Governance through Threat:

Does Short Selling Improve Internal Governance?

Massimo Massa[*], Bohui Zhang[†], Hong Zhang[‡]

Abstract

We explore the relationship between internal governance and the disciplining mechanisms created by the threat of short selling (i.e., "short-selling potential"). We argue that the presence of short selling increases the cost of agency problems for shareholders and incentivizes them to improve internal governance. Our stock-level tests across 23 developed countries during 2003-2009 confirm that the threat of short selling significantly enhances the quality of internal governance. This effect is stronger for financially constrained firms and more pronounced in countries with weak institutional environments. The governance impact of short selling leads to an improvement in firms' operating performance.

Keywords: Short Selling, International Finance, Corporate Governance, Equity Incentives.

JEL Codes: G30, M41

[*] INSEAD, Boulevard de Constance, 77305 Fontainebleau Cedex, France; E-mail: massimo.massa@insead.edu
[†] University of New South Wales, Sydney, NSW, Australia, 2052; E-mail: bohui.zhang@unsw.edu.au
[‡] INSEAD, 1 Ayer Rajah Avenue, Singapore, 138676; E-mail: hong.zhang@insead.edu

Introduction

The last decade has witnessed a renewed interest in the role of financial markets in disciplining managers. Shareholders – particularly blockholders – may induce good managerial behavior by exiting and pushing down stock prices when bad managerial actions are taken (e.g., Admati and Pfleiderer, 2009; Edmans, 2009; Edmans and Manso, 2011).[1] In this regard, informed trading ("exit") provides an alternative governance mechanism that shareholders can adopt in addition to the traditional "intervention" type of internal governance (e.g., Parrino et al., 2003; Chen et al., 2007; McCahery et al., 2010). Indeed, to some extent, exit and intervention offer substituting governance mechanisms that shareholders can select based on their trade-off between benefits and costs (e.g., Edmans and Manso, 2011; Edmans et al., 2013).

A more general question is whether any type of informed trading that may reveal managerial misbehavior to the market can substitute for internal governance. A notable example is short selling. Short sellers are known to be informed (Senchack and Starks, 1993; Asquith et al. 2005; Cohen et al. 2007; Boehmer et al., 2008) and highly motivated to attack bad firms (e.g., Karpoff and Lou, 2010; Hirshleifer et al., 2011).[2] Short selling appears to discipline managers and reduce their incentives to manipulate (Massa et al., 2013). It may therefore appear reasonable to conjecture that shareholders can rely on the external disciplining mechanism of short selling instead of engaging in direct monitoring of managers. If so, shareholders would optimally *reduce* their direct manager monitoring in the presence of an effective short-selling market.

In this paper, we address this issue by exploring the impact of short selling on internal governance. Our main contribution is to empirically document that the presence of short selling *increases*, rather than reduces, shareholders' incentives to monitor managers. To explore the economic rationale for this, we also provide a simple model with multiple short sellers to show how short selling stimulates shareholders' investment in internal governance. For lack of a better expression, we label this effect "governance through threat".

Our main intuition is as follows. Suppose that a shareholder in a firm can choose between investing in internal governance – e.g., monitoring and intervention – and optimally exiting if she privately observes that the manager misbehaves. In the former case, the shareholder reduces the probability that the manager takes a "bad" action, while in the latter case, she just tries to minimize the

[1] For instance, Edmans and Manso (2011) conclude that "informed trading causes prices to more accurately reflect fundamental value, in turn inducing the manager to undertake actions that enhance value."

[2] Of course, other market participants may also influence the shareholders of firms in this way; however, the short-selling channel is particularly powerful because short sellers are known to be good at processing negative information (e.g., Karpoff and Lou, 2010; Hirshleifer et al., 2011).

loss by selling before the market realizes it. The existence of informed short selling, however, introduces competition in trading over the same set of information. More competition, by revealing more private information to the market, adversely affects the price at which the shareholder can exit. Hence, short selling threatens the payoff of exit. This fact incentivizes the shareholder to spend more on internal governance to reduce the likelihood of the bad action in the first place.

The impact of short selling should vary across firms as a function of the real cost of bad managerial actions. For example, consider financially constrained firms that are more "dependent" on the market for external financing (e.g., Baker et al., 2003). A bad managerial action may not only directly destroy firm value but also impose additional damage to shareholders because the consequent price drop would also significantly increase the cost of capital. Therefore, for these firms, the incentive of shareholders to improve internal governance in the presence of short selling should be stronger. Similarly, because the average agency cost is higher in countries with poor country-level governance than in those with good governance, the marginal impact of short selling should be greater in countries with poor governance.

These considerations also imply that it is the *ex ante* ("potential") threat of short selling, which we refer to as "*short-selling potential"* (SSP), rather than the *ex post* actions of the short sellers that affects the shareholders' governance decisions.[3] We therefore focus our empirical analysis on the impact of SSP on internal governance. Given that short-selling potential is constrained by the capacity of the market, i.e., the fraction of shares available to be lent to short sellers ("*Lendable"*), we use "*Lendable*" as our main empirical proxy for SSP.[4]

Moreover, this proxy for SSP provides several advantages. First, the number of shares available to be lent is mostly determined by the supply-side conditions of short selling and is not directly related to the stock price (e.g., Cohen et al., 2007). Second, more abundant lendable shares reduce short-selling fees (Kaplan et al., 2013) and increase price efficiency in the global market (Saffi and Sigurdsson, 2011), directly conditioning the behavior of stock-price-driven managers. Third, and more importantly, shareholders eager to exercise their monitoring/intervention roles are less likely to supply lendable shares to short sellers on a large scale because doing so would transfer their voting rights and therefore limit their ability to affect governance.[5] In fact, this unique feature of the short-selling market would

[3] For instance, a greater threat may lead to a more substantial improvement in governance, which *reduces* the likelihood of bad managerial behavior and the necessity for short sellers to punish it.

[4] An analysis of naked short selling goes beyond the scope of this paper because naked short selling may complicate the ownership and governance structure of firms by creating more voting shares than the total number of shares outstanding. One benefit of lendable shares is to exclude naked short selling because normal short selling requires short sellers to "locate securities to borrow before selling." In this case, the lender of the shares receives dividends but relinquishes voting rights. The definition of ownership involving short selling is provided by the SEC: http://www.sec.gov/rules/final/34-50103.htm.

[5] A lack of voting rights is known to discourage institutional investors (e.g., Li et al., 2008).

suggest that lending shares – and therefore the ensuing ownership transfer – is orthogonal to shareholder intervention. We will provide empirical evidence that supports this claim.

We test our hypotheses, using a unique dataset on worldwide short selling detailed at the stock level across 23 developed countries during the 2002-2009 period. Our main proxy for corporate governance, which we refer to as the corporate governance index (CGI), comes from RiskMetrics/Institutional Shareholder Services (ISS) and is the most widely used index of governance at the firm level in the international context (e.g., Aggarwal et al., 2009; Aggarwal et al., 2011; and Doidge et al., 2007).[6] We find strong evidence that the governance index is related to SSP, a relationship that is statistically significant and economically relevant. A one-standard-deviation-higher SSP is related to a 6.36% higher CGI.[7] This pattern holds for both US and non-US firms, both before and during the global financial crisis. Indeed, a one-standard-deviation-higher SSP is associated with a 6.97% (13.06%) higher CGI in the US (rest of the world) and a 7.45% (11.42%) higher CGI during the crisis (non-crisis) period.

We further investigate whether the impact of short selling is stronger for firms that are more dependent than others on equity markets for financing. Following Baker et al. (2003), we define equity dependence as a higher KZ index (Kaplan and Zingales, 1997), lower levels of cash flow and cash holdings, and higher leverage. The tests involving these variables lead to two results. First, including these variables does not absorb the impact of SSP. Second, and more importantly, the interaction between SSP and these variables is significant across all specifications, with signs that are consistent with our hypothesis that the impact of SSP is stronger for firms that are relatively more equity dependent.

When we consider country-level governance, we find that SSP promotes better internal governance in all governance conditions. However, the effect is especially strong in countries with weak institutions. In particular, a one-standard-deviation-higher SSP is related to a 9.78% (9.37%, 8.75%, 9.09%, and 13.81%) higher level of governance in countries regulated by civil law (poor disclosure requirements, weak securities regulation, low accounting standards, and loose anti-director rules, respectively). Because country-level governance is known to be complementary to corporate governance (e.g., Doidge et al., 2007; Aggarwal et al, 2009), the substitution effect between short selling and country-level governance further confirms that short selling also has a complementary impact on internal governance.

[6] The data on international firm-level governance come from Aggarwal's website: http://faculty.msb.edu/aggarwal/gov.xls.
[7] Economic significance is based on the standard deviation of the corporate governance index.

Although CGI is a composite index, its components mostly concern the "monitoring/intervention" facet of internal governance.[8] Therefore, the next step is to explore the "incentive" aspect of internal governance by examining the impact of short selling on equity-based executive compensation. Our model predicts that, other things equal, SSP also incentivizes investors to pay more equity-based compensation to better align managerial incentives. Empirically, SSP has a strong positive impact on equity-based compensation, a relationship that holds across different specifications and alternative samples. A one-standard-deviation-higher SSP increases the CEO equity compensation ratio by between 7.14% and 14.77%. In a series of robustness checks, we also show that SSP increases the sensitivity of executives' total compensation to firm performance. These findings suggest that SSP pushes shareholders to significantly enhance the incentive aspects of executive compensation.

Thus far, all of the tests support the hypothesis that the threat of short selling promotes corporate governance. The next question is whether such relationships imply causality. To address this endogeneity issue, we first control for firm-fixed effects to rule out the possibility that the relationship between SSP and governance is spurious because of omitted firm-level variables. We then address the issue of reverse causality, i.e., whether the positive relationship between SSP and internal governance exists because shareholders are eager to exert internal governance *and* supply lendable shares to short sellers. In our context, economic theory and the institutional design of the short-selling market would suggest that the opposite (with respect to our working hypothesis) direction of causality is highly unlikely. Indeed, the ability to monitor requires holding shares and not lending them, even temporarily. Nevertheless, we will address this issue econometrically.

