights, while women are generally more concerned with questions of care and relationship with others (Gilligan (1982), Rothbart et al. (1986), Ford and Lowery

(1986), Gilligan and Attanucci (1988)). A woman, therefore, might be expected to be more sensitive to a group norm to foster relations with group members. In contrast, Bosma et al. (2012), Markussen and Røed (2017), and Gioia (2017) have shown that individuals are substantially less influenced by their peers if the peers are of a different gender. Given that corporate boards are largely comprised of men, women may be expected to be less sensitive to board norms. Regarding professional training, Trevino (1986) suggests that people who often face moral dilemmas in their profession (e.g., doctors), or who are trained to be able to think in an unbiased manner (e.g., law school graduates or those who receive ethical training), have more independent moral reasoning. Generation is included because individuals from different generations have been shown to reason at different cognitive levels depending on the context (Weber (2017), Weber and Elm (2018)). The U.S. designation is incorporated because another important factor in individuals' adherence to social norms is culture and national identity, with individuals from more individualistic cultures (e.g., the United States or the United Kingdom) being less sensitive to social norms than individuals from more collectivist cultures (e.g., Japan or South Korea) (see Gelfand et al. (2011)). Time with the organization is included for two reasons, which are at odds with each other. First, Harris (1990) finds that individuals who have spent more time in an organization are more responsive to the organization's norms. In contrast, Blau (1960) finds that newcomers to an organization feel more pressure to adhere to established norms of behavior and are less likely than old group members to act in disagreement with traditions. Finally, we include two other variables that are expected to capture how much a board member identifies with the board and, accordingly, is more sensitive to the board's norm, the number of other boards the director serves on and whether the director is an independent director (i.e., not an executive of the firm). The number of boards served on is expected to reduce the board member's identification with the board and, hence, sensitivity to board norms. An independent director, at first pass, might be expected to identify less with the board because they are less connected to the firm. With that said, Clune et al. (2014) interview board recruiting committee members and find that they often rely on the like-mindedness of potential candidates and prefer to hire someone who has the right "chemistry" with the board and the CEO. This finding

suggests that independent directors might be more likely to go along with the board's established norms of behavior.

Before proceeding, we briefly digress to discuss potential pitfalls of our approach, which are suggested by critiques of other empirical studies of peer effects.[12] Estimated correlations in behaviors among individuals in a peer group cannot necessarily be attributed to peer effects because they can be attributed to unobserved common preferences or traits when individual assignments to a peer group are endogenous, and arise from unobservable peer group specific treatments. We anticipate that the structural approach we employ, which relies on a theoretically motivated functional form as opposed to average trading behaviors of peers, choices of individuals' characteristics that antecedent studies suggest should be inherently associated with the construct they reflect, and multiple insider trading opportunities for individuals within the sample will be less susceptible to these critiques than a simple specification that regresses each insider's trades on the extent of trade by their peers. With that said, if the mix of an individual's characteristics interacted with the characteristics of their peers is associated with unobservable group assignment determinants or group-level shocks that determine trading behavior, it might be the case that these unobservable group-level attributes are behind the effects of social norms we obtain in the estimation.

3 Data Sources and Descriptives

We restrict our sample to public companies operating in the United States and events occurring after August 24, 2004 – the first day after the SEC adopted the four-day gap rule. For the 8-K filings, we use data collected by the Wharton Research Data Services Analytics (WRDS Analytics). For each 8-K form filed by a company, we gather the Items in the form, the date and time the form was filed, and the date an event happened. When the filing time is after 4 pm or the filing date is a non-trading day, we set the filing date to the next closest NYSE day. We calculate the trading gap as the day difference between the filing date and the event date. We drop observations where the gap

[12] See, for example, Angrist (2014).

is zero and observations with more than a four-business-day gap. Following Cohen et al. (2015), we remove Item 5.02 filings, which are typically stock or option awards granted to the company's management. We remove Item 5.07 filings because they report results of shareholder voting at annual meetings, which are rarely material and are disclosed at least at the meeting itself. We follow Niessner (2015) and remove Item 1.03 filings, which are bankruptcy or receivership and can be anticipated in advance, Item 2.02 filings, which are earnings announcements that are prescheduled and generally subject to blackout periods imposed by companies, and Item 7.01 filings, which relate to Regulation FD and have a 24-hour reporting period.

We obtain data on board members' insider trading from Thomson Reuters, which collects data from Form 4 filings that public-company directors, officers, and beneficial owners of 10% of the stock are required to file within two business days of any stock transaction. The filings report transaction dates, prices, and other details. We keep only transactions classified as sales or purchases, and transactions unrelated to exercising options. For every board member and every 8-K filing, we record the trading instance as 1 if the member traded during the trading gap and 0 if the member did not trade.

To proxy for the net benefit of trade for a given board member (i.e., their personal circumstances), we employ a cumulative abnormal return during the 8-K trading gap, which the period of time between the day the event happened and the day the 8-K form was filed. We take the absolute value of this return to capture the benefit from buying in advance of good news and selling in advance of bad news. We use this return both for directors who engaged in trading, and those who did not. This way we are able to get a proxy that is uniform for all directors within an event, we do not rely on the timing choice and avoid systematic differences in benefit distributions between traders and non-traders. In addition, we include the length of the 8-K trading gap because it captures the ease of accessing the information and completing an insider trade before the filing of the 8-K. We also include three individual characteristics that reflect the individual-specific costs of accessing and trading on the information, which are indicators whether the director is an inside director, whether the director is the firm's CEO, the number of boards on which the director serves,

and the previous variable interacted with whether the director is an inside director. Whether a director is an inside director is included because directors who are executives at the firm may have less costly access to inside information (Adams and Ferreira (2007), Ravina and Sapienza (2010)) and also may have their trades scrutinized to a greater degree by the firm or the public (Bettis et al. (2000), Jagolinzer et al. (2011)). Whether the director is the firm's CEO is added because that individual inside director's position might come with differential access and/or scrutiny. The number of boards an individual director sits on may, similarly, affect the individual's costs of accessing and processing insider information because a great deal of board service takes the director's attention away from the firm (Ferris et al. (2003), Fich and Shivdasani (2006), Masulis and Mobbs (2014), Goergen et al. (2019)). We allow the number of boards to be moderated by whether the director is an inside director because any external board service will likely distract them less from their employer firm's affairs.

We collect data on board members' characteristics and employment history from BoardEx, and data on firms' characteristics from Compustat.

After the selection process described above, we remove firms with missing data, firms with non-positive total assets, events with absolute cumulative abnormal stock return in the upper 1% of the distribution, and firm size, directors' time with the board, and directors' number of other boards in the upper 1% of the distribution. Table 1 shows sample reduction at each step. For the main estimation sample, we end up with a total of 1,210,414 observations for 4,000 firms with 8-K filings from 2005 to 2022.

Summary statistics for the length of the 8-K gap, instances of trading, and potential abnormal returns during the gap, together with the distribution of trading activity across events, are provided in Table 2. The average length of the trading gap in our sample is 2.16 days. About 0.6% of director-firm-event-level observations in our sample are cases in which a director traded the firm's stock. The potential cumulative abnormal return is, on average, 4 percentage points, with 1.1 percentage points at the 25th percentile and 5.0 percentage points at the 75th percentile. Panel B of the table reports how this trading activity is distributed across the 147,356 distinct 8-K events in the sample:

in 95.8% of events no board member traded during the gap, in 3.5% exactly one director traded, and in only 0.7% did two or more directors trade, with a maximum of nine trading directors in a single event.

Table 3 presents summary statistics for individual-level and firm-event-level characteristics. About 14.4% of our observations are female members of the board of directors. 12.4% of observations have a Law degree, 11.5% are a CPA, and 1.4% are a CFA. The majority of the sample are Boomers – about 63.9% of observations. They are followed by the Silent generation (23.4%), Generation X (11.7%), the Greatest Generation (0.5%) and Millennials (0.5%). About 15.5% of observations are an executive director. On average, a given director sits on about 4.03 boards at a time. An average director has spent about 7.2 years with the firm.

For firm characteristics, a median firm has about $1,657.4 million in total assets. 40% of our observations are firms in the Manufacturing industry, followed by Finance and Insurance (15%).

For event characteristics, 42.4% of observations have only one-day 8-K gap. For other observations, the length of the 8-K gap appears to be distributed uniformly: about 19.7% (17.5%, 20.4%) of observations have a two- (three-, four-) day gap. The vast majority of 8-Ks (84.3% of observations) are Item 9.01 - Financial Statements and Exhibits.

4 Estimation Procedure

We estimate the model using Maximum Likelihood Estimation. We maximize the likelihood of observing the set of individuals who do and do not engage in trading at a given firm during a given 8-K gap. We assume that an individual's decision to trade is determined by: (1) the benefit they expect to earn from the trade, which is proxied for using the realized cumulative abnormal returns and individual-specific circumstances described above, and (2) the costs of engaging in insider trading stemming from exogenously imposed costs, their personal costs, and their costs related to adhering to the norm on the board. We further assume that there is an additive error ε_{ift} in either

predicting the benefit or determining the cost of trading, and this error has logistic distribution.[13] An individual will trade if their benefit net of their costs is above zero, i.e., if $b_{ift} - \frac{N_{ft}-1}{N_{ft}-1+\omega_{ift}}(c_{ft} + (1-\omega_{ift})p_{ift}) - \frac{N_{ft}\omega_{ift}}{N_{ft}-1+\omega_{ift}}\frac{\bar{\psi}_{ft}}{1-\bar{\chi}_{ft}} - \varepsilon_{ift} > 0$, and not trade otherwise. The probability of observing a trading choice for individual i at firm f during event t is:

1. If $\textit{Trade}_{ift} = 1$

$$L_{ift}(\textit{Trade}_{ift}\text{=1}) = \sigma\left(b_{ift} - \frac{N_{ft}-1}{N_{ft}-1+\omega_{ift}}(c_{ft} + (1-\omega_{ift})p_{ift}) - \frac{N_{ft}\omega_{ift}}{N_{ft}-1+\omega_{ift}}\frac{\bar{\psi}_{ft}}{1-\bar{\chi}_{ft}}\right),$$

2. If $\textit{Trade}_{ift} = 0$

$$L_{ift}(\textit{Trade}_{ift}\text{=0}) = 1-\sigma\left(b_{ift} - \frac{N_{ft}-1}{N_{ft}-1+\omega_{ift}}(c_{ft} + (1-\omega_{ift})p_{ift}) - \frac{N_{ft}\omega_{ift}}{N_{ft}-1+\omega_{ift}}\frac{\bar{\psi}_{ft}}{1-\bar{\chi}_{ft}}\right),$$

where $\bar{\psi}_{ft} = \frac{1}{N_{ft}}\sum_{j\in\Omega_{ft}}\frac{N_{ft}-1}{N_{ft}-1+\omega_{jft}}(c_{ft} + (1-\omega_{jft})p_{jft})$, $\bar{\chi}_{ft} = \frac{1}{N_{ft}}\sum_{j\in\Omega_{ft}}\frac{N_{ft}\omega_{jft}}{N_{ft}-1+\omega_{jft}}$, and $\sigma()$ denotes the sigmoid function. For the net benefit of trade driven by the expected return and an individual's specific circumstances, we define $b_{ift} \equiv r_{ft} - d_{ift} \equiv r_{ft} - \Lambda_d' Z_{ift}^d$, where Z_{ift}^d includes variables capturing circumstances as discussed above. We also define $c_{ft} = \exp(\Lambda_c' Z_{ft}^c)$ and $p_{ift} = \exp(\Lambda_p' Z_{ift}^p)$ to ensure that both types of cost are non-negative[14] and $\omega_{ift} = \sigma(\Lambda_\omega' Z_{ift}^\omega)$ to ensure that the sensitivity to social norms lies between 0 and 1. For all parameters (c, p, ω), vector Z_{ift} denotes the vector of variables describing a particular individual in a particular firm-event and Λ' denotes the vector of parameters that are estimated.

The maximum likelihood estimator (MLE) identifies the set of model parameters Λ_d', Λ_c', Λ_p', and Λ_ω' that maximize the joint log-likelihood of the observed trading decisions:

$$\sum_{(i,f,t)\in\mathcal{O}} \log L_{ift}(\textit{Trade}_{ift}),$$

[13] Note that the distribution of the noise term is not non-parametrically identified in discrete choice theory (McFadden (1974), McFadden (1981)).

[14] Note that as $c, p \to 0$, the probability of trading approaches $\sigma(r_{ft})$. Given that r in our sample lies in the interval from 0 to 0.33, the probability lies in the interval from 0.50 to 0.58. These are the implied insider trading probabilities in the absence of any costs.

where $\mathcal{O}$ is the estimation sample.

As the costs and the sensitivity to social norms are defined as non-linear transformations of linear functions of variables, the effects of a change in a given variable on the costs or sensitivities to social norms differ across individuals. To provide the economic meaning of the estimated coefficients in front of variables Z_{ift}, we calculate average marginal effects (AMEs) of all variables on the parameters (costs or sensitivities) they are part of.

There are two types of variables that we use based on their level of impact: director-level variables (gender, professional designation, generation, etc.) and firm-event-level variables (total assets, industry, trading gap length, etc.). Variables of the first type only affect a given director directly when they change, while variables of the second type directly affect the whole board.

AMEs also need to be computed differently for binary and continuous variables. For continuous variables, the derivative of the parameter can be evaluated at each point. For a given parameter g (i.e., c, p or ω) and a variable X we use the following formula for the average marginal effect of X on g:

$$AME(X, g) = \frac{1}{|\mathcal{O}|} \sum_{(i,f,t)\in\mathcal{O}} \frac{\partial g_{ift}}{\partial X_{ift}}(Z^g_{ift}). \tag{11}$$

For instance, for a continuous variable such as the number of boards a director sits on, the AME is the average slope of the parameter with respect to that variable.