We employ the same methodology as Aggarwal et al. (2011) in conducting Granger causality tests. The tests produce two results: 1) changes in SSP strongly predict changes in internal governance; and 2) changes in internal governance do not predict changes in future SSP. The first result is consistent with a causal link that runs from SSP to governance, as hypothesized. The second result confirms the conjectured institutional implication that shares to be lent are unlikely to be supplied by shareholders engaged in improving governance. This observation rejects reverse causality and is consistent with the general intuition of Khanna and Mathews (2012) that controlling blockholders, who presumably play the monitoring/intervening roles, only have incentives, if any, to trade *against* short sellers, to offset their negative price impact.[9]

[8] CGI is based on 41 firm-level internal governance attributes. Out of 41 attributes, only the following three are directly related to equity compensation incentives: (37) Directors receive all or a portion of their fees in stock; (39) Options grants align with company performance and a reasonable burn rate; (40) Officers' and directors' stock ownership is at least 1% but not over 30% of total shares outstanding.

[9] The difference is that they examine how uninformed short-selling manipulations affect blockholders, whereas we, following the literature, explore the case where short sellers are informed and punish suspicious firms (e.g., Cohen et al., 2007; Boehmer et al., 2008; Karpoff and Lou, 2010; Hirshleifer et al., 2011; Dyck et al., 2010). However, the impact of short selling on price is the same in the two cases.

The Granger causality tests confirm that there are shareholders not engaged in governance but willing to supply lendable shares to the short-selling market. The interesting question is who these shareholders are. We argue that institutional investors who passively track a benchmark with no performance goals fit well into this economic role, e.g., exchange-traded funds (ETFs) or similar passive institutional investors. Indeed, on the one hand, these investors are passive and typically do not engage in governance-related activities because they lack the incentives to do so. For instance, Dyck et al. (2010) provide a list of important players that blow the whistle on corporate fraud; not surprisingly, short sellers are on the list, but ETFs are not. Our own diagnostic tests, which will be discussed shortly, also confirm that ETFs do not directly enhance internal governance. On the other hand, ETFs supply lendable shares to the short-selling market, and the astonishing growth rate of the ETF industry (40% every year from 2001 to 2010) can provide large exogenous variations in the number of shares available for short selling.[10] Indeed, univariate regressions reveal that ETF ownership might explain approximately 39% of SSP variation in the global market, which confirms that ETFs are a primary supplier of lendable shares.

These properties allow us to extend the intuition of Hirshleifer et al. (2011) and use ETFs as an instrument to proxy for the efficiency and potential impact of short selling. The main difference with respect to Hirshleifer et al. (2011) is that they use overall institutional ownership to capture the impact of short selling, whereas we focus on one special type of passive institutional investor to locate the supply of governance-unrelated lendable shares. We show that instrumented SSP is strongly and positively related both to CGI and to equity-based executive compensation. A one-standard-deviation-higher instrumented lendable shares is correlated with a 16.86% higher quality of governance and a 20.57% higher level of equity-based compensation.

The quality of the instrument is confirmed both by statistical tests (Staiger and Stock, 1997) and by the finding that, although ETFs by themselves are positively related to corporate governance in general, the positive relationship becomes insignificant when SSP is zero. The latter result suggests that ETFs do not monitor managers by themselves; instead, SSP is the necessary channel through which ETFs affect governance. This relationship fits the requirements of a good instrument, as it confirms that omitted characteristics that may attract ETF ownership, but are orthogonal to SSP, do not enhance governance (i.e., the exclusion restriction). The use of this instrument further confirms our causal interpretation of the positive effect of SSP on corporate governance and offers additional insights into the formation and evolution of the short-selling market.

[10] ETFs are bound by rules on securities lending similar to those governing traditional mutual funds. For instance, in Europe, ETF providers can lend up to 80% of their basket of securities to a third party to generate revenues. The 2011 IMF "Global Financial Stability Report" provides more information about the potential role of ETFs in the short-selling market.

Finally, we conduct two additional tests to further refine the analysis of the impact of SSP on corporate governance. First, we find that SSP improves the quality of the board structure of a firm. Because a board internally monitors management behavior for the benefit of investors, this result provides an explicit example of how short selling increases the monitoring incentives of investors and complements our general tests that use the CGI index.[11] Second, we assess whether the disciplining effect of SSP on internal governance has any real implications for firm performance. We find that SSP increases the future return on assets (ROA) of a firm through its impact on CGI or on equity-based compensation. A one-standard-deviation-higher level of SSP-related governance (equity-based compensation), for instance, is related to a 24.99% (16.64%) higher ROA. To the extent that firms with good governance are known to have better performance, this result confirms that the complementary impact of short selling on corporate governance achieves the same actual result.

Our results contribute to several strands of the literature. First, to the best of our knowledge, we are the first to investigate the impact of the short-selling market on internal governance. The existing governance literature has considered alternative actions between "voice and exit" (Maug, 1998; Kahn and Winton, 1998; Faure-Grimaud and Gromb, 2004) and has focused on "voice" as the main disciplining device. For example, hedge fund activism has been identified as an important source of governance (e.g., Brav et al., 2008; Clifford, 2008; Greenwood and Schor, 2009; Klein and Zur, 2009, 2011). More recently, Admati and Pfleiderer (2009), Edmans (2009), and Edmans and Manso (2011) show that walking the "Wall Street Rule" is a governance mechanism. In particular, Edmans and Manso (2011) examine competitive trading among multiple blockholders, showing that such trading disciplines managers. We extend their intuition and demonstrate that trading competition from short sellers also significantly affects the tradeoff between voice and exit. In doing so, we also extend the potential determinants of corporate governance and equity compensation from within the firm (e.g., Core and Guay 1999; Core et al. 1999; Bushman and Smith 2001; Armstrong et al. 2010; the latter provides a recent survey) to external market participants, who do not have stakes in the firm but who may trade on its private information.

Second, we contribute to the literature on short selling. The standard short-selling literature links short-selling activities to stock returns (Senchack and Starks, 1993; Asquith and Meulbroek, 1995; Aitken et al., 1998) through their effect on the informativeness of stock prices. For example, Cohen et al. (2007) document the ability of short sellers' trades to predict future stock returns, which suggests that short sellers have access to private information and affect stock-market liquidity and efficiency (e.g., Bris et al., 2007; Boehmer et al., 2008; Boehmer and Wu 2010; Saffi and Sigurdsson, 2011;

[11] This test, as well as the tests based on equity compensation, also mitigates the potential impact on our analyses of anti-takeover provisions, whose role is debated in the recent literature (see, e.g., Smith 2013).

Kecskes et al., 2013). We extend this line of research by examining the *ex ante* impact of short selling on corporate governance, based on the *ex post* observation that short sellers attack bad managerial actions (e.g., Karpoff and Lou, 2010; Hirshleifer et al., 2011). This approach provides explicit economic channels through which information efficiencies provided by the short-selling market yield a beneficial result in the corporate market.

Third, our results contribute to the literature that relates shareholder composition to firm performance (e.g., Morck et al., 1988; Himmelberg et al., 1999, Holderness et al., 1999; Franks and Mayer, 2001; Franks et al., 2001) and corporate governance (e.g., Claessens et al. 2000; La Porta et al., 2002; Claessens and Laeven, 2003; Ferreira and Matos, 2008; Aggarwal et al., 2011; Laeven and Levine, 2008; Doidge et al., 2007). Whereas the extant literature focuses primarily on large/controlling shareholders with positive stakes, we are the first to present a positive role for a party who benefits from negative information through negative stakes at a cost to existing shareholders, i.e., short sellers.

Finally, our findings provide evidence that firms shape their behaviors in response to the stock market, which suggests or confirms a feedback effect recently proposed in the literature (e.g., Chen et al., 2007; Edmans et al., 2011, 2012). Our contribution is to show that awareness of the existence of a large group of short sellers ready to punish managerial slack can help a firm reduce slack in its beginning stages.

The remainder of the paper is organized as follows. In Section II, we present our main hypotheses. In Section III, we describe the data and the construction of the main variables. In Sections IV and V, we provide the main evidence about the relations between short-selling potential and the quality of internal firm governance. Section VI contains endogeneity tests. Section VII provides additional tests related to board structures and value creation. A brief conclusion follows.

II. A Stylized Model and Hypotheses

We now outline our simple model and its main hypotheses and refer to Appendix A for all proofs. Consider a three-period set up. In Period 0, the manager of the firm may take a "bad action" (e.g., investments in projects with negative net present value) that damages shareholders' value but benefits the manager privately. The bad action occurs with probability q_1, which, for the time being, is assumed to be exogenous. We use a variable $\tilde{\alpha}$ to describe whether or not the bad action occurs. This variable takes a value of 1 if the bad action occurs and 0 otherwise.

If no bad action occurs, the liquidation value of the firm in period 2 is v. If the bad action occurs, the liquidation value of the firm is reduced by $\tilde{\delta}$. We assume that $\tilde{\delta}$ is normally distributed, i.e., $\tilde{\delta} \sim N(\delta_0, \Sigma_\delta)$, where δ_0 and Σ_δ are positive constants that denote mean and variance, respectively. The

parameters q_1, δ_0, and Σ_δ are known by the market. However, before period 2, the market does not observe the managerial action or the realized value of $\tilde{\delta}$.

The firm has a representative informed shareholder (hereafter, *the investor*), who has η shares of firm stock to start with, as well as some liquidity traders (hereafter, *the noise trader*), who must trade u shares of the stock to cover their private liquidity shocks in the first period ($u \sim N(0, \sigma_u^2)$). The total number of shares is normalized to one. The investor is informed about the value of $\tilde{\delta}$ as well as the managerial action. She can take two actions to maximize the total consumption or wealth that she can derive from her shares.

First, the investor can invest some capital, K, in internal governance, such as (though not limited to) improving the monitoring of the manager and ensuring better disclosure and transparency. Without loss of generality, we assume that the internal governance mechanism prevents the bad action from occurring with probability q for any givern value of $\tilde{\delta}$. That is, governance spending reduces the probability that the manager takes the bad action from q_1 to $q_1^{'} = q_1 - q$. We assume that q is an increasing and concave function of K (i.e., $q_K^{'} > 0$ and $q_K^{''} < 0$, where $q_K^{'}$ and $q_K^{''}$ are the first- and second-order derivatives of q with respect to K).

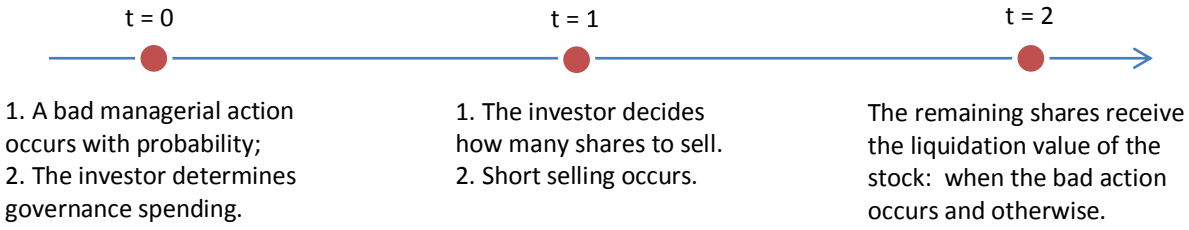
Second, if the bad managerial action occurs (i.e., $\tilde{a} = 1$), the investor can choose to sell e shares of the firm in the first period ($e \in [0, \eta]$) and keep the remaining shares until the liquidation date of period 2. In this scenario, which occurs with probability $q_1^{'}$, the investor's consumption becomes $C_1 = eP_1^{'} + (\eta - e)P_2^{'}$, where $P_1^{'}$ and $P_2^{'}$ are the prices of the stock in the first and second periods, respectively, when $\tilde{a} = 1$. It is easy to see that the price in period 2 is $P_2^{'} = v - \tilde{\delta}$. The price in period 1 ($P_1^{'}$) is determined by the market, as we shall see below. If, instead, the bad action is not taken ($\tilde{a} = 0$), then the price of the stock remains $P_1 = P_2 = v$. In this scenario, the investor can hold the stock until period 2 and enjoy consumption of $C_0 = \eta P_2 = \eta v$.

Overall, the investor maximizes her expected consumption by optimally choosing the amount of capital to invest in governance and the number of shares to sell in period 1 as follows: $Max_{K,e}\, C = C_1 \times q_1^{'} + C_0 \times \left(1 - q_1^{'}\right) - K$.

Next, we introduce short selling. Intuitively, because short sellers are informed (e.g., Senchack and Starks, 1993; Asquith et al. 2005; Cohen et al. 2007, Boehmer et al., 2008), they compete with the investor to trade on the basis of negative information about the manager taking the bad action. This competition may adversely affect the stock price, making "exit" more costly and inducing the investor to spend more on governance.

To verify this intuition, we assume that there are *N* short sellers in the market and that the short sellers are as informed as the investor; i.e., the short sellers observe the private information of $\tilde{\delta}$ as well as $\tilde{a}$. If $\tilde{a} = 1$, the *k*th short seller submits an order of $\xi_k < 0$ shares of the stock to the market to short sell the stock in Period 1. In Period 2, the shorts are covered. We also assume that there are l shares available to be lent to short sellers (i.e., lendable shares). This constrains the total amount of feasible short selling, i.e., $\sum_k \xi_k < l$. Figure 1 illustrates the timeline.

Figure 1: The Timeline of the Model



Finally, we specify how the price is set in Period 1. We use the one-period version of Holden and Subrahmanyam (1992) to model potential competition among informed traders in the Kyle (1985) framework and extend it to allow for governance spending.[12] Specifically, each short seller maximizes her expected trading payoff: $\pi_k = \left(P_2^{'} - P_1^{'}\right)\xi_k$. Because short sellers are informed about $\tilde{\delta}$, they directly observe $P_2^{'} = v - \tilde{\delta}$ before they trade. The market observes the summation of the order flows: $X = e + \sum_k \xi_k + u$. Following Holden and Subrahmanyam (1992), we examine a symmetric equilibrium in which all short sellers behave in the same way because they are similarly informed; i.e., the optimal amount of $\xi_k$would be the same for all short sellers.

Before we solve the maximization problem of the investor, it is helpful to understand how competition affects trading behavior and the stock price in general. Thus, we first explore an economy in which *N* short sellers compete with each other in trading the signal $\tilde{\delta}$ that they observe; i.e., we ignore the investor for the time being. The general effect, which is summarized in Lemma 1 in Appendix 1, is that more competition among the informed short sellers induces them to trade more aggressively. This reveals more private information.

The lemma also shows that the total number of lendable shares imposes a natural capacity constraint on the feasible degree of competition. The larger the number of shares available to short sellers ("lendable"), the higher is the level of competition among short sellers and the greater the degree of price efficiency. While the degree of competition can be affected by other economic

[12] Models with multiple informed investors can also be found in Kyle (1984) and Foster and Viswanathan (1993). Edmans and Manso (2011) examine the informed trading of multiple blockholders. Our paper mainly focuses on the case of one informed blockholder and multiple informed short sellers.

conditions, existing empirical evidence supports the intuition that lendable shares increase price efficiency (Saffi and Sigurdsson, 2011). Thus, evidence shows that this constraint is perhaps one of the most relevant ones in the short selling market, which motivates us to use the supply of lendable shares as an empirical proxy for short-selling potential.

Next, we move on to the investor side. We solve the equilibrium in which the investor determines her optimal governance spending, K, and the optimal exiting strategy in the first period, e, in the presence of $N-1$ short sellers. This leads to the following proposition:

Proposition 1: *Short selling increases the incentive of the investor to invest in internal governance.*

The main intuition behind Proposition 1 is as follows. The bad managerial action reduces the consumption of the investor by destroying the liquidation value of the firm. Because the market does not know the exact amount of the value destroyed, the investor can engage in informed trading and benefit from it; e.g., she can strategically exit before the negative information is fully incorporated into the share price. However, trading competition from short sellers reduces this ability, which makes the exit option more costly and incentivizes the investor to invest in governance to reduce the likelihood of the bad action in the first place.

The impact of competition on governance spending is affected by the real cost of the bad managerial action for the firm. For example, firms relying more on external financing are more "equity dependent" (e.g., Baker et al., 2003). For these firms, any negative price movement caused by a bad managerial action may increase the cost of external financing and further reduce firm value – in addition to the direct cost of the bad managerial action. Thus, the average damage of $\tilde{\delta}$ to equity-dependent firms should increase when their stock prices drop. If so, the threat of more significant price drops due to short-selling competition should motivate investors to spend more on governance, in the spirit of Proposition 1. This assumption leads to the following corollary:

Corollary 1: *The impact of short selling on governance incentives is larger for firms that are more equity dependent.*

The real cost of a bad managerial action may also vary across countries, which provides an additional dimension in which to test the impact of short selling. Because the average agency cost in countries with good country-level governance is lower than that in countries with bad governance, the average value of $\tilde{\delta}$ should decrease in the quality of country governance. Intuitively, this should reduce the net damage to the investor, which weakens the impact of competition on firm-level governance spending. This effect is stated in the following corollary:

Corollary 2: *The impact of short selling on governance spending is smaller for firms located in countries with good country-level governance.*

Finally, monitoring and intervention are not the only types of mechanisms that can reduce the probability that the value-destroying action occurs. As an alternative to formal governance, the investor can also choose to pay equity compensation to the manager, which also reduces the likelihood that the manager will take the bad action. Of course, equity compensation is costly; hence, the investor must determine the optimal equity compensation. The following proposition summarizes the relationship between competition and equity compensation when only the latter is used.

Proposition 2: *Short selling enhances the incentive for the investor to pay higher equity compensation to the manager*.

Proposition 2 states that competition from the short-selling market affects equity compensation similarly to the manner in which it affects governance investments. Because equity compensation reduces the likelihood that the manager will take a bad action in the first place, the threat of strong competition from the short selling market incentivizes the investor to pay the manager higher equity compensation.

III. Construction of Data and Main Variables

We now describe our data sources and the construction of our main variables.

A. Data Sample and Sources

The sample covers the period between 2003 and 2009. We begin with all publicly listed companies for which we have accounting and stock market information from Datastream/WorldScope. We match this sample with short-selling information obtained from Data Explorers, with firm-level corporate governance and equity-based compensation information from RiskMetrics and BoardEx and data on institutional investors' stock holdings from FactSet/LionShares.

We obtain equity-lending data from Data Explorers, a research company that collects equity and bond lending data directly from the securities-lending desks of the world's leading banks. The data are available monthly from May 2002, weekly from August 2004, and daily from July 2006. Data Explorers provides information on lending volumes, lending fees, and the number of securities that are made available for lending. In particular, Data Explorers reports the following variables for each stock daily: lendable value in dollars, active lendable value in dollars, total balance value on loan in dollars,

and weighted average loan fee (across active contracts) in basis points.[13] A more detailed description of the data can be found in Saffi and Sigurdsson (2011) and Jain et al. (2012).

The composite corporate governance index is based on governance attributes from RiskMetrics/Institutional Shareholder Services (ISS), an index, constructed by Aggarwal et al. (2011), that covers a five-year period from 2004 to 2008 across 23 developed markets. RiskMetrics compiles firm-level governance attributes by aggregating information from regulatory filings, annual reports, and firm websites. Following Aggarwal et al. (2011), we examine 41 governance attributes with a distribution across four governance categories, including 24 attributes for board structure, eight attributes for ownership and compensation, six attributes for anti-takeover provisions, and three attributes for audit.

Equity-based compensation and board structure information is obtained from BoardEx. The BoardEx database contains information on board structures, board remuneration, and detailed profiles of board members (such as employment history, nationality, and educational affiliations) for more than 400,000 executives and board members of over 14,500 firms, beginning in 1999 (including coverage of 6,500 international firms). BoardEx data have been used in several studies, including Cohen et al. (2008), Schmidt (2009), and Aggarwal et al. (2011).

The data on institutional investor ownership are from the FactSet/LionShares database, which provides portfolio holdings of institutional investors worldwide. FactSet compiles institutional ownership information from public filings by investors (such as 13-F filings in the US), company annual reports, stock exchanges, and regulatory agencies around the world. Institutions are defined as professional money managers, including mutual fund companies, investment advisors, pension funds, bank trusts, and insurance companies. The database has been used in several other studies investigating the investment behavior of foreign investors (Ferreira and Matos, 2007; Bartram et al., 2010; Ng et al., 2011). Because institutional ownership represents over 40% of the total world stock market capitalization during our sample period, we control for institutional ownership in all our regressions to stress the impact of short selling. We also obtain ETF ownership of stocks from this database, which we use below as a measuring instrument for lending supply in the short-selling market.