For binary variables, we calculate the discrete analog of the derivative forward at point 0 (or derivative backward at point 1) and average them over the sample. For a given parameter g and a binary variable D, we compute the AME as:

$$AME(D, g) = \frac{1}{|\mathcal{O}|} \sum_{(i,f,t)\in\mathcal{O}} [g_{ift}(D_{ift} = 1) - g_{ift}(D_{ift} = 0)]. \tag{12}$$

For example, for a binary variable such as CPA, the AME is the average difference between the parameter with the indicator switched on and switched off.

As discussed before, there might be a concern that our results simply reflect firm-8-K-level shocks to directors' insider trading behavior, such as temporary changes in internal controls, as

opposed to genuine peer effects. If these firm-8-K-level shocks manifest as correlation between the errors ε_{ift} within the same firm at the same time, we can mitigate it by clustering standard errors of our estimates at the firm-8-K level. We compute both classic and cluster-robust standard errors.

5 Estimation Results

In the first specification of the model, exogenous and personal costs of insider trading are linear functions of characteristics and the sensitivity to social norms is a constant for all directors. The purpose of this first specification is to test whether directors appear, on average, sensitive to social norms.

The estimated model parameters and the implied AMEs are presented in Table 4. Panel A describes the weight ω that a director places on the board norm rather than on their personal norm. In this specification we hold that weight common to all directors, so Panel A contains only a constant. Panel B describes the personal cost p, Panel C describes the exogenously imposed cost c, and Panel D shows the coefficient in front of variables which, in addition to the expected return form trade, describe individuals' circumstances while trading. Each panel opens with the sample average of the parameter it describes. The weight ω lies between zero and one by construction. The first column reports the estimated coefficients on the underlying linear indices. Their signs are informative, but their magnitudes are not directly meaningful, as discussed above. We therefore report AMEs in the second column. These effects are in the units of the parameter, so each of them should be read against the sample average at the head of its panel. Constants have no marginal effect of their own, so we mark those cells with a dash. We report classical standard errors in parentheses and standard errors clustered at the filing-event level in brackets, and we base inference on the latter.

The estimates suggest that social norms are a meaningful determinant of directors' insider trading behavior. In particular, the estimated constant parameter implies a value of sensitivity of about $\omega = 0.55$ with a standard error of 0.07. In other words, when deciding whether to engage in insider trading, a typical director puts a weight of about 55% on the social norm and the remaining 45%

on their personal norm of behavior in their psychic component of perceived insider trading cost.

In the second specification, we make individuals' sensitivities to social norms a linear function of individuals' characteristics. The primary purpose of this specification, in addition to testing the presence of the social norms effect, is to examine which factors are associated with variation in directors' sensitivities to social norms. The estimated raw parameters and AMEs are presented in Table 5. First, corroborating the results of the first specification, in the second specification, the constant term in the directors' sensitivity to social norms is of a meaningful economic magnitude. The constant term in the sensitivity to social norms implies a value of the constant term in ω of about 21.0%, with a standard error of 0.03.

Multiple factors appear to vary directors' sensitivities to the board's norm. Consistent with prior evidence that females are more caring and concerned about relationships with members of their social groups (Gilligan (1982), Rothbart et al. (1986), Ford and Lowery (1986), Gilligan and Attanucci (1988)), female directors appear to be more sensitive to board norms. Specifically, on average, a female director's weight on the norm is about 7.4 percentage points higher than that of a male director. For professional background, having a CPA reduces a director's sensitivity to the norm by about 6.9 percentage points, while having a CFA or a law degree does not meaningfully vary directors' sensitivities to social norms. Directors of different generations exhibit economically different sensitivities to social norms. A strong difference is shown by Millennials: they are about 21.1 percentage points less sensitive to social norms. This effect strongly supports evidence in Weber (2017) and Weber and Elm (2018) that Millennials exhibit a stronger personal orientation in ethical decision making. With respect to directors' status at the firm, directors who have spent more time at the firm put less weight on board norms: on average, an additional year at a firm implies about 0.8 percentage points lower sensitivity to the board norm. In addition, executive directors appear to be about 6.8 percentage points less sensitive to social norms. These two results echo the newcomer's effect documented by Blau (1960): people who are new in a group feel more pressure to comply with existing group norms. Finally, directors who sit on more boards at the same time appear less sensitive to social norms on a given board, perhaps due to these directors'

greater distraction and weaker identification as a part of a given board's social group.

We plot the distribution of the sensitivity to social norms for our sample in the right panel of Figure 2. The distribution of sensitivities to social norms shows a number of interesting features. First, as discussed above, the distribution has a mean at about 0.201, with a value of about 0.148 at the first quartile and about 0.272 at the fourth quartile. The distribution is not bell-shaped: the left tail is meaningfully heavier than the right tail. There is a noticeable mass with ω_{ift} close to 0, implying that many individuals are not sensitive to board norms at all.

The estimated coefficients in front of individuals' personal costs, exogenous costs, and variables capturing circumstances are mostly consistent with expectations derived from prior literature. For directors' personal costs of insider trading, a number of interesting observations emerge. In both specifications, consistent with females' generally different moral standards (Borkowski and Ugras (1998) and McCabe et al. (1991)), female directors' personal costs are higher, implying that female directors are less likely to engage in insider trading. The coefficient is very large in the first specification but small and insignificant (yet positive) in the second specification. For educational and professional backgrounds, our findings across the two specifications are conflicting. Interestingly, the effects of the generations directors belong to show consistently strong effects on the directors' personal insider trading costs. Compared to Baby Boomers, directors of the Millennial (only in the second specification) and the Greatest generations perceive insider trading as a less favorable activity, while directors of the Silent Generation and Generation X perceive insider trading as more favorable. This pattern is consistent with two complementary frameworks from prior literature. Under imprinting theory (Marquis and Tilcsik (2013)), values acquired during formative developmental periods persist long after the originating conditions have passed. A substantial body of work in economics and finance documents such effects in the context of financially relevant decisions. Individuals who experience recessions in their formative years hold systematically different beliefs about markets decades later (Giuliano and Spilimbergo (2014)). Cohorts exposed to macroeconomic downturns exhibit persistently lower risk-taking (Malmendier and Nagel (2011)). Early-life experiences also shape the financial policies of corporate executives well into their careers (Mal-

mendier et al. (2011)). Under this lens, directors growing up during periods of weak enforcement or market exuberance, such as the Silent Generation in the postwar securities environment and Generation X during financial liberalization in the 1980s, plausibly hold more permissive attitudes toward insider trading. Directors whose formative years coincided with regulatory backlash or financial crisis, such as the Greatest Generation during the Depression and New Deal era and Millennials in the post-2008 environment, plausibly hold less permissive ones. Another theory is Strauss and Howe's generational archetype theory (Strauss and Howe (1991, 1997)). In this framework, the Greatest Generation and Millennials are both classified as "Hero" cohorts that were raised during perceived crises and oriented toward collective civic projects, while the Silent Generation and Generation X are believed to have developed more risk-tolerant orientations.

In Figures 1 and 2, on the right and in the middle, we plot the distribution of the level of directors' personal costs of insider trading. Note that the distribution is not smooth because personal cost functions only include binary variables. In both models, the mean estimated personal cost is economically meaningful: it corresponds to a return-equivalent cost of approximately 1.5 hundred percentage points of the firm's stock return.

As for the exogenously imposed costs of insider trading, these costs appear greater in larger firms, consistent with these firms having internal controls of higher quality and facing greater public scrutiny. In Figures 1 and 2, on the left, we plot the distribution of the level of exogenously imposed costs of insider trading for our sample for the two specifications. On average, the exogenous return-equivalent costs are about 2.0 or 3.5, substantially larger than the personal costs, and have a bell-shaped distribution.

Finally, the variables proxying for individual-and-trade-specific circumstances have a predictable effect on the perceived net benefit of trade. Note that a positive (negative) value in front of a variable implies this variable reduces (increases) the net benefit, i.e., makes trading less (more) attractive. Trading appears more attractive for executive directors, perhaps reflecting these directors' easier access to inside information and thus trading opportunities (Adams and Ferreira (2007), Ravina and Sapienza (2010)). The number of boards a director sits on or whether a director is a CEO do

not show significant consistent effects on the net benefit of trading across the two specifications. Longer gaps between an event and an 8-K filing imply a higher perceived net benefit from insider trading. This result is intuitive and captures the fact that directors are more likely to potentially obtain inside information and execute a trade if they have more time to do so.

For most variables, clustered standard errors and classic standard errors are not substantially different, suggesting that, in the data, there is no strong correlation between random factors determining directors' trading within a given 8-K event.

6 How Important Are Social Norms?

Our coefficient estimates suggest that social norms influence insider trading activities, but the estimates themselves provide limited insight into the magnitude of their influence. We provide some additional insight into the importance of social norms from three perspectives.

6.1 Relative Importance of Social Norms

First, using the model structure, we compute the relative importance of social norms in determining directors' choice to engage in insider trading. To do so, we compute the fraction of the total costs of insider trading that is due to directors' sensitivity to social norms. For director i at firm f during event t, the importance of social norms is computed as:

$$\textit{Importance of social norms}_{ift} = \frac{\frac{N_{ft}\omega_{ift}}{N_{ft}-1+\omega_{ift}}\frac{\bar{\psi}_{ft}}{1-\bar{\chi}_{ft}}}{\frac{N_{ft}-1}{N_{ft}-1+\omega_{ift}}\left(c_{ft}+(1-\omega_{ift})p_{ift}\right)+\frac{N_{ft}\omega_{ift}}{N_{ft}-1+\omega_{ift}}\frac{\bar{\psi}_{ft}}{1-\bar{\chi}_{ft}}}, \quad (13)$$

where $c_{ift} = \exp\left(\Lambda_c' Z_{ift}^c\right)$, $p_{ift} = \exp\left(\Lambda_p' Z_{ift}^p\right)$, and $\omega_{ift} = \sigma\left(\Lambda_\omega' Z_{ift}^\omega\right)$.

Table 6 presents the distribution of the estimated relative importance of social norms in the board of directors population for the two model specifications. Based upon the estimates, social norms appear to play a substantial role in directors' decisions to engage in insider trading. For a median director, about 26.2% or 65.1% (depending on the specification) of their perceived cost of

insider trading comes from the desire to adhere to the norm in their social group, i.e., the board. For the director at the 25th percentile, about 19.3% or 59.2% of the cost comes from social norms; for the director at the 75th percentile, about 32.4% or 71.1% of the cost comes from social norms. Finally, the standard deviation of the relative importance of social norms is 0.096 or 0.095, suggesting a moderate variation in the importance of social norms to director decisions.

6.2 Benchmark without Sensitivity to Social Norms

Second, we adopt a statistical perspective and evaluate whether including social norms in the model of individuals' undesirable behavior significantly enhances the model's explanatory power. To do so, we estimate an alternative model in which we set individuals' sensitivity to social norms to zero. We conduct likelihood ratio tests comparing our models (with constant sensitivity to social norms and with sensitivity to social norms as a function of characteristics) with the model with zero sensitivity to social norms. The tests reject the null hypothesis that all individual's sensitivities to social norms are zero. We provide the estimates of the model without social norms and the likelihood ratio tests in Internet Appendix 11.1.

6.3 Counterfactual Analysis: Absence of the Social Norms Effect

Third, we consider a counterfactual scenario where we remove the effect of social norms by setting individuals' sensitivities to norms to zero. To evaluate how this change would worsen insider trading behavior, we compute the increase in the exogenous costs of insider trading required to compensate for the absence of social norms.

Specifically, we look for a constant that helps achieve the same likelihood of insider trading in the scenario without social norms. Using the specification where sensitivity to social norms is a function of characteristics, we find that the exogenous insider trading costs for each director need to be increased by about 2.48 or 0.87 in return-equivalent unites, depending on the specification – about 123.4% or 24.4% – in order to compensate for the absence of social norms. This finding highlights the importance of social norms: if directors did not consider their peers' actions in

choosing their actions, regulators or corporations would need to substantially increase the cost of insider trading to reduce insider trading to the level we observe in the data.

7 Tone at The Top: Social Norms with Influential Individuals

In the main specification of our model, we assumed that all individuals have the same effect on the norm in their group because the norm was defined as the average action threshold for group members. In reality, however, it is plausible that certain individuals within a group have more influence on members' actions than others. Specifically, in the boardroom setting, such an individual may be a company CEO (Hermalin and Weisbach (1998); Adams and Ferreira (2007); Baldenius et al. (2014); Morse et al. (2011); Shivdasani and Yermack (1999); Coles et al. (2014); Fracassi and Tate (2012); Hwang and Kim (2009); Cohen et al. (2012); Graham et al. (2020); Khanna et al. (2015); Bruynseels and Cardinaels (2014); Carcello et al. (2011); Lisic et al. (2016); Cassell et al. (2018); Adams et al. (2010)).

To test whether CEOs tend to have additional influence on norms formed within a board, we introduce an additional parameter – the weight that a CEO carries in the norm formation relative to all other board members. In the model, we re-define the "average" threshold for engaging in an undesirable activity as a weighted average of other individuals' thresholds:[15]

$$\hat{s}_i^{(v)} = \frac{\sum_{j \in \Omega, j \neq i} v_j \hat{\beta}_j}{\sum_{j \in \Omega, j \neq i} v_j}, \tag{14}$$

where $v_j = 1$ for all j that are not a CEO, and v_j is allowed to be above 1 for j that are a CEO. Appendix 10.2 derives the equilibrium of the extended model.

Our estimation[16] fails to find that CEOs carry any additional weight in other board members'

[15] We assume that all group members, including influential individuals (i.e., CEOs), are norm takers. It is possible, however, that an influential individual takes into account their effect on the group's social norm. When we model this extension, the derivation of equilibrium becomes more cumbersome, although all the implications of our model stay qualitatively the same. Most importantly, the way that social norms enter individuals' decision-making remains unchanged.