We combine Datastream data with the short-selling, corporate governance, and institutional holdings data, using SEDOL and ISIN codes for non-US firms. We use CUSIP to merge the short-selling data with US security data from Datastream. The final sample includes information about approximately 15,450 stocks across 23 countries. As shown in Appendix B, the sample includes 3,395

[13] Data Explorers applies several filters to calculate active lendable value by excluding shares that are frozen and cannot be lent.

non-US firms and 1,185 US firms in 2003; these numbers increase to 7,652 non-US firms and 4,006 US firms by December 2009.

After we match the beginning sample from Datastream/WorldScope with Data Explorers, the base sample covers 65,450 firm-year observations over the period from 2003 to 2009. The match with RiskMetrics shrinks the sample size to 20,957 firm-year observations, using a shorter period from 2004 to 2008. For tests of equity-based compensation and board structure, we match the base sample with BoardEx and obtain a sample of 14,917 firm-year observations from 2003 to 2009.

B. Main Variables

Consistent with the literature (e.g., Aggarwal et al., 2009, 2011), we use the corporate governance index (CGI), constructed as the average of 41 governance attributes for each firm and year, as the main proxy for internal governance. Each individual governance attribute is a dummy variable equal to one if a firm satisfies certain standards for that attribute and zero otherwise. Thus, the higher the CGI value, the better the quality of a firm's internal governance.

The measures of managerial incentives and, in particular, the equity-based segment of executive compensation are standard in the literature. The CEO equity-compensation ratio (*CEOEqRatio*) is the ratio of a CEO's equity, options, and long-term incentive plan (LTIP) compensation to the CEO's total compensation. The executive equity compensation ratio (*ExeEqRatio*) is the ratio of the average equity, options, and LTIP compensation of the top executives to their total compensation. CEO equity compensation (*CEOEqComTA*) is the log of a CEO's equity, options, and LTIP compensation scaled by a firm's total assets. Executive equity compensation (*ExeEqComTA*) is the log of top executives' average equity, options, and LTIP compensation scaled by a firm's total assets. These variables are also applied in Adams and Ferreira (2009), Agrawal and Nasser (2010), and Armstrong at el. (2012).

Finally, to provide an explicit example of internal monitoring, we also zoom in and use measures of board size, board independence, and whether a board is busy to proxy for the quality of internal monitoring. We adopt both continuous and dummy variables. The busy board metric (*BoardBusy*) denotes the average number of both public and private firm directorships held by directors on the board. The busy board dummy (*BoardBusyD*) equals one if the average number of directorships of both public and private firms held by directors on the board is greater than three. Board independence (*BoardInd*) is the proportion of independent directors on the board. The board independence dummy (*BoardIndD*) equals one if the ratio of independent directors on the board is greater than 50%. Board size (*BoardSize*) denotes the number of directors on the board. The board size dummy (*BoardSizeD*) equals one if the number of directors on the board is greater than five but less than 16. The same variables have been widely applied in the existing literature (e.g., Masulis et al., 2012).

We define our main measure of short-selling potential (SSP), *Lendable*, as the annual average fraction of shares of a firm available (to be lent) to short sellers. More specifically, we follow Equation (4) of Saffi and Sturgesson (2011) in computing the ratio of the value of shares supplied to the short-selling market to the market capitalization of the stock for each month; we then take the averages of the monthly ratios as the annual *Lendable* ratio. We use annual frequency because corporate governance variables are primarily defined annually.

Our control variables include the American Depository Receipt (*ADR*) dummy, closely held ownership (*CH*), the logarithm of firm size (*Size*), financial leverage (*Leverage*), the return-on-asset ratio (*ROA*), research and development expenses (*R&D*), the logarithm of annual stock returns over the prior 12 months (*Momentum*), stock return volatility defined over the prior 12 months (*STD*), and institutional ownership (*IO*). Institutional ownership is the aggregated equity holdings of domestic and foreign institutional investors as a percentage of the total number of outstanding shares. We also construct ETF ownership (*ETF*) as the percentage of the total number of outstanding shares owned by ETFs that fully replicate benchmark indexes. A detailed definition of all these variables is provided in Appendix B.

We present the summary statistics for the main variables in Table 1. Panel A reports the number of observations (N), mean, median, standard deviation (STD), decile distribution (90% and 10%), and quartile distribution (75% and 25%) of the variables. The mean (6.3%) of *Lendable* is close to the mean (8.0%) of the lending supply variable in Saffi and Sturgesson (2011). The difference between these two values arises because firms must have valid quality of internal governance variables to be included in our sample. CGI has a mean value of 56.1%, which is similar to that of the sample distribution of Aggarwal et al. (2011). The mean (42.8%) of *CEOEqRatio* in our international sample is close to that (43.0%) of the equity compensation ratio in the US sample of Armstrong et al. (2012). The other control variables also have distributions that are consistent with the literature.

Panel B reports the Pearson correlation coefficients among the main variables. The correlation coefficients provide preliminary evidence of a positive relationship between short-selling potential and corporate governance variables. For example, the correlation coefficient between CGI and *lendable* is 0.269. While this relationship provides some preliminary evidence, the correlation is contemporaneous and may be spurious because of the absence of control variables. Therefore, the next step of the analysis is to examine the relationship in a multivariate framework.

IV. Short Selling and Internal Governance

We now analyze the link between internal governance and SSP. We first provide the main results and then consider the role of information and financial constraints. We estimate the following panel regression as the baseline for our multivariate analysis:

$$CGI_{i,t+1} = \alpha + \beta_1 \times SSP_{i,t} + \beta_2 \times X_{i,t} + \varepsilon_{i,t}\,, \quad (1)$$

where $CGI_{i,t+1}$ denotes a firm's corporate governance index, $SSP_{i,t}$ is the proxy for short-selling potential, and $X_{i,t}$ is a vector that stacks a list of firm-specific characteristics such as firm size (*Size*), whether the firm is closely held (*CH*) or is listed in the US (*ADR*), book leverage (*Leverage*), profitability (*ROA*), research and development expenses (*R&D*), institutional ownership (*IO*), and stock characteristics such as the log of annual stock returns (*Return*) and stock return volatility (*STD*). We also control for (without reporting the coefficients, in the interest of brevity) industry-, country-, and year-level fixed effects (ICY). The standard errors are adjusted for heteroskedasticity and firm-level clustering.

We report the results in Table 2. Columns (1) and (2) are based on the entire sample, whereas columns (3) and (4) consider the subsamples of firms from the US and the rest of the world, respectively. Columns (5) and (6) focus on two sample periods, namely, the crisis period, i.e., the global financial crisis (2007-2008), and the period that excludes the crisis ("Ex.Crisis").

The results show a strong positive relationship between internal governance and SSP, a relationship that holds across the different specifications and alternative samples. The effect is statistically significant and economically relevant. A one-standard-deviation-higher SSP correlates with a 6.36% higher value of the internal governance index. This pattern holds both for the US and the rest of the world (NUS), both before and during the crisis. A one-standard-deviation-higher SSP is related to a 6.97% (13.06%) higher level of governance in the US (rest of the world) and to a 7.45% (11.42%) higher level of governance during the crisis (non-crisis) period.

Among the control variables, the results are consistent with our expectations. Firms with high proportions of closely held ownership tend to have a lower quality of governance, a finding that is consistent with agency issues in dual-class firms (e.g., Masulis et al., 2009). Larger firms and firms with higher proportions of institutional ownership have better governance, consistent with Gillan and Starks (2003) and Aggarwal et al. (2011). Controlling for these variables highlights the role of SSP in governance, independent of institutional ownership.

We next investigate whether the impact of short selling is stronger for firms that are relatively more dependent on equity for financing. To do so, we regress governance on the KZ index (*KZ, KZ4*), cash flows (*CF*), cash holdings (*Cash*), and leverage (*Leverage*), as well as on the interactions between SSP and these variables. We report the results in Table 3. These results show that the involvement of

these variables does not absorb the general governance impact of SSP. More importantly, the more dependent the firm is on equity for financing (i.e., the more financially constrained the firm is, the lower its cash flows and cash holdings and the higher its leverage), the more strongly is SSP related to governance. For instance, the sensitivity of CGI with respect to the interaction between SSP and the *KZ* index is 0.030 (t-statistic of 3.08), which implies that SSP has a greater impact on corporate governance for more financially constrained firms.

Next, we test whether the positive impact of short selling on internal governance is particularly strong in countries with weak institutions. We consider several country-level governance variables, including whether the country is ruled by civil law or common law (*ComLaw*). Common law has been shown to proxy for better regulatory and institutional environments (La Porta et al., 1996). We also consider the quality of disclosure requirement rules (*DisReq*), securities regulation and protection (*SecReg*), national accounting standards (*AccSta*), and the anti-director index (*AntiDir*). These variables have been used by La Porta et al. (2006), Djankov et al. (2008), and Hail and Leuz (2006). We re-estimate the previous specifications, splitting the sample in terms of these institutional characteristics.

We report the results in Table 4. We find that the positive link between governance and SSP is stronger in the case of lower-quality institutional frameworks. In particular, a one-standard-deviation higher SSP is related to a 9.78% (9.37%, 8.75%, 9.09%, and 13.81%) higher level of governance in the case of civil law countries (with lower-quality disclosure requirements, security regulation protections, accounting standards, and anti-director rules, respectively) compared to countries with higher-quality institutional frameworks.

These results provide evidence for the hypothesis that short selling improves internal governance, particularly in the case of more market-dependent firms and firms located in countries with weaker institutional frameworks.

V. Short Selling and Executive Compensation

As we argued above, SSP may also affect executive compensation. Thus, we now directly test the impact of SSP on equity-based compensation. We use the following list of empirical proxies to capture the sensitivity of executive compensation to stock price: the CEO equity compensation ratio (*CEOEqRatio*), CEO equity compensation (*CEOEqComTA*), the executive equity compensation ratio (*ExeEqRatio*), and executive equity compensation (*ExeEqComTA*). We proceed in two steps.