[16] Estimation results are untabulated and available upon request.

formation of the perceived board norm. The estimated coefficient that CEOs carry is statistically indistinguishable from 1.

One reason we fail to find results supporting the notion of "tone at the top" might be that we do not identify potential influential individuals on the board correctly. In an attempt to improve our methodology, we conduct two alternative estimations where we define influential individuals not simply as CEOs but as CEOs with certain characteristics. Specifically, in the first specification, we rely on the literature on CEO-chair duality as a source of CEO power over the board (Brickley et al. (1997); Goyal and Park (2002); Adams et al. (2005); Ryan and Wiggins (2004); Graham et al. (2020)) and allow only CEOs who are also chairmen of the board to carry an additional weight in board members' group formation. In the second specification, borrowing from the literature on CEO tenure and entrenchment (Hermalin and Weisbach (1998); Baker and Gompers (2003); Ryan and Wiggins (2004); Coles et al. (2014); Graham et al. (2020)), we only allow CEOs who have been in their position for a longer time (defined as time as a CEO being above the median or above the third quartile for our sample) to carry an additional weight. Both specifications fail to find that CEOs that would be expected to have a greater influence on the board carry any additional weight in the formation of social norms on their boards.

Taken together, our results suggest that the notion of "tone at the top" may not be as pronounced when applied to informal board norms of behavior in the insider trading setting.

8 Additional Specifications of the Model

To provide additional insights and test the robustness of our model, we estimate two additional specifications of the model where directors' sensitivities to social norms are functions of directors' characteristics.

8.1 Effect of Country of Upbringing

In the first additional specification, we include directors' countries of upbringing as an additional factor that might affect their personal perceived costs of insider trading (p) and their sensitivities to social norms (ω). To identify a director's country of upbringing, we identify the country in which the director attended university for their undergraduate degree. Among the non-missing observations, about 93.4% of directors in our sample went to a university in the USA. Hence, to capture the potential effect of the culture of upbringing, we include a dummy variable that equals one for directors from American universities and zero for all other directors. We do not choose this specification as our main specification because, once we restrict our data to only cases in which we observe a director's undergraduate university, the number of observations drops by about three quarters.

Appendix 10.4 shows the estimates of the extended model. For an average director in our sample, graduating from a U.S. university decreases sensitivity to social norms by about 4.7 percentage points, as expected from directors from a more individualistic culture (Gelfand et al. (2011)).

The effect of attending a university in the U.S. on personal direct costs of insider trading is statistically insignificant.

8.2 Characteristics Included in the Sensitivity-to-norms Function Also Included in the Costs Function

In the second additional specification, we aim to examine whether some effects of social norms we document might be due to the fact that we include some individuals' characteristics into the linear function for the sensitivity to social norms but not into the linear function for the direct costs of insider trading (either exogenous or personal). If some characteristics included in the sensitivity-to-norms function affect insider trading per se and not through the norms effect, we might overestimate the impact of social norms.

Appendix 10.5 presents estimates and implied average marginal effects for the model where all

the variables included in the sensitivity-to-norms function are also included in the personal costs, exogenous costs, or net benefit function. The documented directors' sensitivity to the social norms continues to be significant, although it increases to about 65.5% for an average director.

9 Conclusion

We have offered a structural estimation approach for estimating the importance, if any, of endogenous social norms in individuals' moral decision-making. We apply this approach to the corporate boardroom setting by estimating how an endogenous social norm influences directors' decisions to engage in insider trading. We find that the endogenous norm, on average, accounts for about one-fifth or one-third of the perceived cost of insider trading for the median board member, suggesting that an endogenous social norm is a relatively important determinant of insider trading behavior. Furthermore, we find that individuals' exogenously imposed and personal personal costs of trading and individuals' sensitivities to a social norm regarding trading are consistent with individual characteristics highlighted in antecedent moral reasoning literature, which suggests that our measures reflect to some extent the underlying constructs of interest. Hence, within a boardroom setting, our analysis suggests that endogenous norms are present, and in the case of trading decisions, economically significant.

The approach we offer is generic enough that, given appropriate data, it could be applied in different corporate and non-corporate contexts, such as managers or partners in local corporate offices, households in a neighborhood, students at a school, or law enforcement officers in a precinct. The application of the approach to a broader set of settings would add insight into whether endogenous social norms are important determinants of behavior more generally, and help identify when and, if so, why the social norm mechanism plays an important role in influencing behaviors.

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Figures and Tables

Table 1: Sample selection procedure. One observation is at the 8-K filing-director level.

	Sample size	Number of firms
Initial sample of 8-K filings joined with active board directors	8,227,384	6,675
Exclude 8-K filings with items 5.02, 5.07, 1.03, 2.02, 7.01	7,268,556	6,674
Restrict 8-K filing-to-event gap to 1–4 business days	3,063,553	6,646
Restrict filing dates to on or after 24 August 2004	2,728,682	6,629
Exclude events with missing event-window returns	2,547,270	6,532
Exclude events with missing firm fundamentals from Compustat	2,435,433	6,143
Exclude director-events without a matched board-count record	2,435,433	6,143
Exclude 8-K filings with items 6.02, 6.05, 6.03, 1.05, 5.06	2,435,318	6,143
Exclude events with at most two directors on the board ($n \leq 2$)	2,433,681	6,138
Exclude events with stock price $\leq \$1$ or non-positive total assets	2,326,619	6,073
Exclude events with any director missing board tenure	2,151,935	5,674
Exclude events with cumulative abnormal return at or above the 99th percentile	2,129,576	5,670
Exclude events with any director missing any variable used in estimation of the main specification	1,210,414	4,000
Additionally exclude events with any director missing bachelor's degree country of origin	378,703	2,043

Table 2: Summary statistics for the trading gap, trading indicator, and cumulative abnormal return (Panel A), and the distribution of trading activity across 8-K events (Panel B), on the filtered estimation sample. In Panel A one observation is at the 8-K filing-director level; all 1,137,132 director-events in the filtered estimation sample are included and the return is the potential return. Panel B tabulates the 139,074 distinct 8-K events by the number of board members who purchased or sold the company's stock during the trading gap, reporting the number of events, the share of events, and the cumulative share. The maximum number of trading directors in a single event is 9. *Trading Gap* is the number of business days between the 8-K event date and the 8-K filing date. *Traded* equals one if the director purchased or sold the company's stock during the trading gap. *CAR* is the cumulative abnormal return used as the return measure in estimation. All returns are potential returns.

Panel A: Summary statistics (all director-events)

Statistic	N	Mean	St. Dev.	Pctl(25)	Median	Pctl(75)
Trading Gap	1,137,132	2.168	1.183	1	2	3
Traded	1,137,132	0.007	0.082	0	0	0
CAR	1,137,132	0.040	0.046	0.011	0.024	0.050

Panel B: Trading directors per event

Trading directors	Events	% of events	Cumulative %
0	132,959	95.60	95.60
1	5,125	3.69	99.29
2	691	0.50	99.79
3	182	0.13	99.92
4	69	0.05	99.97
≥ 5	48	0.03	100.00
Total	139,074	100.00	

Table 3: Summary statistics for board members', firms' and events' characteristics. One observation is at the 8-K filing–director level; all $N = 1{,}137{,}132$ observations come from the filtered estimation sample, reported in natural units before standardization. Panel A reports continuous, binary, and small-categorical features; Panels B and C report shares of observations for NAICS sectors and 8-K item indicators. *Log total assets* is the natural log of total assets ($ million). *CEO* equals 1 if the director holds the CEO role on that board. *Executive director* equals 1 if the director holds more executive than supervisory roles. *Number of boards* is the director's current board count. *Tenure* is in years. Tenure and Number of Boards are winsorized at the 99.9$^{\text{th}}$ percentile. *Female*, *CPA*, *CFA*, and *Law degree* are indicator variables. A law degree equals 1 if a director has a JD, LLB, LLM, or LLD. *Filing gap* indicators use the trading gap in business days between event and filing dates. *Generation* indicators use the director's birth-year cohort.

Panel A: Continuous and binary variables

	Mean	SD	P25	Median	P75
Firm characteristics					
Log total assets	7.294	2.190	5.747	7.368	8.803
Director characteristics					
CEO	0.114	0.318	0	0	0
Executive director	0.156	0.363	0	0	0
Number of boards	4.474	4.082	2	3	6
Tenure (years)	7.144	6.854	2.189	5.071	9.973
Female	0.135	0.342	0	0	0
CPA	0.114	0.318	0	0	0
CFA	0.014	0.117	0	0	0
Law degree (JD/LLB/LLM/LLD)	0.124	0.330	0	0	0
Generation:					
Baby boomer	0.637	0.481	0	1	1
Silent	0.247	0.431	0	0	0
Gen X	0.106	0.308	0	0	0
Greatest	0.006	0.076	0	0	0
Millennial	0.004	0.063	0	0	0
Filing characteristics					
Filing gap (business days between event and filing):					
1 day	0.422	0.494	0	0	1
2 days	0.196	0.397	0	0	0
3 days	0.174	0.380	0	0	0
4 days	0.208	0.406	0	0	0

Table 3: *(continued)* Shares of observations for NAICS sectors (Panel B) and 8-K item indicators (Panel C). One sector and one 8-K item are dropped as reference categories in the regression specifications. Items are ordered by descending share; a filing may disclose multiple items, so item shares do not sum to one.

Panel B: NAICS sector composition

Sector	Share	Sector	Share
Manufacturing	39.8%	Wholesale trade	2.3%
Finance & insurance	15.0%	Health care & social assistance	2.2%
Information	7.4%	Administrative & support services	1.5%
Mining, quarrying & oil and gas extraction	6.5%	Accommodation & food services	1.5%
Real estate, rental & leasing	6.2%	Construction	1.3%
Utilities	4.6%	Educational services	0.6%
Professional, scientific & technical services	4.0%	Arts, entertainment & recreation	0.5%
Retail trade	3.2%	Other services	0.3%
Transportation & warehousing	2.9%	Agriculture, forestry, fishing & hunting	0.2%

Panel C: 8-K item disclosure frequency

Item	Share	Item	Share
9.01 — Financial statements & exhibits	84.1%	2.05 — Exit / disposal costs	1.2%
1.01 — Entry into material agreement	30.3%	4.01 — Auditor change	0.8%
8.01 — Other events	29.4%	2.06 — Material impairment	0.5%
2.03 — New financial obligation	9.7%	4.02 — Non-reliance on prior financials	0.5%
5.03 — Charter / bylaw amendment	6.2%	5.05 — Code-of-ethics amendment / waiver	0.4%
3.02 — Unregistered equity sale	2.9%	2.04 — Obligation triggering event	0.3%
2.01 — Acquisition / disposition of assets	2.9%	5.01 — Change in control	0.2%
1.02 — Material agreement terminated	2.8%	5.04 — Benefit-plan trading suspension	0.2%
3.03 — Modification of security-holder rights	1.6%	1.04 — Mine safety	0.1%
3.01 — Delisting notice	1.5%	5.08 — Shareholder director nominations	0.1%

Table 4: Maximum-likelihood estimates and average marginal effects for the specification with all directors sharing the same sensitivity to social norms. Each model parameter is a linear index of characteristics passed through a transformation that keeps it in range: the exogenous cost of trading $c = \exp(\Lambda_c' Z^c)$, the personal cost $p = \exp(\Lambda_p' Z^p)$, and the weight on social norms $\omega = \sigma(\Lambda_\omega' Z^\omega)$, where $\sigma(\cdot)$ is the sigmoid. The direct component $d = \Lambda_d' Z^d$ enters the threshold linearly and is not exponentiated. See the notes below the table for how to read the two columns.

Variable	Coefficient	AME
Panel A: Determinants of the weight put on social norms as opposed to personal costs (ω)		
A higher ω puts more weight on the board norm and less on the director's own standards		
Sample average: $\bar{\omega} = 0.551$ (0.052) [0.068]		
Constant	0.204 (0.212) [0.274]	—
Panel B: Determinants of personal costs (p)		
A higher p means the director's own standards make trading more costly		
Sample average: $\bar{p} = 1.535$ (0.537) [0.482]		
Constant	0.399 (0.363) [0.327]	—
Director characteristics		
Female	0.518 (0.159) [0.155]	0.954 (0.107) [0.132]
CPA	0.121 (0.060) [0.062]	0.194 (0.077) [0.085]
CFA	-0.145 (0.165) [0.189]	-0.208 (0.195) [0.225]
Law degree (JD/LLB/LLM/LLD)	0.145 (0.066) [0.069]	0.236 (0.076) [0.090]
Generation (reference: Baby boomer):		
Greatest	0.457 (0.198) [0.221]	0.887 (0.352) [0.426]
Silent	-0.225 (0.095) [0.093]	-0.326 (0.053) [0.061]
Gen X	-0.459 (0.189) [0.167]	-0.590 (0.074) [0.097]
Millennial	-0.552 (0.412) [0.463]	-0.652 (0.267) [0.310]
Panel C: Determinants of the net cost of trading due to exogenous factors (c)		
A higher c means factors outside the director's control make trading more costly		
Sample average: $\bar{c} = 2.010$ (0.336) [0.353]		
Constant	0.736 (0.165) [0.175]	—
Firm characteristics		
Log total assets	0.007 (0.002) [0.002]	0.014 (0.004) [0.005]
Panel D: Determinants of individual circumstances affecting trading (d)		
A higher d implies a lower benefit from trading		
Sample average: $\bar{d} = -0.664$ (0.017) [0.021]		
Director characteristics		
CEO	-0.001 (0.042) [0.042]	-0.001 (0.042) [0.042]
Executive director	-1.288 (0.047) [0.047]	-1.288 (0.047) [0.047]

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Variable	Coefficient	AME
Number of boards	-0.037 (0.003) [0.003]	-0.037 (0.003) [0.003]
Executive director × number of boards	0.019 (0.007) [0.006]	0.019 (0.007) [0.006]
Filing characteristics		
Filing gap (reference: 1 day):		
2 days	-0.506 (0.035) [0.043]	-0.506 (0.035) [0.043]
3 days	-0.873 (0.034) [0.043]	-0.873 (0.034) [0.043]
4 days	-1.017 (0.032) [0.040]	-1.017 (0.032) [0.040]

Notes. The Coefficient column reports the estimated elements of Λ_ω, Λ_p, Λ_c and Λ_d. Because the cost parameters are non-linear transformations of these linear indices, a coefficient is not the effect of the variable on the parameter, and that effect differs across directors. The AME column reports the effect, averaged over the sample. For a continuous variable it is the average derivative of the parameter with respect to the variable. For a binary variable it is the average change from 0 to 1. AMEs are in the units of the parameter, so each one can be read against the sample average at the head of its panel.