First, we show how SSP affects the magnitude of equity-based executive compensation variables. We regress the measures of equity-based compensation on SSP with a set of control variables, where

the control variables and the econometric specification are the same as in the previous table. We estimate the following:

$$EC_{i,t+1} = \alpha + \beta_1 Lendable_{i,t} + \beta_2 X_{i,t} + \varepsilon_{i,t}, \quad (2)$$

where $EC_{i,t+1}$ refers to the CEO equity compensation ratio (*CEOEqRatio*) in Panel A of Table 5, CEO equity compensation (*CEOEqComTA*) in Panel B, the executive equity compensation ratio (*ExeEqRatio*) in Panel C, and executive equity compensation (*ExeEqComTA*) in Panel D.

The results show a strong positive relationship between equity-based compensation and SSP, a relationship that holds across the different specifications and alternative samples. For example, focusing on *CEOEqRatio,* a one-standard-deviation increase in SSP leads to an increase in *CEOEqRatio* of between 7.14% and 14.77%. As in the previous cases, this result holds for both US and non-US firms (NUS) and both before and during the crisis period. Indeed, a one-standard-deviation increase in SSP related to a 10.36% (12.43%) increase in the CEO equity-based compensation ratio in the US (rest of the world) and to a 7.14% (14.77%) increase in the CEO equity-based compensation ratio during the crisis (non-crisis) period.

As a robustness check, we also regress the total amount of executive compensation on firm performance and the interaction term between SSP and performance to determine whether short selling provides more performance-linked incentives for executives. In particular, we consider the following three measures of performance: return-on-asset ratio (*ROA*), abnormal annual stock returns (*AbnReturn*), and the log of annual stock returns (*Return*).

We report the results in Table 6. Panels A and B tabulate the results for CEO total compensation (*CEOTotCompTA*) and executive total compensation (*ExeTotCompTA*), respectively. The results show that SSP significantly increases the sensitivity of executive compensation to firm performance. For instance, in Column (2), the interaction term between *Lendable* and *AbnReturn* is positive and significant at the 5% level, with a coefficient of 0.471 and a *t*-statistic of 2.77.

Finally, we also test how equity dependence and country-level governance affect the impact of SSP on CEO and executive compensation. Because the results are very similar to those in Tables 3 and 4, we leave them unreported in the interest of brevity. For instance, the regression coefficient of *CEOEqRatio* on the interaction between SSP and the *KZ* index is 0.477 (t-statistic 3.04), which suggests that the impact is also higher for more financially constrained firms. The interactions between SSP and the other variables used in Table 3 also typically have the same sign and similar t-statistics. In addition, the impact of short selling on CEO and executive equity compensation is more pronounced in economies with weaker institutional frameworks, i.e., economies ruled by civil law and that have weaker disclosure requirements, securities regulations, accounting standards, and anti-director rules.

VI. Endogeneity Tests

Endogeneity is a potential concern; that is, whereas we show that SSP positively affects internal governance, could it be that SSP itself is actually supplied by shareholders eager to exercise governance? This reverse causality may create the same positive relationship between the two factors. In this section, we first show that, as implied by the institutional features of the short-selling market, SSP itself is not supplied by shareholders eager to exercise governance. We then complement this analysis with evidence that ETFs, which do not themselves monitor managers, supply lendable shares to short sellers that subsequently affect the governance incentives of the other shareholders.

A. Potential Spurious Correlation

We first use lagged dependent variables and firm-fixed effects (in addition to our standard specifications) to examine the issues of spurious correlation that might result from the omission of relevant variables that are correlated with our focus variable. The results are reported in Models (1)-(3) of Panel A and Panel B of Table 7, in which *CGI* and *CEOEqRatio* are used as dependent variables, respectively. Our main results remain significant, with a one-standard-deviation-higher SSP related to a 2.32% (11.05%) higher level of internal governance (equity-based compensation). In the specification based on changes, a one-standard-deviation-higher SSP is related to a 1.03% (6.70%) higher level of internal governance (equity-based compensation). These results exclude the issue of spurious correlation resulting from omitted firm characteristics.

Reverse causality is a more important issue. Conceptually, a large-scale supply of lendable shares is unlikely to be issued by investors eager to monitor and intervene, as lending shares entails giving up, at least temporarily, their voting rights. This behavior contradicts both incentives for and the ability of shareholders to exert governance. We use the same methodology as Agrawal et al. (2011) to econometrically confirm the institutional impact that the first-difference Granger causality test adequately determines the direction of causality. In particular, we estimate the following equations:

$$\begin{cases} \Delta CGI_{i,t+1}\left(\Delta CEOEqRatio_{i,t+1}\right) = \alpha + \beta_1 \Delta Lendable_{i,t} + \beta_2 \Delta X_{i,t} + \varepsilon_{i,t} \\ \Delta Lendable_{i,t+1} = \alpha + \beta_1 \Delta CGI_{i,t}\left(\Delta CEOEqRatio_{i,t}\right) + \beta_2 \Delta X_{i,t} + \varepsilon_{i,t} \end{cases}, \qquad (3)$$

where $Lendable_{i,t}$ refers to the fraction of shares of a firm available to lend and $X_{i,t}$ is the previously defined vector of control variables. We use industry-, country-, and year-fixed effects. The standard errors are adjusted for heteroskedasticity and firm-level clustering.

The first regression, reported in Models (4) and (5) of Table 7 (Panel A for *CGI* and Panel B for *CEOEqRatio*), tests for causality from SSP to governance, as we hypothesized. The second regression explores reverse causality, with results tabulated in Models (6) and (7) of the same table. The results

show that changes in SSP significantly predict changes in governance, which is consistent with our intuition. By contrast, changes in the governance do not lead to any change in the supply of lendable shares. Thus, as implied by the design of the short-selling market, there is no reverse causality from governance to SSP.

The results of the two regressions strongly suggest that certain types of shareholders are uninterested in performing governance roles and instead supply lendable shares to short sellers, allowing the latter to impact governance on their behalf. The next section undertakes the task of identifying this type of ownership and its economic impact.

B. An Instrumental Variable Approach

As we argued above, exchange-traded funds (ETFs) provide a good example of passive institutional investors who supply governance-*unrelated* lendable shares to the short-selling market. First, various findings, including those of Dyck et al. (2010) and our own, discussed below, indicate that ETFs do not intervene in governance matters. Indeed, ETFs are known as a mutual-fund type of investment vehicle with the lowest level of fees in the market, and the fee feature makes them the least likely candidate, among all institutional investors, to monitor firms. Simultaneously, ETFs supply lendable shares to the short-selling market, and the astonishing growth rate of the industry – 40% growth each year from 2001 to 2010, compared to the 5% annual growth rate observed in global mutual funds and equity markets over the same period – provides large exogenous variations in the volume of shares available for short selling. Indeed, the growth rate of lendable shares in the global market, as reported by Saffi and Sigurdsson (2011), is closer to that of the ETF industry than to the open-end fund industry or any other type of mutual funds in the market. These observations strongly suggest that there are sufficient amounts of governance-unrelated lendable shares in the market to be exploited by short sellers.

To lay out our empirical tests, we build on the argument of Hirshleifer et al. (2011) that institutional ownership offers a powerful instrument for short selling. However, to achieve our specific goal of identifying SSP that is unrelated to governance, we focus on the specific type of institutional ownership that is unrelated to governance, namely, ETFs. Based on the arguments made above, ETF ownership is likely to be a powerful instrument because it meets both the exclusion restriction and the inclusion restriction; as ETFs do not directly enhance governance, they make shares available to short sellers. Specifically, we estimate the following two-stage system:

$$\begin{cases} Stage\ 1: SSP_{i,t} = \alpha + \beta_1 ETF_{i,t} + \beta_2 X_{i,t} + \varepsilon_{i,t} \\ Stage\ 2: CGI_{i,t+1}\left(CEOEqRatio_{i,t+1}\right) = \alpha + \beta_1 Predicted\ SSP_{i,t} + \beta_2 X_{i,t} + \varepsilon_{i,t} \end{cases}, (4)$$

where $SSP_{i,t}$ refers to short-selling potential, and $X_{i,t}$ is the vector of control variables. Note that institutional ownership appears in both stages to ensure that its impact is controlled for in both the first and second stage. We estimate panel specifications with industry-, country- and year-level fixed effects and adjust the standard errors for heteroskedasticity and cluster at the firm level.

We report the results in Table 8. In Panel A, the dependent variable is *CGI*, whereas in Panel B, the dependent variable is *CEOEqRatio*. Models (1) and (2) report the two stages of the regression analysis. We observe that SSP is strongly positively related to ETF ownership in the first-stage regression. The *t*-statistic is always above 45, which translates, in an F-test, to well above the threshold of weak exogeneity proposed by Staiger and Stock (1997). The effect is also economically significant. A one-standard-deviation-higher ETF ownership correlates with a 38.75% higher short-selling potential, which confirms that ETFs are among the major suppliers of lendable shares to the short-selling market.

Moreover, the second-stage regression documents a strong positive correlation between the instrumented SSP and both the quality of governance (Panel A) and equity-based compensation (Panel B). A one-standard-deviation-higher instrumented SSP is related to an increase of 16.86% in the quality of governance and an increase of 20.57% in equity-based compensation. The former measurement more than doubles the initial economic magnitude reported in Table 2 (the latter is also higher). The increase in power is not surprising, as ETFs are likely to be a very powerful instrument for governance-unrelated SSP.

Models (3) and (4) specify similar instrumental variable regressions, although the instrumental variable is now the residual of ETF ownership from an (unreported) pre-stage regression in which we further orthogonalize ETF ownership on analyst coverage (*Analyst*), news coverage (*NewsCoverage*), and Amihud (2002) illiquidity (*Illiquidity*). Its residual, *ETF-Res*, is then used to replace ETF ownership in the two-stage regressions above, as reported in Models (3) and (4). This orthogonalization aims to further exclude liquidity effects. Note that if liquidity reduces short-selling costs, then its impact on governance is similar to that of lendable shares. However, we use lendable shares as our main variable because its institutional design makes it more exogenous to governance-related ownership, as discussed above. By contrast, liquidity may be endogenous to governance. Of course, we expect ETF-related liquidity to also be exogenous to governance (after controlling for institutional ownership). Nonetheless, we attempt to empirically verify whether this is the case. This implication is fully supported by the data; explicitly removing liquidity does not affect the significance of the impact of instrumented SSP on governance.[14]

[14] Unreported results show that if we orthogonalize IO, using the pre-stage regression, the results remain unchanged. Here, for consistency across all tables, we report the results with IO as a control variable in both stages.