The specification also includes NAICS sector indicators (reference: Accommodation and Food Services), one indicator per 8-K item disclosed in the event (omitted item: Item 1.01), and filing-year indicators (reference: 2004). Their coefficients and AMEs are estimated but not tabulated. The estimation sample ends in 2022: the insider-trading outcome is not observed after 2023-01-30, so 2023 and 2024 are dropped. Classical standard errors are in parentheses. Standard errors clustered at the 8-K filing-event level are in brackets.

Fit. Log-likelihood $= -43{,}175.66$. N observations $= 1{,}137{,}132$. N events $= 139{,}074$. N parameters $= 73$.

Table 5: Maximum-likelihood estimates and average marginal effects for the specification with sensitivity to social norms as a function of director characteristics. Each model parameter is a linear index of characteristics passed through a transformation that keeps it in range: the exogenous cost of trading $c = \exp(\Lambda_c' Z^c)$, the personal cost $p = \exp(\Lambda_p' Z^p)$, and the weight on social norms $\omega = \sigma(\Lambda_\omega' Z^\omega)$, where $\sigma(\cdot)$ is the sigmoid. The direct component $d = \Lambda_d' Z^d$ enters the threshold linearly and is not exponentiated. See the notes below the table for how to read the two columns.

Variable	Coefficient	AME
Panel A: Determinants of the weight put on social norms as opposed to personal costs (ω)		
A higher ω puts more weight on the board norm and less on the director's own standards		
Sample average: $\bar{\omega} = 0.210$ (0.030) [0.034]		
Constant	-0.520 (0.186) [0.204]	—
Director characteristics		
Female	0.430 (0.118) [0.133]	0.074 (0.023) [0.027]
CPA	-0.481 (0.223) [0.315]	-0.069 (0.029) [0.040]
CFA	0.137 (0.228) [0.295]	0.023 (0.039) [0.050]
Law degree (JD/LLB/LLM/LLD)	-0.193 (0.132) [0.146]	-0.029 (0.019) [0.021]
Executive director	-0.473 (0.130) [0.143]	-0.068 (0.020) [0.023]
Number of boards	-0.108 (0.012) [0.011]	-0.017 (0.002) [0.002]
Tenure on board	-0.048 (0.007) [0.008]	-0.008 (0.001) [0.001]
Generation (reference: Baby boomer):		
Greatest	-29.435 (10000.003) [0.000]	-0.211 (0.030) [0.035]
Silent	0.086 (0.099) [0.112]	0.014 (0.016) [0.018]
Gen X	0.047 (0.120) [0.152]	0.007 (0.019) [0.025]
Millennial	-20.510 (9458.547) [0.318]	-0.211 (0.030) [0.035]
Panel B: Determinants of personal costs (p)		
A higher p means the director's own standards make trading more costly		
Sample average: $\bar{p} = 1.484$ (0.453) [0.350]		
Constant	0.381 (0.304) [0.228]	—
Director characteristics		
Female	0.107 (0.088) [0.102]	0.165 (0.144) [0.170]
CPA	0.255 (0.085) [0.094]	0.417 (0.135) [0.190]
CFA	-0.212 (0.194) [0.240]	-0.284 (0.218) [0.282]
Law degree (JD/LLB/LLM/LLD)	0.169 (0.063) [0.055]	0.268 (0.090) [0.099]
Generation (reference: Baby boomer):		
Greatest	0.570 (0.165) [0.138]	1.136 (0.226) [0.253]
Silent	-0.087 (0.054) [0.057]	-0.127 (0.071) [0.080]
Gen X	-0.455 (0.201) [0.205]	-0.564 (0.117) [0.153]
Millennial	0.423 (0.156) [0.136]	0.780 (0.220) [0.231]

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Variable	Coefficient	AME
Panel C: Determinants of the net cost of trading due to exogenous factors (c)		
A higher c means factors outside the director's control make trading more costly		
Sample average: $\bar{c} = 3.546$ (0.435) [0.369]		
Constant	1.267 (0.127) [0.110]	—
Firm characteristics		
Log total assets	0.012 (0.002) [0.002]	0.042 (0.005) [0.007]
Panel D: Determinants of individual circumstances affecting trading (d)		
A higher d implies a lower benefit from trading		
Sample average: $\bar{d} = -0.610$ (0.023) [0.027]		
Director characteristics		
CEO	-0.028 (0.042) [0.042]	-0.028 (0.042) [0.042]
Executive director	-0.883 (0.111) [0.123]	-0.883 (0.111) [0.123]
Number of boards	0.015 (0.006) [0.007]	0.015 (0.006) [0.007]
Executive director × number of boards	0.010 (0.008) [0.008]	0.010 (0.008) [0.008]
Filing characteristics		
Filing gap (reference: 1 day):		
2 days	-0.512 (0.035) [0.043]	-0.512 (0.035) [0.043]
3 days	-0.880 (0.034) [0.043]	-0.880 (0.034) [0.043]
4 days	-1.033 (0.032) [0.040]	-1.033 (0.032) [0.040]

Notes. The Coefficient column reports the estimated elements of Λ_ω, Λ_p, Λ_c and Λ_d. Because the cost parameters are non-linear transformations of these linear indices, a coefficient is not the effect of the variable on the parameter, and that effect differs across directors. The AME column reports the effect, averaged over the sample. For a continuous variable it is the average derivative of the parameter with respect to the variable. For a binary variable it is the average change from 0 to 1. AMEs are in the units of the parameter, so each one can be read against the sample average at the head of its panel.

The specification also includes NAICS sector indicators (reference: Accommodation and Food Services), one indicator per 8-K item disclosed in the event (omitted item: Item 1.01), and filing-year indicators (reference: 2004). Their coefficients and AMEs are estimated but not tabulated. The estimation sample ends in 2022: the insider-trading outcome is not observed after 2023-01-30, so 2023 and 2024 are dropped. Classical standard errors are in parentheses. Standard errors clustered at the 8-K filing-event level are in brackets.

Fit. Log-likelihood $= -43{,}004.43$. N observations $= 1{,}137{,}132$. N events $= 139{,}074$. N parameters $= 84$.

Table 6: Summary statistics of the relative importance of social norms for directors, by model specification (one panel per specification). The relative importance is computed as the fraction of a director's total cost of insider trading that is attributable to the social-norms summand, given the estimated model parameters: *Importance of social norms*$_{ift}$ $= \frac{\frac{N_{ft}\omega_{ift}}{N_{ft}-1+\omega_{ift}}\frac{\bar{\psi}_{ft}}{1-\bar{\chi}_{ft}}}{\frac{N_{ft}-1}{N_{ft}-1+\omega_{ift}}\left(c_{ift}+(1-\omega_{ift})p_{ift}\right)+\frac{N_{ft}\omega_{ift}}{N_{ft}-1+\omega_{ift}}\frac{\bar{\psi}_{ft}}{1-\bar{\chi}_{ft}}}$.

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Median	Pctl(75)	Max
Panel A: all individuals have the same sensitivity to social norms. Estimated model parameters in Table 4.								
Importance of social norms	1,137,132	0.667	0.095	0.477	0.592	0.651	0.711	1.275
Panel B: sensitivity to social norms is a linear function of individual characteristics. Estimated model parameters in Table 5.								
Importance of social norms	1,137,132	0.256	0.096	0.000	0.193	0.262	0.324	0.683

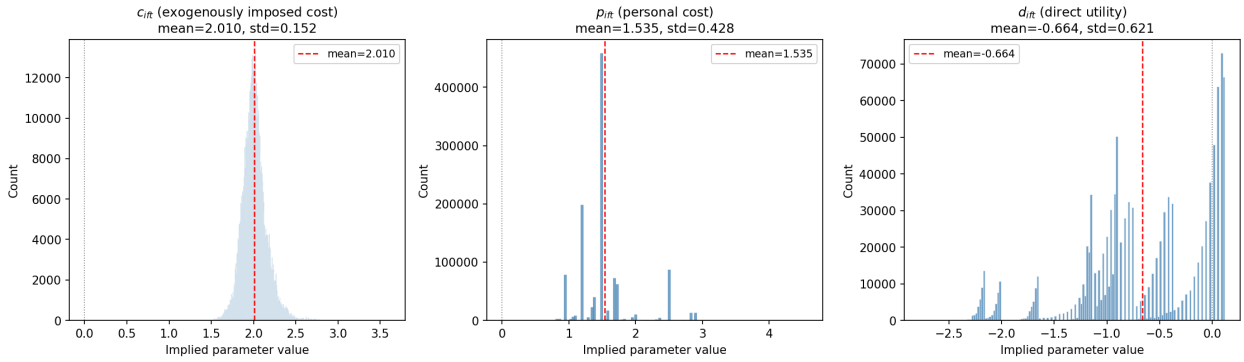

Figure 1: Distributions of the estimated implied model parameters for the specification where all directors are assumed to have the same sensitivity to social norms. The distributions are evaluated at the maximum-likelihood parameter estimates over the estimation sample. The four panels are, from left to right, the exogenously imposed cost c_{ft}, the personal cost p_{ift}, and the direct component d_{ift}. Each panel reports the sample mean and standard deviation; the red dashed line marks the mean. The raw estimated model parameters are in Table 4.

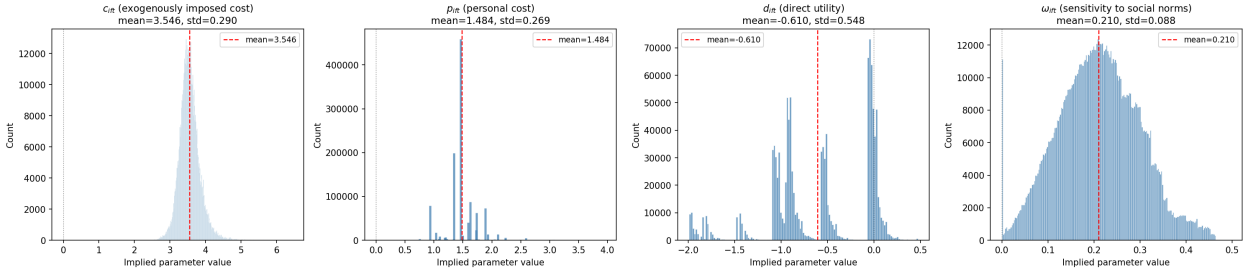

Figure 2: Distributions of the estimated implied model parameters for the specification where directors' sensitivities to social norms are functions of characteristics. The distributions are evaluated at the maximum-likelihood parameter estimates over the estimation sample. The four panels are, from left to right, the exogenously imposed cost c_{ft}, the personal cost p_{ift}, the direct component d_{ift}, and the sensitivity to social norms ω_{ift}. Each panel reports the sample mean and standard deviation; the red dashed line marks the mean. The raw estimated model parameters are in Table 5.

10 Appendix

10.1 Comparative statics of the optimal threshold to engage in an undesirable activity with respect to an individual's sensitivity to the social norm

In this section, we derive $\frac{d\beta_i}{d\omega_i}$. Define: $A_i(\omega_i) = \frac{N-1}{N-1+\omega_i}\left(c + (1-\omega_i)p_i\right), B_i(\omega_i) = \frac{N\omega_i}{N-1+\omega_i}, C \equiv \sum_{j\in\Omega, j\neq i} A_j, D \equiv \sum_{j\in\Omega, j\neq i} B_j, H(\omega_i) \equiv N - D - B_i(\omega_i)$. Thus,

$$\beta_i(\omega_i) = A_i(\omega_i) + B_i(\omega_i)\frac{A_i(\omega_i) + C}{H(\omega_i)}.$$

Differentiating $A_i(\omega_i)$ with respect to ω_i gives

$$A_i'(\omega_i) = -\frac{(N-1)(c+Np_i)}{(N-1+\omega_i)^2}.$$

Therefore, $A_i'(\omega_i) < 0$ as long as $c + Np_i > 0$.

Differentiating $B_i(\omega_i)$ gives

$$B_i'(\omega_i) = \frac{N(N-1)}{(N-1+\omega_i)^2}.$$

Thus, $B_i'(\omega_i) > 0$.