To verify that ETFs do not directly engage in governance, we perform certain diagnostic tests, reported in Columns (5)-(8). In Column (5), we observe that ETF is positively related to governance in the full sample. However, Column (6) shows that when there is no SSP (i.e., *lendable*=0), ETFs have no impact on governance. This finding suggests that SSP is the necessary channel for ETF ownership to affect governance, which implies that the impact of ETF ownership, reported in Column (5), does not arise from direct governance practices. Indeed, this diagnostic test suggests that any omitted characteristics that may attract ETF ownership but are orthogonal to SSP do not enhance governance, confirming that the instrument satisfies not only the inclusion restriction but also the exclusion restriction. If we ask the reverse question of whether ETF ownership is a necessary channel for SSP to affect governance, we find that the answer is negative because SSP remains positively related to both governance and equity-based compensation when ETF ownership is zero (Column (7)) or even when institutional ownership is zero (Column (8)). The results are not surprising because other shareholders supply lendable shares to the market, which also promotes governance. The results presented in these two columns illustrate the power of short selling in the market and its overall impact on internal governance.

Overall, the evidence confirms the previous results regarding short-selling potential and the quality of governance. More importantly, these results allow us to provide a causal interpretation of the relationship, on that suggests a channel for the effect of short-selling potential on the quality of internal governance. Thus, the increase in short-selling potential resulting from the exogenous growth of ETF ownership helps increase the quality of internal governance. This pattern verifies the disciplining role of short-selling potential.

VII. Robustness Checks and Additional Tests

Finally, we provide two additional tests to gain additional information regarding the economic role of short selling. First, because the board plays the pivotal role in monitoring managers internally, we should examine how short selling improves the quality of the board structure. Second, because firms with good governance are known to have better operating performance, we test whether the complementary impact of short selling on corporate governance in general helps investors achieve the same economic result.

A. Additional Robustness Checks

We begin by investigating how short selling improves board structure, as an illustration of the enhanced monitoring incentives of investors. We report the results in Table 9. The dependent variables are busy board (*BoardBusyD* or *BoardBusy*) in Panel A, board independence (*BoardIndD* or *BoardInd*)

in Panel B, and board size (*BoardSizeD* or *BoardSize*) in Panel C. We provide an analysis of the overall sample (Column (1)), the US sample (Column (2)), the non-US sample (Column (3)), the non-crisis period (Column (4)), and the crisis period (Column (5)).

In all of these cases, we find that SSP improves the quality of the board. In particular, a one-standard-deviation-higher SSP is related to a 6.23% less busy board, a 2.63% more independent board, and a 1.75% larger board size. These findings provide explicit illustrations of how improved monitoring can be achieved, which adds to the general analyses of the previous sections.

B. Short Selling, Internal Governance, and Value Creation

Finally, we test whether the disciplining effect of SSP on internal governance has any direct implications for firm performance. We report the results in Table 10. We begin by preliminarily regressing firm profitability (ROA) on SSP, finding a strongly positive link between SSP and profitability, as reported in Columns (1)-(5). The impact of a one-standard-deviation increase in SSP is related to an increase in profitability that ranges from 2.48% for the overall sample to 2.93% (10.50%) for the US (rest of the world) and to 7.38% (2.80%) during the crisis (non-crisis) period.

Next, we regress both governance and equity-based compensation on SSP and use the projected part as the main variable. This proxies for the role of either governance or equity-based compensation and is then used to explain profitability. The results are reported in Columns (6)-(10) for governance and Columns (11)-(15) for equity-based compensation. The results show that both SSP-related governance and SSP-related equity-based compensation directly affect firm profitability. A one-standard-deviation-higher level of SSP-related governance (equity-based compensation) is related to a 24.99% (16.64%) higher ROA. This result provides evidence of a direct impact of the disciplining effect of SSP on firm profitability and suggests that much of the impact of governance on firm performance is the result of short selling, which is consistent with our working hypothesis.

Conclusion

We study how "trading-based governance" affects internal governance through the channel of short selling. Using a simple model, we argue that the threat of short-selling attacks triggered by bad managerial actions pushes existing shareholders to better control management, either through improved internal governance or via enhanced equity compensation. Thus, short-selling-based discipline mechanisms are complementary with, instead of substituting for, internal governance.

We consistently find a significantly positive relationship between short-selling potential (our empirical proxy for the threat of short selling) and the ISS index (our empirical proxy for the quality of internal governance) in our empirical tests. The effect is stronger for firms that are more financially

constrained and in economies with less market-oriented institutions, such as civil-law systems, lower quality financial disclosure, poorer securities regulation protection, and less developed accounting standards.

In addition, short-selling potential increases the sensitivity of management compensation to performance and boosts the monitoring role of the board. All the results are robust to an instrumental variable specification in which ETF ownership is used as an instrument that affects the number of shares available to be lent in the market but is unrelated to (bad) information that may lead directly to short selling.

Finally, we show that short-selling potential in general enhances firm profitability (ROA). More importantly, we document that the part of internal governance that is directly explainable in terms of short selling enhances firm profitability.

Our results provide evidence in favor of the beneficial effect of the short-selling market on the corporate market. The relationship between short selling and internal governance – the threat of short selling causing investors to practice better internal governance – may help us better understand and regulate the contemporaneous development of financial markets and corporations.

References

Admati, A.R., Pfleiderer, P., 2009. The Wall Street walk and shareholder activism: Exit as a form of voice. Review of Financial Studies 22, 2645-2685.

Aggarwal, R., Erel, I., Ferreira, M., Matos, P., 2011. Does governance travel around the world? Evidence from institutional investors. Journal of Financial Economics 100, 154-181.

Aggarwal, R., Erel, I., Stulz, R., and Williamson, R., 2009. Differences in governance practices between US and foreign firms: measurement, causes, and consequences. Review of Financial Studies 22, 3131-3169.

Aitken, M., Frino, A., McCorry, M., Swan, P., 1998. Short sales are almost instantaneously bad news: Evidence from the Australian Stock Exchange. Journal of Finance 53, 2205-2223.

Armstrong, C., W. Guay, and J. Weber, 2010, The role of information and financial reporting in corporate governance and debt contracting, Journal of Accounting & Economics 50, 179 - 234.

Asquith, P., Meulbroek, L., 1995. An empirical investigation of short interest. Working Paper, M.I.T.

Asquith, P., Pathak, P., Ritter, J., 2005, Short interest, institutional ownership, and stock returns. Journal of Financial Economics78, 243–276.

Baker, M., Stein, J.C., Wurgler, J., 2003. When does the market matter? Stock prices and the investment of equity-dependent firms. Quarterly Journal of Economics 118, 969-1006.

Boehmer, E., Jones, C., Zhang, X., 2008. Which Shorts are Informed? Journal of Finance 63, 491-527.

Boehmer, E., Wu, J., 2010. Short selling and the price discovery process. Working paper, Oregon University.

Brav, A., Jiang, W., Partnoy, F., Thomas, R., 2008. Hedge fund activism, corporate governance, and firm performance. Journal of Finance 63, 1729-1776.

Bris, A., Goetzmann, W., Zhu, N., 2007. Efficiency and the bear: Short sales and markets around the world. Journal of Finance 62, 1029-1079.

Bushman, R., and A.J. Smith, 2001, Financial accounting information and corporate governance, Journal of Accounting & Economics 32, 237–333.

Chen, X., Harford, J., Li, K., 2007. Monitoring: Which institutions matter? Journal of Financial Economics 86, 279-305.

Claessens, S., Djankov, S., Lang, L., 2000. The separation of ownership and control in East Asian corporations. Journal of Financial Economics 58, 81-112.

Cohen, L., Diether, K., Malloy, C., 2007. Supply and demand shifts in the shorting market. Journal of Finance 62, 2061-2096.

Core, J. and W. Guay, 1999, The use of equity grants to manage optimal equity incentive levels, Journal of Accounting and Economics 28: 151-184.

Core, J. R., W. Holthausen, and D. F. Larcker, 1999, Corporate governance, chief executive officer compensation, and firm performance, Journal of Financial Economics 51, 371-406.

Cronqvist, H., Fahlenbrach, R., 2009. Large shareholders and corporate policies. Review of Financial Studies 22, 3941-3976.

Doidge, C., Karolyi, G.A., Stulz, R.M., 2007. Why do countries matter so much for corporate governance? Journal of Financial Economics 86, 1-39.

Dyck, A., Morse, A., Zingales, L., 2010, Who blows the whistle on corporate fraud? Journal of Finance 65, 2213-2253.

Edmans, A., 2009. Blockholder trading, market efficiency, and managerial myopia. Journal of Finance 64, 2481-2513.

Edmans, A., Fang, V., Zur, E., 2013. The effect of liquidity on governance. Review of Financial Studies, forthcoming.

Edmans, A, Goldstein, I., Jiang, W., 2011. Feedback effects and the limits to arbitrage. Working Paper.

Edmans, A, Goldstein, I., Jiang, W., 2012. The real effects of financial markets: The impact of prices on takeovers. Journal of Finance 67, 933-971.

Edmans, A., Manso, G., 2011. Governance through trading and intervention: A theory of multiple blockholders. Review of Financial Studies 24, 2395-2428.

Faure-Grimaud, A., Gromb, D., 2004. Public trading and private incentives. Review of Financial Studies 17, 985-1014.

Ferreira, M., Matos, P., 2008. The colors of investors' money: The role of institutional investors around the world? Journal of Financial Economics 88, 499-533.

Foster, F. D., and S. Viswanathan. 1993. The Effect of Public Information and Competition on Trading Volume and Price Volatility. Review of Financial Studies 6:23–56.

Franks, J., Mayer, C., Renneboog, L., 2001. Who disciplines management in poorly performing companies? Journal of Financial Intermediation 10, 209-249.

Greenwood, R., Schor, M., 2009. Investor activism and takeovers. Journal of Financial Economics 92, 362-375.

Hart, O.D., 1983. The market mechanism as an incentive scheme. Bell Journal of Economics 14, 366-382.

Himmelberg, C., Hubbard, R.G., Palia, D., 1999. Understanding the determinants of managerial ownership and the link between ownership and performance. Journal of Financial Economics 53, 353-384.

Hirshleifer, D., Teoh, S.H., Yu, J., 2011. Short arbitrage, return asymmetry and the accrual anomaly. Review of Financial Studies 24, 2429-2461.

Holderness, C., Kroszner, R., Sheehan, D., 1999. Were the good old days that good? Evolution of managerial stock ownership and corporate governance since the great depression. Journal of Finance 54, 435-469.

Holden, C. W., and A. Subrahmanyam. 1992. Long-lived Private Information and Imperfect Competition. Journal of Finance 47:247–70.

Iliev, P., Lowry, M., 2013. Are mutual funds active voters? Working paper.

Jain, A., Jain, P., McInish, T., McKenzie, M., 2012. Worldwide reach of short selling regulations. Journal of Financial Economics, forthcoming.

Kahn, C., Winton, A., 1998. Ownership structure, speculation, and shareholder intervention. Journal of Finance 53, 99-129.

Kaplan, S., Moskowitz, T., Sensoy, B., 2013. The effects of stock lending on security prices: an experiment. National Bureau of Economic Research, Working Paper.

Kaplan, S., Zingales, L., 1997. Do investment-cash flow sensitivities provide useful measures of financing constraints? Quarterly Journal of Economics 112, 169-215.

Karpoff, J., Lou, Z., 2010. Short sellers and financial misconduct. Journal of Finance 65, 1879-1913.

Kecskes, A., S. A. Mansi, and A. Zhang 2013, Are short sellers informed? Evidence from the bond market, Accounting Review 88, 611-639.

Klein, A., Zur, E., 2009. Entrepreneurial shareholder activism: Hedge funds and other private investors. Journal of Finance 64, 187-230.

Klein, A., Zur, E., 2011. The impact of hedge fund activism on the target firm's existing bondholders. Review of Financial Studies 24, 1735-1771.

Kyle, A. 1984. Market Structure, Information, Futures Markets, and Price Formation. In Gary G. Storey, Andrew Schmitz, and Alexander H. Sarris, (eds.), International Agricultural Trade: Advanced Readings in Price Formation, Market Structure, and Price Instability. Boulder, CO: Westview.

Kyle, A, 1985. Continuous auctions and insider trading. Econometrica 53, 1315-1335.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., 2006. What works in securities laws? Journal of Finance 61, 1-32.

Li, K., Ortiz-Molina, H., Zhao, X., 2008. do voting rights affect institutional investment decisions? evidence from dual-class firms. Financial Management 37, 713-745.

Massa, M., Zhang, B., Zhang, H., 2013. The invisible hand of short selling: Does short selling disciplines earnings manipulation? Working paper.

Maug, E., 1998. Large shareholders as monitors: Is there a tradeoff between liquidity and control? Journal of Finance 53, 65-98.

McCahery, J., Starks, L., Sautner, Z., 2010. Behind the scenes: The corporate governance preferences of institutional investors. Working Paper, University of Amsterdam.

Morck, R., Shleifer, A., Vishny, R., 1988. Management ownership and market valuation: An empirical analysis. Journal of Financial Economics 20, 293-315.

Parrino, R., Sias, R., Starks, L., 2003. Voting with their feet: Institutional ownership changes around forced CEO turnover. Journal of Financial Economics 68, 3-46.

Saffi, P., Sigurdsson, K., 2011. Price efficiency and short selling. Review of Financial Studies 24, 821-852.

Senchack, A.J., Starks, L., 1993. Short-sale restrictions and market reaction to short-interest announcements. Journal of Financial and Quantitative Analysis 28, 177-194.

Smith, E., 2013, Do shareholders want less governance?, working paper.

Staiger, D., Stock, J.H., 1997. Instrumental variables regression with weak instruments. Econometrica 65, 557-586.

Appendix A: The Model

We first explore an economy in which *N* short sellers compete with each other in trading the signal $\tilde{\delta}$ that they observe (i.e., we ignore the investor for the time being). Later, we will show that the trading behavior of the investor can be effectively treated as short selling. This equivalence can help us pin down the impact of real short selling on corporate governance. The following lemma summarizes the properties of an economy in which there are *N* short sellers trading the signal $\tilde{\delta}$.

Lemma 1: When each of the *N* short sellers observes the signal $\tilde{\delta}$ and trades competitively in Period 1, there exists a unique linear equilibrium characterized by the following properties:

1) the market price is $P_1^{'} = v - \delta_0 + \lambda(\sum_k \xi_k + u)$, where $\lambda = \sqrt{\frac{N}{(N+1)^2}\frac{\Sigma_0}{\sigma_u^2}}$ is a constant;
2) the optimal trading amount is $\xi_k^* = \alpha + \beta\tilde{\delta}$, where $\alpha = \frac{\delta_0}{(N+1)\lambda}$ and $\beta = -\frac{1}{(N+1)\lambda}$;
3) the precision of the market price increases in the degree of competition (N): when $\tilde{\delta} > \delta_0$, we have $\frac{\partial P_1'}{\partial N} < 0$; and
4) more lendable shares allow more short sellers to compete in the market and thus give rise to a higher degree of price efficiency: $N \le \frac{l^2}{(\tilde{\delta}-\delta_0)^2}\frac{\Sigma_0}{\sigma_u^2}$.

Proof (Lemma 1): Similar to Kyle (1985), we assume that the market maker follows a linear pricing function, $P_1^{'} = v - \delta_0 + \lambda(\sum_k \xi_k + u)$, based on the total order flows he observes. Based on this public information, as well as on the private information that $P_2^{'} = v - \tilde{\delta}$, the *k*th short seller maximizes

$$\pi_k = \xi_k\left(P_2^{'} - P_1^{'}\right) = \xi_k\left[v - \tilde{\delta} - \left(v - \delta_0 + \lambda\left(\xi_k + \sum\nolimits_{i\neq k}\xi_i + u\right)\right)\right]$$
$$= \xi_k\left[\delta_0 - \tilde{\delta} - \lambda(\xi_k + (N-1)\xi_i^* + u)\right]. \qquad (A1)$$

In the second line, we use the condition that in a symmetric equilibrium, $\sum_{i\neq k}\xi_i = (N-1)\xi_i^*$, because the rest of the $N-1$ short sellers will submit a similar order, which we denote as ξ_i^*. The first order condition (FOC) is $2\lambda\xi_k^* + \lambda(N-1)\xi_i^* = \delta_0 - \tilde{\delta}$ for the *k*th short seller, where ξ_k^* denotes her optimal trading amount. The FOC can be solved by observing that $\xi_k^* = \xi_i^*$. This leads to $\xi_k^* = \frac{\delta_0 - \tilde{\delta}}{(N+1)\lambda}$, which verifies property (2). In particular, if $N = 1$, we obtain the standard Kyle solution.

To solve for the constant λ, we note that, from the market maker's perspective, the private signal $\tilde{\delta}$ and the total order flow $X = \sum_k \xi_k + u = N\alpha + N\beta\tilde{\delta} + u$ are joint-normally distributed. Specifically, the vector $\left(\tilde{\delta},\ X\right)^T$ has the expected value $(\delta_0, 0)^T$ and the covariance matrix (Σ_0, $N\beta\Sigma_0$; $N\beta\Sigma_0$,

$N^2\beta^2\,\Sigma_0 + \sigma_u^2$). This allows the market to use the total order flow to update the value of the private signal as $E\left[\tilde{\delta}\middle|X\right] = \delta_0 + \frac{N\beta\Sigma_0}{N^2\beta^2\,\Sigma_0+\sigma_u^2}X$, which implies that $\lambda = \frac{-N\beta\Sigma_0}{N^2\beta^2\,\Sigma_0+\sigma_u^2}$. Because $\beta = -\frac{1}{(N+1)\lambda}$, one can verify that the value of λ is as specified in (1).

To obtain (3), we recognize that because $\xi_k^* = \frac{\delta_0-\tilde{\delta}}{(N+1)\lambda}$, $X = \sum_k \xi_k + u = \frac{N(\delta_0-\tilde{\delta})}{(N+1)\lambda} + u$. Plugging this expression back into the pricing kernel, we obtain $P_1^{'} = v - \delta_0 + \lambda X = v - \frac{N\tilde{\delta}+\delta_0}{N+1} + \lambda u$. Thus, when $\tilde{\delta} > \delta_0$, the stock is overpriced without short selling. In this case, an increase in *N* further pushes the price downward toward its real value.[15]

Finally, because $\xi_k^* = \frac{\delta_0-\tilde{\delta}}{(N+1)\lambda}$, the total amount of short selling is $\frac{N(\delta_0-\tilde{\delta})}{(N+1)\lambda}$, which must be less than l. Plugging $\lambda = \sqrt{\frac{N}{(N+1)^2}\frac{\Sigma_0}{\sigma_u^2}}$ into this expression leads to $N \le \frac{l^2}{\left(\tilde{\delta}-\delta_0\right)^2}\frac{\Sigma_0}{\sigma_u^2}$, as described in (4). Hence, other things being equal, the capacity of the lendable share market constrains the total number of non-cooperative traders. Q.E.D.■

Lemma 1 indicates that more competition among informed short sellers induces them to trade more aggressively in the aggregate, which causes more private information to be incorporated into the market price. For instance, when there is only one monopoly short seller, her optimal trading is $\xi_{N=1}^* = \frac{\delta_0-\tilde{\delta}}{2\lambda}$, which incorporates approximately half of her private signal into the market price in the single period model ($P_{1,N=1}^{'} = v - \frac{\tilde{\delta}+\delta_0}{2} + \lambda u$). Simply introducing another informed trader into the economy induces both traders to trade $\xi_{N=2}^* = \frac{\delta_0-\tilde{\delta}}{3\lambda}$ shares. While the demand from each trader is smaller than the monopoly demand, the aggregate demand is higher ($2 \times \xi_{N=2}^* = \frac{2(\delta_0-\tilde{\delta})}{3\lambda} > \xi_{N=1}^*$), which effectively reveals more private information to the market: $P_{1,N=2}^{'} = v - \frac{2\tilde{\delta}+\delta_0}{3} + \lambda u$ is closer to the true value of the firm, $v - \tilde{\delta}$, than $P_{1,N=1}^{'}$ is.

Likewise, competition from more short sellers increases the aggregate trading demand, which causes still more private information to be incorporated into the market price. The intuition behind this result is the most important one of the lemma: more competition in the short-selling market allows information to be more effectively incorporated into the price. While we demonstrate this intuition in a

[15] If $\tilde{\delta} < \delta_0$, the stock would have been underpriced without informed trading. As can easily be seen, from $P_1' = v - \frac{N\tilde{\delta}+\delta_0}{N+1} + \lambda u$, price efficiency still increases in *N*, except that short sellers actually buy the stock in this case.

one-period Kyle model, the same intuition holds in multi-period models, such as Holden and Subrahmanyam (1992).