Since $H'(\omega_i) = -B_i'(\omega_i)$, we have

$$\frac{d\beta_i(\omega_i)}{d\omega_i} = A_i'(\omega_i) + \frac{\left[B_i'(\omega_i)(A_i(\omega_i)+C) + B_i(\omega_i)A_i'(\omega_i)\right]H(\omega_i) - B_i(\omega_i)(A_i(\omega_i)+C)H'(\omega_i)}{H(\omega_i)^2}.$$

Substituting $H'(\omega_i) = -B_i'(\omega_i)$ gives

$$\frac{d\beta_i(\omega_i)}{d\omega_i} = A_i'(\omega_i) + \frac{\left[B_i'(\omega_i)(A_i(\omega_i)+C) + B_i(\omega_i)A_i'(\omega_i)\right]H(\omega_i) + B_i(\omega_i)(A_i(\omega_i)+C)B_i'(\omega_i)}{H(\omega_i)^2}.$$

Collecting terms,

$$\frac{d\beta_i(\omega_i)}{d\omega_i} = A_i'(\omega_i) + \frac{B_i(\omega_i)A_i'(\omega_i)}{H(\omega_i)} + \frac{B_i'(\omega_i)(A_i(\omega_i)+C)}{H(\omega_i)} + \frac{B_i(\omega_i)B_i'(\omega_i)(A_i(\omega_i)+C)}{H(\omega_i)^2}.$$

This can be written as

$$\frac{d\beta_i(\omega_i)}{d\omega_i} = \left(1 + \frac{B_i(\omega_i)}{H(\omega_i)}\right)\left[A_i'(\omega_i) + \frac{B_i'(\omega_i)(A_i(\omega_i)+C)}{H(\omega_i)}\right].$$

Because $H(\omega_i) = N - D - B_i(\omega_i)$, we also have

$$1 + \frac{B_i(\omega_i)}{H(\omega_i)} = \frac{N-D}{H(\omega_i)}.$$

Therefore,

$$\frac{d\beta_i(\omega_i)}{d\omega_i} = \frac{N-D}{H(\omega_i)}\left[A_i'(\omega_i) + \frac{B_i'(\omega_i)(A_i(\omega_i)+C)}{H(\omega_i)}\right].$$

Substituting the expressions for $A_i'(\omega_i)$ and $B_i'(\omega_i)$, we obtain

$$\frac{d\beta_i(\omega_i)}{d\omega_i} = \frac{N-D}{H(\omega_i)}\left[-\frac{(N-1)(c+Np_i)}{(N-1+\omega_i)^2} + \frac{N(N-1)}{(N-1+\omega_i)^2}\frac{A_i(\omega_i)+C}{H(\omega_i)}\right].$$

Factoring out the positive term $(N-1)/(N-1+\omega_i)^2$ gives

$$\frac{d\beta_i(\omega_i)}{d\omega_i} = \frac{N-D}{H(\omega_i)}\frac{N-1}{(N-1+\omega_i)^2}\left[-(c+Np_i) + \frac{N(A_i(\omega_i)+C)}{H(\omega_i)}\right].$$

Hence, the exact condition for $\frac{d\beta_i(\omega_i)}{d\omega_i} > 0$ is

$$\frac{N-D}{H(\omega_i)}\left[-(c+Np_i) + \frac{N(A_i(\omega_i)+C)}{H(\omega_i)}\right] > 0.$$

This is the most general sign condition, provided $H(\omega_i) \neq 0$. Given the assumptions of our model, $H(\omega_i) = N - D - B_i(\omega_i) > 0$, $N - D > 0$, the prefactor $\frac{N-D}{H(\omega_i)}$ is positive. Therefore, $\frac{d\beta_i(\omega_i)}{d\omega_i} > 0$

if and only if

$$\frac{A_i(\omega_i)+C}{H(\omega_i)} > \frac{c}{N} + p_i.$$

Or, using the original notation,

$$\frac{\bar{\psi}}{1-\bar{\chi}} > \frac{c}{N} + p_i.$$

10.2 "Tone at the Top" Extension of the Model

In the model with influential individuals, the social norm for an individual i is defined as a weighted average of other individuals' thresholds: $\hat{s}_i^{(v)} = \frac{\sum_{j\in\Omega, j\neq i} v_j \hat{\beta}_j}{\sum_{j\in\Omega, j\neq i} v_j}$, where $v_j = 1$ for all j that are not a CEO, president, or chairman, $v_{\text{CEO only}}$ is the weight for the CEO-only, $v_{\text{president only}}$ is the weight for the president-only, $v_{\text{chairman only}}$ is the weight for the chairman-only, $v_{\text{CEO-president}}$ is the weight for the CEO-and-president, $v_{\text{CEO-chairman}}$ is the weight for the CEO-and-chairman, $v_{\text{chairman-president}}$ is the weight for the chairman-and-president, and $v_{\text{CEO-chairman-president}}$ is the weight for the CEO-chairman-and-president.

$$\beta_i = c + (1-\omega_i)\, p_i + \frac{\sum_{j\in\Omega} v_j}{\sum_{j\in\Omega, j\neq i} v_j} \omega_i \frac{\sum_{j\in\Omega, j\neq i} v_j \beta_j}{\sum_{j\in\Omega} v_j} \tag{15}$$

$$\left(\sum_{j\in\Omega, j\neq i} v_j\right) \beta_i = \left(\sum_{j\in\Omega, j\neq i} v_j\right) (c + (1-\omega_i)\, p_i) + \omega_i \sum_{j\in\Omega, j\neq i} v_j \beta_j \tag{16}$$

$$\left(\sum_{j\in\Omega, j\neq i} v_j + \omega_i v_i\right) \beta_i = \left(\sum_{j\in\Omega, j\neq i} v_j\right) (c + (1-\omega_i)\, p_i) + \omega_i \sum_{j\in\Omega} v_j \beta_j \tag{17}$$

$$\frac{\left(\sum_{j\in\Omega, j\neq i} v_j + \omega_i v_i\right)}{\sum_{j\in\Omega} v_j} \beta_i = \frac{\left(\sum_{j\in\Omega, j\neq i} v_j\right)}{\sum_{j\in\Omega} v_j} (c + (1-\omega_i)\, p_i) + \omega_i \frac{\sum_{j\in\Omega} v_j \beta_j}{\sum_{j\in\Omega} v_j} \tag{18}$$

$$\beta_i = \frac{\left(\sum_{j\in\Omega, j\neq i} v_j\right)}{\left(\sum_{j\in\Omega, j\neq i} v_j + \omega_i v_i\right)} (c + (1-\omega_i)\, p_i) + \frac{\omega_i \sum_{j\in\Omega} v_j}{\left(\sum_{j\in\Omega, j\neq i} v_j + \omega_i v_i\right)} \bar{\beta}^{(v)} \tag{19}$$

where

$$\bar{\beta}^{(v)} = \frac{\sum\limits_{j\in\Omega} v_j\beta_j}{\sum\limits_{j\in\Omega} v_j} \tag{20}$$

Dividing both sides of the equation by $\sum\limits_{j\in\Omega} v_j$:

$$\begin{aligned}
\frac{\beta_i}{\sum\limits_{j\in\Omega} v_j} &= \frac{1}{\sum\limits_{j\in\Omega} v_j}\frac{\left(\sum\limits_{j\in\Omega,j\neq i} v_j\right)}{\left(\sum\limits_{j\in\Omega,j\neq i} v_j + \omega_i v_i\right)}\left(c + (1-\omega_i)\, p_i\right) + \frac{1}{\sum\limits_{j\in\Omega} v_j}\frac{\omega_i \sum\limits_{j\in\Omega} v_j}{\left(\sum\limits_{j\in\Omega,j\neq i} v_j + \omega_i v_i\right)}\bar{\beta}^{(v)} &(21)\\
&= \frac{1}{\sum\limits_{j\in\Omega} v_j}\psi_i^{(v)} + \frac{1}{\sum\limits_{j\in\Omega} v_j}\chi_i^{(v)}\bar{\beta}^{(v)}, &(22)
\end{aligned}$$

where $\psi_i^{(v)} = \frac{\left(\sum\limits_{j\in\Omega,j\neq i} v_j\right)}{\left(\sum\limits_{j\in\Omega,j\neq i} v_j+\omega_i v_i\right)}\left(c + (1-\omega_i)\, p_i\right)$ and $\chi_i^{(v)} = \frac{\omega_i \sum\limits_{j\in\Omega} v_j}{\left(\sum\limits_{j\in\Omega,j\neq i} v_j+\omega_i v_i\right)}$. Multiplying both sides of the equation by v_i and summing these equations across all individuals in the organization implies the equilibrium $\bar{\beta}^{(v)}$ must satisfy

$$\bar{\beta}^{(v)} = \bar{\psi}^{(v)} + \bar{\chi}^{(v)}\bar{\beta}^{(v)}, \tag{23}$$

where $\bar{\psi}^{(v)} = \frac{\sum\limits_{j\in\Omega} v_j\psi_j^{(v)}}{\sum\limits_{j\in\Omega} v_j}$ and $\bar{\chi}^{(v)} = \frac{\sum\limits_{j\in\Omega} v_j\chi_j^{(v)}}{\sum\limits_{j\in\Omega} v_j}$. Solving for $\bar{\beta}^{(v)}$ yields

$$\bar{\beta}^{(v)} = \frac{\bar{\psi}^{(v)}}{1-\bar{\chi}^{(v)}}. \tag{24}$$

Proposition 2 *In the model extension with influential individuals, an individual i will engage in an undesirable activity if and only if:*

$$b_i > \frac{\left(\sum\limits_{j\in\Omega,j\neq i} v_j\right)}{\left(\sum\limits_{j\in\Omega,j\neq i} v_j + \omega_i v_i\right)}\left(c + (1-\omega_i)\, p_i\right) + \frac{\omega_i \sum\limits_{j\in\Omega} v_j}{\left(\sum\limits_{j\in\Omega,j\neq i} v_j + \omega_i v_i\right)}\frac{\bar{\psi}^{(v)}}{1-\bar{\chi}^{(v)}}. \tag{25}$$

10.3 Standard errors and inference

We compute both classic and cluster-robust standard errors of our estimates. Classic standard errors are computed from the inverse observed-information matrix. To account for dependence among directors exposed to the same 8-K event, we also calculate standard errors clustered at the firm–8-K event level using the Huber-White sandwich estimator. Specifically, we sum the individual score vectors within each event, form the outer products of these event-level score sums, and use them as the meat of the sandwich covariance matrix, with the observed-information matrix providing the bread. The coefficient tables report classical standard errors in parentheses and event-clustered standard errors in square brackets.

10.4 Estimates of the model where individuals' country of upbringing is included in the function determining individuals' sensitivities to social norms

Table 7: Maximum-likelihood estimates and average marginal effects for the specification where directors' country of upbringing enters both the personal cost and the sensitivity to social norms. The specification is the baseline model of Table 5 with an indicator for holding a US bachelor's degree added to Z^p and Z^ω. Each of the four model parameters is a linear index of characteristics: the exogenous cost of trading $c = \exp(\Lambda_c' Z^c)$, the personal cost $p = \exp(\Lambda_p' Z^p)$, the weight on social norms $\omega = \sigma(\Lambda_\omega' Z^\omega)$ with $\sigma(\cdot)$ the sigmoid, and the direct utility of trading $d = \Lambda_d' Z^d$, which enters the trading condition untransformed. See the notes below the table for how to read the two columns.

Variable	Coefficient	AME
Panel A: Determinants of the weight put on social norms as opposed to personal costs (ω)		
A higher ω puts more weight on the board norm and less on the director's own standards		
Sample average: $\bar{\omega} = 0.292$ (0.064) [0.129]		
Constant	0.027 (0.234) [0.411]	—
Director characteristics		
Female	0.451 (0.087) [0.120]	0.092 (0.016) [0.016]
CPA	-1.739 (0.732) [0.834]	-0.241 (0.065) [0.112]
CFA	-0.109 (0.173) [0.201]	-0.021 (0.032) [0.035]
Law degree (JD/LLB/LLM/LLD)	0.091 (0.061) [0.067]	0.018 (0.012) [0.015]

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Variable	Coefficient	AME
US bachelor's degree	-0.235 (0.086) [0.123]	-0.047 (0.016) [0.018]
Executive director	-0.711 (0.213) [0.331]	-0.125 (0.032) [0.036]
Number of boards	-0.071 (0.014) [0.019]	-0.014 (0.003) [0.003]
Tenure on board	-0.025 (0.007) [0.014]	-0.005 (0.001) [0.002]
Generation (reference: Baby boomer):		
Greatest	-19.756 (8885.761) [0.624]	-0.294 (0.064) [0.129]
Silent	-0.009 (0.050) [0.060]	-0.002 (0.010) [0.011]
Gen X	-0.430 (0.089) [0.143]	-0.078 (0.010) [0.011]
Millennial	-0.732 (0.743) [0.844]	-0.121 (0.101) [0.115]
Panel B: Determinants of personal costs (p)		
A higher p means the director's own standards make trading more costly		
Sample average: $\bar{p} = 0.202$ (0.055) [0.094]		
Constant	-5.161 (3.707) [4.475]	—
Director characteristics		
Female	0.344 (0.196) [0.291]	0.078 (0.050) [0.058]
CPA	5.120 (3.665) [4.395]	3.544 (7.583) [9.089]
CFA	-2.331 (3.167) [5.006]	-0.185 (0.048) [0.049]
Law degree (JD/LLB/LLM/LLD)	-0.369 (0.232) [0.234]	-0.063 (0.034) [0.036]
US bachelor's degree	0.425 (0.440) [0.424]	0.071 (0.057) [0.057]
Generation (reference: Baby boomer):		
Greatest	5.741 (3.658) [4.384]	54.599 (191.610) [229.180]
Silent	-0.225 (0.151) [0.147]	-0.042 (0.026) [0.030]
Gen X	-0.148 (0.174) [0.188]	-0.028 (0.031) [0.031]
Millennial	3.365 (0.937) [1.063]	5.375 (5.386) [5.082]
Panel C: Determinants of the net cost of trading due to exogenous factors (c)		
A higher c means factors outside the director's control make trading more costly		
Sample average: $\bar{c} = 3.994$ (0.410) [0.832]		
Constant	1.382 (0.111) [0.206]	—
Firm characteristics		
Log total assets	0.014 (0.002) [0.003]	0.056 (0.011) [0.018]
Panel D: Determinants of individual circumstances affecting trading (d)		
A higher d implies a lower benefit from trading		
Sample average: $\bar{d} = -0.508$ (0.042) [0.048]		
Director characteristics		
CEO	-0.022 (0.074) [0.074]	-0.022 (0.074) [0.074]
Executive director	-0.460 (0.208) [0.225]	-0.460 (0.208) [0.225]

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Variable	Coefficient	AME
Number of boards	0.027 (0.012) [0.017]	0.027 (0.012) [0.017]
Executive director × number of boards	-0.015 (0.014) [0.017]	-0.015 (0.014) [0.017]
Filing characteristics		
Filing gap (reference: 1 day):		
2 days	-0.444 (0.062) [0.075]	-0.444 (0.062) [0.075]
3 days	-0.841 (0.058) [0.073]	-0.841 (0.058) [0.073]
4 days	-0.892 (0.055) [0.070]	-0.892 (0.055) [0.070]

Notes. The Coefficient column reports the estimated elements of Λ_ω, Λ_p, Λ_c and Λ_d. Because the cost parameters are non-linear transformations of these linear indices, a coefficient is not the effect of the variable on the parameter, and that effect differs across directors. The AME column reports the effect, averaged over the sample. For a continuous variable it is the average derivative of the parameter with respect to the variable. For a binary variable it is the average change from 0 to 1. AMEs are in the units of the parameter, so each one can be read against the sample average at the head of its panel.

The specification also includes NAICS sector indicators (reference: Accommodation and Food Services), one indicator per 8-K item disclosed in the event (omitted item: Item 1.01), and filing-year indicators (reference: 2004). Their coefficients and AMEs are estimated but not tabulated. The estimation sample ends in 2022: the insider-trading outcome is not observed after 2023-01-30, so 2023 and 2024 are dropped. Requiring a non-missing country of upbringing drops a further two thirds of the observations, so this table is estimated on a smaller sample than the baseline and its coefficients are not directly comparable to it. Classical standard errors are in parentheses. Standard errors clustered at the 8-K filing-event level are in brackets.

Fit. Log-likelihood $= -13{,}931.68$. N observations $= 355{,}316$. N events $= 46{,}678$. N parameters $= 86$.

10.5 Estimates of the model where all the variables included in the function determining individuals' sensitivities to social norms are included in functions determining individuals' insider trading costs

Table 8: Maximum-likelihood estimates and average marginal effects for the specification where every variable entering the sensitivity-to-norms function also enters one of the functions determining the cost or the direct utility of trading. The specification is the baseline model of Table 5 with board tenure added to Z^d; the director's demographic and credential variables already enter Z^p, and the executive-director indicator and the number of boards already enter Z^d. Each of the four model parameters is a linear index of characteristics: the exogenous cost of trading $c = \exp(\Lambda_c' Z^c)$, the personal cost $p = \exp(\Lambda_p' Z^p)$, the weight on social norms $\omega = \sigma(\Lambda_\omega' Z^\omega)$ with $\sigma(\cdot)$ the sigmoid, and the direct utility of trading $d = \Lambda_d' Z^d$, which enters the trading condition untransformed. See the notes below the table for how to read the two columns.

Variable	Coefficient	AME
Panel A: Determinants of the weight put on social norms as opposed to personal costs (ω)		
A higher ω puts more weight on the board norm and less on the director's own standards		
Sample average: $\bar{\omega} = 0.655$ (0.035) [0.040]		
Constant	0.662 (0.171) [0.199]	—
Director characteristics		
Female	-0.536 (0.161) [0.183]	-0.126 (0.039) [0.043]
CPA	0.028 (0.023) [0.027]	0.006 (0.005) [0.006]
CFA	-0.034 (0.056) [0.062]	-0.008 (0.013) [0.014]
Law degree (JD/LLB/LLM/LLD)	0.060 (0.022) [0.025]	0.013 (0.005) [0.006]
Executive director	0.011 (0.057) [0.064]	0.002 (0.013) [0.014]
Number of boards	-0.010 (0.003) [0.003]	-0.002 (0.001) [0.001]
Tenure on board	0.018 (0.002) [0.002]	0.004 (0.001) [0.001]
Generation (reference: Baby boomer):		
Greatest	0.362 (0.108) [0.121]	0.076 (0.022) [0.024]
Silent	-0.051 (0.016) [0.019]	-0.011 (0.004) [0.004]
Gen X	-0.221 (0.021) [0.024]	-0.051 (0.006) [0.007]
Millennial	-0.096 (0.095) [0.109]	-0.022 (0.022) [0.025]
Panel B: Determinants of personal costs (p)		
A higher p means the director's own standards make trading more costly		
Sample average: $\bar{p} = 0.326$ (0.047) [0.058]		
Constant	-38.780 (7071.025) [0.095]	—
Director characteristics		
Female	39.641 (7071.025) [0.095]	2.459 (0.354) [0.433]
CPA	0.077 (0.098) [0.117]	0.026 (0.033) [0.040]
CFA	-0.376 (0.327) [0.385]	-0.103 (0.071) [0.082]
Law degree (JD/LLB/LLM/LLD)	0.246 (0.099) [0.115]	0.088 (0.035) [0.040]
Generation (reference: Baby boomer):		
Greatest	2.067 (0.540) [0.592]	2.234 (1.274) [1.365]
Silent	-0.132 (0.113) [0.136]	-0.041 (0.032) [0.038]

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Variable	Coefficient	AME
Gen X	-0.063 (0.080) [0.091]	-0.020 (0.025) [0.029]
Millennial	-20.762 (8766.734) [0.224]	-0.328 (0.048) [0.058]
Panel C: Determinants of the net cost of trading due to exogenous factors (c)		
A higher c means factors outside the director's control make trading more costly		
Sample average: $\bar{c} = 1.927$ (0.210) [0.244]		
Constant	0.694 (0.110) [0.127]	—
Firm characteristics		
Log total assets	0.005 (0.001) [0.001]	0.010 (0.003) [0.003]
Panel D: Determinants of individual circumstances affecting trading (d)		
A higher d implies a lower benefit from trading		
Sample average: $\bar{d} = -0.654$ (0.020) [0.024]		
Director characteristics		
CEO	-0.048 (0.045) [0.043]	-0.048 (0.045) [0.043]
Executive director	-1.189 (0.094) [0.098]	-1.189 (0.094) [0.098]
Number of boards	-0.017 (0.005) [0.005]	-0.017 (0.005) [0.005]
Executive director × number of boards	0.022 (0.007) [0.006]	0.022 (0.007) [0.006]
Tenure on board	-0.061 (0.004) [0.004]	-0.061 (0.004) [0.004]
Filing characteristics		
Filing gap (reference: 1 day):		
2 days	-0.506 (0.035) [0.043]	-0.506 (0.035) [0.043]
3 days	-0.873 (0.034) [0.043]	-0.873 (0.034) [0.043]
4 days	-1.016 (0.032) [0.040]	-1.016 (0.032) [0.040]

Notes. The Coefficient column reports the estimated elements of Λ_ω, Λ_p, Λ_c and Λ_d. Because the cost parameters are non-linear transformations of these linear indices, a coefficient is not the effect of the variable on the parameter, and that effect differs across directors. The AME column reports the effect, averaged over the sample. For a continuous variable it is the average derivative of the parameter with respect to the variable. For a binary variable it is the average change from 0 to 1. AMEs are in the units of the parameter, so each one can be read against the sample average at the head of its panel.

Board tenure enters both Z^ω and Z^d; the two are separately identified only because ω passes through the sigmoid and enters the peer-belief aggregates while d shifts the director's own threshold untransformed, so the two tenure coefficients should be read together rather than in isolation. The specification also includes NAICS sector indicators (reference: Accommodation and Food Services), one indicator per 8-K item disclosed in the event (omitted item: Item 1.01), and filing-year indicators (reference: 2004). Their coefficients and AMEs are estimated but not tabulated. The estimation sample ends in 2022: the insider-trading outcome is not observed after 2023-01-30, so 2023 and 2024 are dropped. Classical standard errors are in parentheses. Standard errors clustered at the 8-K filing-event level are in brackets.

Fit. Log-likelihood $= -42{,}914.90$. N observations $= 1{,}137{,}132$. N events $= 139{,}074$. N parameters $= 85$.

10.6 Alternative placements of the direct component

The main specification (Model A) keeps the exogenous cost block and gives the direct component the filing gap, the CEO and executive-director indicators, the number of other boards and their interaction. Two variants redistribute those characteristics. Model B removes the exogenous cost block entirely and moves every characteristic it carried into the direct component, so the peer-belief aggregates are formed from the personal cost and the sensitivity to social norms alone. Model C restricts the direct component to the filing-gap indicators and returns the director characteristics to the exogenous cost block, where they act through the exponentiated cost rather than shifting the threshold linearly.

Table 9: Maximum-likelihood estimates and average marginal effects for the specification with sensitivity to social norms as a function of director characteristics, using no exogenous cost block, with every cost covariate in the direct component (Model B). Each model parameter is a linear index of characteristics passed through a transformation that keeps it in range: the exogenous cost of trading $c = \exp(\Lambda_c' Z^c)$, the personal cost $p = \exp(\Lambda_p' Z^p)$, and the weight on social norms $\omega = \sigma(\Lambda_\omega' Z^\omega)$, where $\sigma(\cdot)$ is the sigmoid. The direct component $d = \Lambda_d' Z^d$ enters the threshold linearly and is not exponentiated. See the notes below the table for how to read the two columns.

Variable	Coefficient	AME
Panel A: Determinants of the weight put on social norms as opposed to personal costs (ω)		
A higher ω puts more weight on the board norm and less on the director's own standards		
Sample average: $\bar{\omega} = 0.395$ (0.053) [0.143]		
Constant	3.312 (1.155) [2.405]	—
Director characteristics		
Female	-6.350 (1.863) [2.057]	-0.356 (0.088) [0.210]
CPA	-2.605 (1.184) [1.518]	-0.196 (0.071) [0.112]
CFA	2.288 (1.531) [1.894]	0.169 (0.089) [0.099]
Law degree (JD/LLB/LLM/LLD)	-0.152 (1.155) [1.923]	-0.012 (0.090) [0.149]
Executive director	0.271 (0.715) [1.028]	0.021 (0.055) [0.080]
Number of boards	-0.236 (0.073) [0.121]	-0.018 (0.004) [0.007]
Tenure on board	-0.717 (0.199) [0.267]	-0.056 (0.005) [0.007]
Generation (reference: Baby boomer):		
Greatest	2.060 (2.768) [1.986]	0.153 (0.194) [0.150]
Silent	8.673 (2.519) [4.155]	0.569 (0.084) [0.215]
Gen X	-0.643 (1.122) [3.066]	-0.050 (0.086) [0.240]
Millennial	2.478 (5.258) [11.523]	0.181 (0.344) [0.749]

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Variable	Coefficient	AME
Panel B: Determinants of personal costs (p)		
A higher p means the director's own standards make trading more costly		
Sample average: $\bar{p} = 6.287$ (0.140) [0.169]		
Constant	1.845 (0.022) [0.027]	—
Director characteristics		
Female	0.096 (0.008) [0.009]	0.624 (0.050) [0.061]
CPA	0.031 (0.007) [0.010]	0.200 (0.048) [0.066]
CFA	-0.037 (0.032) [0.049]	-0.228 (0.194) [0.296]
Law degree (JD/LLB/LLM/LLD)	0.022 (0.008) [0.011]	0.137 (0.051) [0.068]
Generation (reference: Baby boomer):		
Greatest	0.084 (0.031) [0.045]	0.549 (0.214) [0.308]
Silent	-0.081 (0.010) [0.019]	-0.496 (0.059) [0.112]
Gen X	-0.069 (0.009) [0.014]	-0.420 (0.053) [0.083]
Millennial	-0.053 (0.151) [0.410]	-0.322 (0.900) [2.448]
Panel C: Determinants of individual circumstances affecting trading (d)		
A higher d implies a lower benefit from trading		
Sample average: $\bar{d} = -1.054$ (0.138) [0.166]		
Firm characteristics		
Log total assets	0.037 (0.007) [0.011]	0.037 (0.007) [0.011]
Director characteristics		
CEO	-0.011 (0.042) [0.042]	-0.011 (0.042) [0.042]
Executive director	-1.249 (0.048) [0.049]	-1.249 (0.048) [0.049]
Number of boards	-0.033 (0.003) [0.004]	-0.033 (0.003) [0.004]
Executive director × number of boards	0.018 (0.007) [0.006]	0.018 (0.007) [0.006]
Filing characteristics		
Filing gap (reference: 1 day):		
2 days	-0.508 (0.035) [0.043]	-0.508 (0.035) [0.043]
3 days	-0.876 (0.034) [0.043]	-0.876 (0.034) [0.043]
4 days	-1.026 (0.032) [0.040]	-1.026 (0.032) [0.040]

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Variable	Coefficient	AME

Notes. The Coefficient column reports the estimated elements of Λ_ω, Λ_p, Λ_c and Λ_d. Because the cost parameters are non-linear transformations of these linear indices, a coefficient is not the effect of the variable on the parameter, and that effect differs across directors. The AME column reports the effect, averaged over the sample. For a continuous variable it is the average derivative of the parameter with respect to the variable. For a binary variable it is the average change from 0 to 1. AMEs are in the units of the parameter, so each one can be read against the sample average at the head of its panel.

The specification also includes NAICS sector indicators (reference: Accommodation and Food Services), one indicator per 8-K item disclosed in the event (omitted item: Item 1.01), and filing-year indicators (reference: 2004). Their coefficients and AMEs are estimated but not tabulated. The estimation sample ends in 2022: the insider-trading outcome is not observed after 2023-01-30, so 2023 and 2024 are dropped. Classical standard errors are in parentheses. Standard errors clustered at the 8-K filing-event level are in brackets.

Fit. Log-likelihood $= -43{,}093.89$. N observations $= 1{,}137{,}132$. N events $= 139{,}074$. N parameters $= 83$.

Table 10: Maximum-likelihood estimates and average marginal effects for the specification with all directors sharing the same sensitivity to social norms, using no exogenous cost block, with every cost covariate in the direct component (Model B). Each model parameter is a linear index of characteristics passed through a transformation that keeps it in range: the exogenous cost of trading $c = \exp(\Lambda_c' Z^c)$, the personal cost $p = \exp(\Lambda_p' Z^p)$, and the weight on social norms $\omega = \sigma(\Lambda_\omega' Z^\omega)$, where $\sigma(\cdot)$ is the sigmoid. The direct component $d = \Lambda_d' Z^d$ enters the threshold linearly and is not exponentiated. See the notes below the table for how to read the two columns.

Variable	Coefficient	AME
Panel A: Determinants of the weight put on social norms as opposed to personal costs (ω)		
A higher ω puts more weight on the board norm and less on the director's own standards		
Sample average: $\bar{\omega} = 0.542$ (0.053) [0.066]		
Constant	0.169 (0.212) [0.264]	—
Panel B: Determinants of personal costs (p)		
A higher p means the director's own standards make trading more costly		
Sample average: $\bar{p} = 6.410$ (0.140) [0.167]		
Constant	1.852 (0.022) [0.027]	—
Director characteristics		
Female	0.141 (0.015) [0.018]	0.948 (0.106) [0.125]
CPA	0.030 (0.011) [0.013]	0.193 (0.075) [0.083]
CFA	-0.022 (0.029) [0.031]	-0.142 (0.179) [0.196]
Law degree (JD/LLB/LLM/LLD)	0.034 (0.011) [0.013]	0.222 (0.073) [0.086]
Generation (reference: Baby boomer):		
Greatest	0.124 (0.048) [0.058]	0.846 (0.349) [0.421]
Silent	-0.050 (0.008) [0.010]	-0.318 (0.052) [0.059]

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Variable	Coefficient	AME
Gen X	-0.099 (0.013) [0.017]	-0.612 (0.074) [0.097]
Millennial	-0.092 (0.048) [0.054]	-0.562 (0.281) [0.314]
Panel C: Determinants of individual circumstances affecting trading (d)		
A higher d implies a lower benefit from trading		
Sample average: $\bar{d} = -1.063$ (0.138) [0.165]		
Firm characteristics		
Log total assets	0.030 (0.006) [0.008]	0.030 (0.006) [0.008]
Director characteristics		
CEO	-0.000 (0.042) [0.042]	-0.000 (0.042) [0.042]
Executive director	-1.283 (0.047) [0.047]	-1.283 (0.047) [0.047]
Number of boards	-0.037 (0.003) [0.003]	-0.037 (0.003) [0.003]
Executive director × number of boards	0.019 (0.007) [0.006]	0.019 (0.007) [0.006]
Filing characteristics		
Filing gap (reference: 1 day):		
2 days	-0.506 (0.035) [0.043]	-0.506 (0.035) [0.043]
3 days	-0.875 (0.034) [0.043]	-0.875 (0.034) [0.043]
4 days	-1.019 (0.032) [0.040]	-1.019 (0.032) [0.040]

Notes. The Coefficient column reports the estimated elements of Λ_ω, Λ_p, Λ_c and Λ_d. Because the cost parameters are non-linear transformations of these linear indices, a coefficient is not the effect of the variable on the parameter, and that effect differs across directors. The AME column reports the effect, averaged over the sample. For a continuous variable it is the average derivative of the parameter with respect to the variable. For a binary variable it is the average change from 0 to 1. AMEs are in the units of the parameter, so each one can be read against the sample average at the head of its panel.

The specification also includes NAICS sector indicators (reference: Accommodation and Food Services), one indicator per 8-K item disclosed in the event (omitted item: Item 1.01), and filing-year indicators (reference: 2004). Their coefficients and AMEs are estimated but not tabulated. The estimation sample ends in 2022: the insider-trading outcome is not observed after 2023-01-30, so 2023 and 2024 are dropped. Classical standard errors are in parentheses. Standard errors clustered at the 8-K filing-event level are in brackets.

Fit. Log-likelihood $= -43{,}171.02$. N observations $= 1{,}137{,}132$. N events $= 139{,}074$. N parameters $= 72$.

Table 11: Maximum-likelihood estimates and average marginal effects for the specification with no sensitivity to social norms, using no exogenous cost block, with every cost covariate in the direct component (Model B). Each model parameter is a linear index of characteristics passed through a transformation that keeps it in range: the exogenous cost of trading $c = \exp(\Lambda_c' Z^c)$, the personal cost $p = \exp(\Lambda_p' Z^p)$, and the weight on social norms $\omega = \sigma(\Lambda_\omega' Z^\omega)$, where $\sigma(\cdot)$ is the sigmoid. The direct component $d = \Lambda_d' Z^d$ enters the threshold linearly and is not exponentiated. See the notes below the table for how to read the two columns.

Variable	Coefficient	AME
Panel A: Determinants of personal costs (p)		
A higher p means the director's own standards make trading more costly		
Sample average: $\bar{p} = 6.415$ (0.140) [0.167]		
Constant	1.858 (0.022) [0.026]	—
Director characteristics		
Female	0.073 (0.007) [0.007]	0.479 (0.048) [0.048]
CPA	0.016 (0.006) [0.006]	0.106 (0.040) [0.040]
CFA	-0.015 (0.015) [0.016]	-0.093 (0.097) [0.098]
Law degree (JD/LLB/LLM/LLD)	0.013 (0.006) [0.006]	0.085 (0.038) [0.038]
Generation (reference: Baby boomer):		
Greatest	0.033 (0.027) [0.028]	0.218 (0.179) [0.184]
Silent	-0.032 (0.005) [0.005]	-0.206 (0.030) [0.031]
Gen X	-0.046 (0.006) [0.006]	-0.291 (0.034) [0.035]
Millennial	-0.022 (0.028) [0.029]	-0.142 (0.174) [0.181]
Panel B: Determinants of individual circumstances affecting trading (d)		
A higher d implies a lower benefit from trading		
Sample average: $\bar{d} = -1.070$ (0.138) [0.165]		
Firm characteristics		
Log total assets	0.042 (0.006) [0.007]	0.042 (0.006) [0.007]
Director characteristics		
CEO	0.004 (0.042) [0.042]	0.004 (0.042) [0.042]
Executive director	-1.295 (0.047) [0.047]	-1.295 (0.047) [0.047]
Number of boards	-0.037 (0.003) [0.003]	-0.037 (0.003) [0.003]
Executive director × number of boards	0.019 (0.007) [0.006]	0.019 (0.007) [0.006]
Filing characteristics		
Filing gap (reference: 1 day):		
2 days	-0.506 (0.035) [0.043]	-0.506 (0.035) [0.043]
3 days	-0.875 (0.034) [0.043]	-0.875 (0.034) [0.043]
4 days	-1.023 (0.032) [0.040]	-1.023 (0.032) [0.040]

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Variable	Coefficient	AME

Notes. The Coefficient column reports the estimated elements of Λ_ω, Λ_p, Λ_c and Λ_d. Because the cost parameters are non-linear transformations of these linear indices, a coefficient is not the effect of the variable on the parameter, and that effect differs across directors. The AME column reports the effect, averaged over the sample. For a continuous variable it is the average derivative of the parameter with respect to the variable. For a binary variable it is the average change from 0 to 1. AMEs are in the units of the parameter, so each one can be read against the sample average at the head of its panel.

The specification also includes NAICS sector indicators (reference: Accommodation and Food Services), one indicator per 8-K item disclosed in the event (omitted item: Item 1.01), and filing-year indicators (reference: 2004). Their coefficients and AMEs are estimated but not tabulated. The estimation sample ends in 2022: the insider-trading outcome is not observed after 2023-01-30, so 2023 and 2024 are dropped. Classical standard errors are in parentheses. Standard errors clustered at the 8-K filing-event level are in brackets.

Fit. Log-likelihood $= -43{,}189.14$. N observations $= 1{,}137{,}132$. N events $= 139{,}074$. N parameters $= 71$.

Table 12: Maximum-likelihood estimates and average marginal effects for the specification with sensitivity to social norms as a function of director characteristics, using a full exogenous cost block and a direct component holding only the filing-gap indicators (Model C). Each model parameter is a linear index of characteristics passed through a transformation that keeps it in range: the exogenous cost of trading $c = \exp(\Lambda_c' Z^c)$, the personal cost $p = \exp(\Lambda_p' Z^p)$, and the weight on social norms $\omega = \sigma(\Lambda_\omega' Z^\omega)$, where $\sigma(\cdot)$ is the sigmoid. The direct component $d = \Lambda_d' Z^d$ enters the threshold linearly and is not exponentiated. See the notes below the table for how to read the two columns.

Variable	Coefficient	AME
Panel A: Determinants of the weight put on social norms as opposed to personal costs (ω)		
A higher ω puts more weight on the board norm and less on the director's own standards		
Sample average: $\bar{\omega} = 0.168$ (0.022) [0.020]		
Constant	-0.758 (0.151) [0.156]	—
Director characteristics		
Female	0.423 (0.122) [0.147]	0.062 (0.020) [0.024]
CPA	-0.501 (0.253) [0.390]	-0.060 (0.027) [0.041]
CFA	0.173 (0.240) [0.324]	0.024 (0.036) [0.048]
Law degree (JD/LLB/LLM/LLD)	-0.177 (0.137) [0.151]	-0.023 (0.017) [0.018]
Executive director	-0.442 (0.133) [0.147]	-0.054 (0.017) [0.019]
Number of boards	-0.111 (0.013) [0.013]	-0.015 (0.002) [0.002]
Tenure on board	-0.056 (0.008) [0.007]	-0.008 (0.001) [0.001]
Generation (reference: Baby boomer):		
Greatest	-20.829 (9742.220) [0.209]	-0.169 (0.022) [0.021]
Silent	0.127 (0.102) [0.110]	0.017 (0.014) [0.015]
Gen X	0.027 (0.138) [0.199]	0.004 (0.019) [0.027]
Millennial	-18.560 (7785.091) [1.295]	-0.169 (0.022) [0.020]

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Variable	Coefficient	AME
Panel B: Determinants of personal costs (p)		
A higher p means the director's own standards make trading more costly		
Sample average: $\bar{p} = 1.072$ (0.317) [0.250]		
Constant	0.056 (0.292) [0.216]	—
Director characteristics		
Female	0.171 (0.101) [0.119]	0.194 (0.127) [0.158]
CPA	0.312 (0.103) [0.132]	0.377 (0.134) [0.209]
CFA	-0.324 (0.275) [0.352]	-0.298 (0.201) [0.272]
Law degree (JD/LLB/LLM/LLD)	0.200 (0.074) [0.067]	0.232 (0.083) [0.091]
Generation (reference: Baby boomer):		
Greatest	0.653 (0.173) [0.147]	0.982 (0.210) [0.229]
Silent	-0.136 (0.072) [0.071]	-0.141 (0.063) [0.069]
Gen X	-0.609 (0.290) [0.350]	-0.514 (0.114) [0.167]
Millennial	0.463 (0.168) [0.149]	0.630 (0.202) [0.204]
Panel C: Determinants of the net cost of trading due to exogenous factors (c)		
A higher c means factors outside the director's control make trading more costly		
Sample average: $\bar{c} = 3.966$ (0.317) [0.255]		
Constant	1.407 (0.085) [0.075]	—
Firm characteristics		
Log total assets	0.011 (0.002) [0.002]	0.044 (0.006) [0.007]
Director characteristics		
CEO	-0.016 (0.014) [0.014]	-0.064 (0.054) [0.054]
Executive director	-0.271 (0.037) [0.033]	-0.976 (0.105) [0.116]
Number of boards	0.002 (0.001) [0.001]	0.007 (0.005) [0.005]
Executive director × number of boards	0.005 (0.003) [0.003]	0.020 (0.010) [0.010]
Panel D: Determinants of individual circumstances affecting trading (d)		
A higher d implies a lower benefit from trading		
Sample average: $\bar{d} = -0.469$ (0.016) [0.020]		
Filing characteristics		
Filing gap (reference: 1 day):		
2 days	-0.513 (0.035) [0.043]	-0.513 (0.035) [0.043]
3 days	-0.882 (0.034) [0.043]	-0.882 (0.034) [0.043]
4 days	-1.036 (0.032) [0.040]	-1.036 (0.032) [0.040]

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Variable	Coefficient	AME

Notes. The Coefficient column reports the estimated elements of Λ_ω, Λ_p, Λ_c and Λ_d. Because the cost parameters are non-linear transformations of these linear indices, a coefficient is not the effect of the variable on the parameter, and that effect differs across directors. The AME column reports the effect, averaged over the sample. For a continuous variable it is the average derivative of the parameter with respect to the variable. For a binary variable it is the average change from 0 to 1. AMEs are in the units of the parameter, so each one can be read against the sample average at the head of its panel.

The specification also includes NAICS sector indicators (reference: Accommodation and Food Services), one indicator per 8-K item disclosed in the event (omitted item: Item 1.01), and filing-year indicators (reference: 2004). Their coefficients and AMEs are estimated but not tabulated. The estimation sample ends in 2022: the insider-trading outcome is not observed after 2023-01-30, so 2023 and 2024 are dropped. Classical standard errors are in parentheses. Standard errors clustered at the 8-K filing-event level are in brackets.

Fit. Log-likelihood $= -43{,}011.66$. N observations $= 1{,}137{,}132$. N events $= 139{,}074$. N parameters $= 84$.

Table 13: Maximum-likelihood estimates and average marginal effects for the specification with all directors sharing the same sensitivity to social norms, using a full exogenous cost block and a direct component holding only the filing-gap indicators (Model C). Each model parameter is a linear index of characteristics passed through a transformation that keeps it in range: the exogenous cost of trading $c = \exp(\Lambda_c' Z^c)$, the personal cost $p = \exp(\Lambda_p' Z^p)$, and the weight on social norms $\omega = \sigma(\Lambda_\omega' Z^\omega)$, where $\sigma(\cdot)$ is the sigmoid. The direct component $d = \Lambda_d' Z^d$ enters the threshold linearly and is not exponentiated. See the notes below the table for how to read the two columns.

Variable	Coefficient	AME
Panel A: Determinants of the weight put on social norms as opposed to personal costs (ω)		
A higher ω puts more weight on the board norm and less on the director's own standards		
Sample average: $\bar{\omega} = 0.292$ (0.045) [0.057]		
Constant	-0.888 (0.217) [0.275]	—
Panel B: Determinants of personal costs (p)		
A higher p means the director's own standards make trading more costly		
Sample average: $\bar{p} = 1.032$ (0.304) [0.231]		
Constant	0.009 (0.303) [0.230]	—
Director characteristics		
Female	0.534 (0.136) [0.108]	0.664 (0.078) [0.092]
CPA	0.141 (0.062) [0.060]	0.154 (0.057) [0.060]
CFA	-0.187 (0.186) [0.203]	-0.176 (0.143) [0.158]
Law degree (JD/LLB/LLM/LLD)	0.139 (0.061) [0.058]	0.151 (0.055) [0.061]
Generation (reference: Baby boomer):		
Greatest	0.391 (0.196) [0.206]	0.493 (0.259) [0.294]
Silent	-0.280 (0.103) [0.090]	-0.268 (0.041) [0.045]

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Variable	Coefficient	AME
Gen X	-0.465 (0.159) [0.109]	-0.401 (0.053) [0.066]
Millennial	-0.395 (0.326) [0.328]	-0.337 (0.208) [0.221]
Panel C: Determinants of the net cost of trading due to exogenous factors (c)		
A higher c means factors outside the director's control make trading more costly		
Sample average: $\bar{c} = 3.390$ (0.317) [0.342]		
Constant	1.360 (0.086) [0.092]	—
Firm characteristics		
Log total assets	0.008 (0.002) [0.002]	0.026 (0.006) [0.007]
Director characteristics		
CEO	-0.032 (0.021) [0.023]	-0.109 (0.065) [0.070]
Executive director	-0.422 (0.044) [0.044]	-1.232 (0.052) [0.056]
Number of boards	-0.011 (0.001) [0.002]	-0.039 (0.003) [0.003]
Executive director × number of boards	0.004 (0.003) [0.003]	0.014 (0.010) [0.010]
Panel D: Determinants of individual circumstances affecting trading (d)		
A higher d implies a lower benefit from trading		
Sample average: $\bar{d} = -0.465$ (0.016) [0.020]		
Filing characteristics		
Filing gap (reference: 1 day):		
2 days	-0.508 (0.035) [0.043]	-0.508 (0.035) [0.043]
3 days	-0.876 (0.034) [0.043]	-0.876 (0.034) [0.043]
4 days	-1.023 (0.032) [0.040]	-1.023 (0.032) [0.040]

Notes. The Coefficient column reports the estimated elements of Λ_ω, Λ_p, Λ_c and Λ_d. Because the cost parameters are non-linear transformations of these linear indices, a coefficient is not the effect of the variable on the parameter, and that effect differs across directors. The AME column reports the effect, averaged over the sample. For a continuous variable it is the average derivative of the parameter with respect to the variable. For a binary variable it is the average change from 0 to 1. AMEs are in the units of the parameter, so each one can be read against the sample average at the head of its panel.

The specification also includes NAICS sector indicators (reference: Accommodation and Food Services), one indicator per 8-K item disclosed in the event (omitted item: Item 1.01), and filing-year indicators (reference: 2004). Their coefficients and AMEs are estimated but not tabulated. The estimation sample ends in 2022: the insider-trading outcome is not observed after 2023-01-30, so 2023 and 2024 are dropped. Classical standard errors are in parentheses. Standard errors clustered at the 8-K filing-event level are in brackets.

Fit. Log-likelihood $= -43{,}187.01$. N observations $= 1{,}137{,}132$. N events $= 139{,}074$. N parameters $= 73$.

Table 14: Maximum-likelihood estimates and average marginal effects for the specification with no sensitivity to social norms, using a full exogenous cost block and a direct component holding only the filing-gap indicators (Model C). Each model parameter is a linear index of characteristics passed through a transformation that keeps it in range: the exogenous cost of trading $c = \exp(\Lambda_c' Z^c)$, the personal cost $p = \exp(\Lambda_p' Z^p)$, and the weight on social norms $\omega = \sigma(\Lambda_\omega' Z^\omega)$, where $\sigma(\cdot)$ is the sigmoid. The direct component $d = \Lambda_d' Z^d$ enters the threshold linearly and is not exponentiated. See the notes below the table for how to read the two columns.

Variable	Coefficient	AME
Panel A: Determinants of personal costs (p)		
A higher p means the director's own standards make trading more costly		
Sample average: $\bar{p} = 0.877$ (0.300) [0.203]		
Constant	-0.141 (0.347) [0.235]	—
Director characteristics		
Female	0.450 (0.134) [0.093]	0.463 (0.049) [0.049]
CPA	0.121 (0.058) [0.051]	0.112 (0.041) [0.041]
CFA	-0.170 (0.163) [0.168]	-0.137 (0.103) [0.110]
Law degree (JD/LLB/LLM/LLD)	0.096 (0.052) [0.046]	0.088 (0.039) [0.040]
Generation (reference: Baby boomer):		
Greatest	0.232 (0.176) [0.172]	0.229 (0.177) [0.181]
Silent	-0.255 (0.105) [0.081]	-0.209 (0.030) [0.031]
Gen X	-0.359 (0.136) [0.081]	-0.274 (0.035) [0.037]
Millennial	-0.167 (0.227) [0.230]	-0.135 (0.165) [0.172]
Panel B: Determinants of the net cost of trading due to exogenous factors (c)		
A higher c means factors outside the director's control make trading more costly		
Sample average: $\bar{c} = 4.938$ (0.301) [0.204]		
Constant	1.685 (0.063) [0.053]	—
Firm characteristics		
Log total assets	0.009 (0.001) [0.002]	0.047 (0.007) [0.008]
Director characteristics		
CEO	0.001 (0.011) [0.011]	0.005 (0.054) [0.054]
Executive director	-0.290 (0.022) [0.016]	-1.295 (0.048) [0.049]
Number of boards	-0.008 (0.001) [0.001]	-0.038 (0.003) [0.003]
Executive director × number of boards	0.003 (0.002) [0.002]	0.016 (0.009) [0.008]
Panel C: Determinants of individual circumstances affecting trading (d)		
A higher d implies a lower benefit from trading		
Sample average: $\bar{d} = -0.465$ (0.016) [0.020]		
Filing characteristics		
Filing gap (reference: 1 day):		

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Variable	Coefficient	AME
2 days	-0.508 (0.035) [0.043]	-0.508 (0.035) [0.043]
3 days	-0.875 (0.034) [0.043]	-0.875 (0.034) [0.043]
4 days	-1.023 (0.032) [0.040]	-1.023 (0.032) [0.040]

Notes. The Coefficient column reports the estimated elements of Λ_ω, Λ_p, Λ_c and Λ_d. Because the cost parameters are non-linear transformations of these linear indices, a coefficient is not the effect of the variable on the parameter, and that effect differs across directors. The AME column reports the effect, averaged over the sample. For a continuous variable it is the average derivative of the parameter with respect to the variable. For a binary variable it is the average change from 0 to 1. AMEs are in the units of the parameter, so each one can be read against the sample average at the head of its panel.

The specification also includes NAICS sector indicators (reference: Accommodation and Food Services), one indicator per 8-K item disclosed in the event (omitted item: Item 1.01), and filing-year indicators (reference: 2004). Their coefficients and AMEs are estimated but not tabulated. The estimation sample ends in 2022: the insider-trading outcome is not observed after 2023-01-30, so 2023 and 2024 are dropped. Classical standard errors are in parentheses. Standard errors clustered at the 8-K filing-event level are in brackets.

Fit. Log-likelihood $= -43{,}198.64$. N observations $= 1{,}137{,}132$. N events $= 139{,}074$. N parameters $= 72$.

11 Internet Appendix

11.1 Estimates of the model without social norms and likelihood ratio test to compare this model with the paper's models

The table below provides estimated parameters and implied AMEs for the model without sensitivity to social norms.

Table 15: Maximum-likelihood estimates and average marginal effects for the specification with no sensitivity to social norms, using the exogenous cost block and a full direct component (Model A). Each model parameter is a linear index of characteristics passed through a transformation that keeps it in range: the exogenous cost of trading $c = \exp(\Lambda_c' Z^c)$, the personal cost $p = \exp(\Lambda_p' Z^p)$, and the weight on social norms $\omega = \sigma(\Lambda_\omega' Z^\omega)$, where $\sigma(\cdot)$ is the sigmoid. The direct component $d = \Lambda_d' Z^d$ enters the threshold linearly and is not exponentiated. See the notes below the table for how to read the two columns.

Variable	Coefficient	AME
Panel A: Determinants of personal costs (p)		
A higher p means the director's own standards make trading more costly		
Sample average: $\bar{p} = 1.350$ (0.655) [0.408]		
Constant	0.295 (0.489) [0.304]	—
Director characteristics		
Female	0.313 (0.137) [0.086]	0.473 (0.048) [0.049]
CPA	0.078 (0.047) [0.038]	0.109 (0.041) [0.041]
CFA	-0.093 (0.102) [0.099]	-0.120 (0.102) [0.106]
Law degree (JD/LLB/LLM/LLD)	0.062 (0.040) [0.033]	0.086 (0.039) [0.039]
Generation (reference: Baby boomer):		
Greatest	0.154 (0.133) [0.125]	0.224 (0.178) [0.182]
Silent	-0.162 (0.088) [0.060]	-0.210 (0.030) [0.031]
Gen X	-0.226 (0.117) [0.067]	-0.280 (0.035) [0.037]
Millennial	-0.102 (0.146) [0.145]	-0.131 (0.169) [0.176]
Panel B: Determinants of the net cost of trading due to exogenous factors (c)		
A higher c means factors outside the director's control make trading more costly		
Sample average: $\bar{c} = 4.661$ (0.656) [0.409]		
Constant	1.556 (0.142) [0.094]	—
Firm characteristics		
Log total assets	0.009 (0.002) [0.002]	0.044 (0.006) [0.007]
Panel C: Determinants of individual circumstances affecting trading (d)		

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Variable	Coefficient	AME
A higher d implies a lower benefit from trading		
Sample average: $\bar{d} = -0.666$ (0.017) [0.021]		
Director characteristics		
CEO	0.004 (0.042) [0.042]	0.004 (0.042) [0.042]
Executive director	-1.298 (0.047) [0.047]	-1.298 (0.047) [0.047]
Number of boards	-0.037 (0.003) [0.003]	-0.037 (0.003) [0.003]
Executive director × number of boards	0.019 (0.007) [0.006]	0.019 (0.007) [0.006]
Filing characteristics		
Filing gap (reference: 1 day):		
2 days	-0.506 (0.035) [0.043]	-0.506 (0.035) [0.043]
3 days	-0.874 (0.034) [0.043]	-0.874 (0.034) [0.043]
4 days	-1.021 (0.032) [0.040]	-1.021 (0.032) [0.040]

Notes. The Coefficient column reports the estimated elements of Λ_ω, Λ_p, Λ_c and Λ_d. Because the cost parameters are non-linear transformations of these linear indices, a coefficient is not the effect of the variable on the parameter, and that effect differs across directors. The AME column reports the effect, averaged over the sample. For a continuous variable it is the average derivative of the parameter with respect to the variable. For a binary variable it is the average change from 0 to 1. AMEs are in the units of the parameter, so each one can be read against the sample average at the head of its panel.

The specification also includes NAICS sector indicators (reference: Accommodation and Food Services), one indicator per 8-K item disclosed in the event (omitted item: Item 1.01), and filing-year indicators (reference: 2004). Their coefficients and AMEs are estimated but not tabulated. The estimation sample ends in 2022: the insider-trading outcome is not observed after 2023-01-30, so 2023 and 2024 are dropped. Classical standard errors are in parentheses. Standard errors clustered at the 8-K filing-event level are in brackets.

Fit. Log-likelihood $= -43{,}194.06$. N observations $= 1{,}137{,}132$. N events $= 139{,}074$. N parameters $= 72$.

The next table provides the results of the likelihood ratio tests to compare the models with sensitivity to social norms with the models without sensitivity to social norms.

Table 16: Sequential likelihood-ratio tests of social-norms specifications. Three nested specifications of increasing flexibility are compared, with each row testing against the row above. The `const_omega_no_bach` specification bridges the two tests: it is the alternative in the boundary test (row 2 vs row 1) and the null in the interior test (row 3 vs row 2). For the boundary test, the standard χ^2 asymptotic distribution does not apply because the restricted value $\omega_{ift} = 0$ lies on the boundary of the parameter space; we report a parametric bootstrap p-value computed from $R = 200$ Monte Carlo replicates simulated under $H_0 : \omega_{ift} = 0 \; \forall (i, f, t) \in \mathcal{O}$ (observed $LR = 51.42$ on $\Delta p = 1$ added parameter; discrete lower bound $1/(R+1) = 0.0050$). For the interior test, the added parameters are interior coefficients on individual characteristics in the ω block, so the standard regularity conditions hold; we report the asymptotic $\chi^2(11)$ p-value (observed $LR = 293.56$). ΔLR and Δp are measured with respect to the previous (less flexible) specification. The estimated parameters of the three specifications are in Tables 15, 4, and 5.

Specification	Log-likelihood	ΔLR vs prev row	Δp	p-value	Test type
`no_omega_no_bach`	$-43,675.27$	—	—	—	—
`const_omega_no_bach`	$-43,649.57$	51.42	1	0.0050	parametric bootstrap
`full_omega_no_bach`	$-43,502.79$	293.56	11	1.99×10^{-56}	asymptotic χ^2