Next, we move to the investor side. As can easily be seen, based on the model set-up described in the previous section, the investor's optimization problem can be expanded as follows:

$$Max_{K,e}\ C = C_1 \times q_1' + C_0 \times (1 - q_1') - K$$
$$= \underbrace{q_1'}_{\text{Prob for bad action to occur}} \times \Big(\underbrace{eP_1'}_{\text{Consumption from the Exit}} + \underbrace{(\eta - e)P_2'}_{\text{Consumption from the rest}} \Big) + \underbrace{\eta v(1 - q_1')}_{\text{Consumption; no bad action}} - \underbrace{K}_{\text{Governance Spending}}. \qquad (A2)$$

To maximize her consumption, the investor must derive two FOCs, one with respect to her governance spending, K, and one with respect to her sales of stocks in the first period, e. Let us first examine the second FOC:

$$\frac{\partial C}{\partial e} = 0 \Leftrightarrow \frac{\partial C_1 \times q_1' + C_0 \times (1 - q_1') - K}{\partial e} = 0 \Leftrightarrow \frac{\partial C_1}{\partial e} = 0.$$

That is, as consumption in the no-bad-action scenario (i.e., $C_0 \times (1 - q_1') - K$) is irrelevant to exit, maximization of total consumption with respect to first-period trading concentrates in the bad scenario. This allows us to explore her optimal exit strategy as follows.

Lemma 2: Suppose that when the bad action occurs, the investor optimally sells e shares of stock in the first period and holds the remaining $(\eta - e)$ shares until the second period; then:

1) her trading is equivalent to short selling $\xi_1 = -e$ shares of stock in the first period while holding the entire η shares of stock until the second liquidation period; and
2) the economy with one informed investor and $N - 1$ similarly informed short sellers resembles the economy with N short sellers, as described in Lemma 1.

Proof (Lemma 2): Optimal first-period sales can be achieved by maximizing expected consumption, conditional on the occurrence of the bad action, as follows:

$$Max_e \quad C_1 = eP_1' + (\eta - e)P_2' = e\left(P_1' - P_2'\right) + \eta P_2'$$
$$= (-e)\left(P_2' - P_1'\right) + \eta P_2' := \xi_1\left(P_2' - P_1'\right) + \eta P_2', \qquad (A3)$$

where the second line re-arranges terms and defines a new variable $\xi_1 = -e$. Equation (A3) demonstrates that consumption contains two elements: $\xi_1\left(P_2' - P_1'\right)$, which is equivalent to the profits that can be generated by short selling ξ_1 shares of stock, using our previous notation, and $\eta P_2'$, which is the payoff for holding all shares until the liquidation period. Equation (A3), in this regard, illustrates a very important accounting identity: any exit in the first period can be regarded as an effective short sale (to be covered in the second period).

Even more important, the maximization problem of (A3) with respect to ξ_1 is equivalent to the maximization problem of (A1), where the short seller tries to maximize $\pi_k = \xi_k\left(P_2^{'} - P_1^{'}\right)$ with respect to ξ_k. Because the investor in (A3) and the short seller in (A1) have exactly the same information set, their optimal trading solutions should also be the same. Hence, the property derived in Lemma 1 can be directly applied to the maximization problem of (A3). This property in general holds when the investor and the short sellers have similar utility functions.

In this case, when the investor is the monopoly informed trader in the market, her optimal strategy converges to that of the monopoly short seller of Lemma 1 ($N = 1$). Likewise, when there are, in addition to the investor, $N - 1$ short sellers, we can effectively treat the investor as the first "effective" short seller and rank the $N - 1$ real short sellers as the second to the N-th effective short seller in the market. In this regard, the characteristics of the economy converge to the "N-short seller" case, as described in Lemma 1.[16] Q.E.D.■

This lemma demonstrates that an informed "exit" in the first period can be regarded as an informed short sale over the same period. While this property is nothing more than a simple accounting identity, it can significantly simplify our intuition regarding the impact of introducing short selling into the economy.

In particular, when there are $N - 1$ short sellers, in addition to the investor, we can effectively count the investor as a short seller and treat the economy as having N symmetric short sellers. In this case, the optimal amount of exit is $-e^* = \xi_1^* = \xi_{k\in 2,\dots,N}^* = \xi_N^* = -\frac{\delta_0 - \tilde{\delta}}{(N+1)\lambda}$, where $\xi_{k\in 2,\dots,N}^*$ refers to the optimal demand from any of the real short sellers, and the stock price becomes $P_1^{'}(e^*, \xi_{k\in 2,\dots,N}^*) = v - \delta_0 + \lambda X = v - \frac{N\tilde{\delta}+\delta_0}{N+1} + \lambda u$.

With this intuition in mind, we can now examine the remaining FOC with respect to governance spending. The main property is summarized in Proposition 1. Here we provide the proof.

Proof (Proposition 1): The optimal amount of governance spending can be derived from the following problem:

$$Max_{K,e^*}\, C = C_1 \times q_1^{'} + C_0 \times \left(1 - q_1^{'}\right) - K$$
$$= \left(\xi_1^*\left(\delta_0 - \tilde{\delta} - \lambda\left(\xi_1^* + (N-1)\xi_{k\in 2,\dots,N}^* + u\right)\right) + \eta\left(v - \tilde{\delta}\right)\right) \times q_1^{'} + \eta v\left(1 - q_1^{'}\right) - K$$

[16] The only exception is property (4), as the total supply of lendable shares affects real short selling rather than the exit of the investor. When there are $N - 1$ real short sellers, the total demand for lendable shares is $\frac{(N-1)(\delta_0 - \tilde{\delta})}{(N+1)\lambda}$. Plugging in $\lambda = \sqrt{\frac{N}{(N+1)^2}\frac{\Sigma_0}{\sigma_u^2}}$ leads to the constraint that N must satisfy: $\frac{(N-1)^2}{N} \leq \frac{l^2}{\left(\tilde{\delta} - \delta_0\right)^2}\frac{\Sigma_0}{\sigma_u^2}$.

$$= \eta v + \left(-\eta\tilde{\delta} + \xi_1^*\left(\delta_0 - \tilde{\delta}\right) - \lambda\xi_1^*\left(\xi_1^* + (N-1)\xi_{k\in 2,\ldots,N}^*\right)\right) \times q_1^{'} - K,$$

$$= \eta v + \left(\underbrace{-\eta\tilde{\delta}}_{\substack{\text{Consumption} \\ \text{loss due to } \tilde{\delta}}} + \underbrace{\frac{\left(\delta_0 - \tilde{\delta}\right)^2}{(N+1)\sqrt{N}}\sqrt{\frac{\sigma_u^2}{\Sigma_0}}}_{\substack{\text{Consumption gain due to} \\ \text{informed trading}}} \right) \times q_1' - K, \qquad A(4)$$

where we incorporate the optimal equilibrium price from Lemma 1 into the second line and rearrange terms in the third line (we also omit the noise trading term in the third line because it does not affect expected consumption when the investor makes governance investment decisions). In the final line, we rewrite the trading variables as a function of competition, as derived from Lemma 1 ($\xi_1^* = \xi_{k\in 2,\ldots,N}^* = \frac{\delta_0 - \tilde{\delta}}{(N+1)\lambda}$ and $= \sqrt{\frac{N}{(N+1)^2}\frac{\Sigma_0}{\sigma_u^2}}$).[17]

The economic interpretation of (A4) is straightforward. The ηv term describes the general consumption of investors in the absence of value-destroying actions. The two elements in brackets capture the effects of the bad action (which occurs with probability $q_1^{'}$) on consumption. The first element describes the general consumption loss when firm value is destroyed. The second element describes the consequence of trading in the first period. The trading is in general profitable because the investor is informed. [18] However, the consumption loss should dominate the trading gain (i.e., $G(N) < 0$), as otherwise the investor and manager can collude by using the bad action to manipulate the stock price; we exclude such manipulations from our model. [19] To simplify the notation, we can define a new variable $D(N) = \eta\tilde{\delta} - \frac{\left(\delta_0 - \tilde{\delta}\right)^2}{(N+1)\sqrt{N}}\sqrt{\frac{\sigma_u^2}{\Sigma_0}}$ to describe the net damage or consumption loss due to the bad action. It is easily checked that competition increases the net damage (i.e., $D_N'(N) \equiv \frac{\partial D(N)}{\partial N} > 0$).

Overall, equation (A4) demonstrates that the bad action reduces the consumption of the investor by destroying the liquidation value of the firm. Meanwhile, because the market does not know the real value destroyed, the investor can engage in informed trading to generate some profits to partially offset her consumption loss. Hence, increased competition makes it more difficult for the investor to recover her consumption loss. This incentivizes the investor to invest in governance to reduce the probability that the bad action occurs in the first place.

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[17] To be more specific, $\xi_1^*\left(\delta_0 - \tilde{\delta}\right) - \lambda N{\xi_1^*}^2 = \frac{\left(\delta_0 - \tilde{\delta}\right)^2}{(N+1)\lambda} - \frac{N\left(\delta_0 - \tilde{\delta}\right)^2}{(N+1)^2\lambda} = \frac{\left(\delta_0 - \tilde{\delta}\right)^2}{(N+1)^2\lambda} = \frac{\left(\delta_0 - \tilde{\delta}\right)^2}{(N+1)\sqrt{N}}\sqrt{\frac{\sigma_u^2}{\Sigma_0}}$.

[18] The *ex ante* value of the trading profits is $\sqrt{\Sigma_0\sigma_u^2}/(N+1)\sqrt{N}$ (recall that $E[\left(\delta_0 - \tilde{\delta}\right)^2] = \Sigma_0$), which increases in the *ex ante* information asymmetry between the investor and the market (Σ_0), decreases in competition, and increases in the level of liquidity supply from the noise trader (σ_u^2).

[19] This implies an additional constraint on the parameter sets that we implicitly assume in the model. When N is large, this constraint is trivially satisfied, as the trading gain decreases rapidly in competition.

To explore the optimal governance investment policy, we can use $q_1' = q_1 - q(K)$ to rewrite consumption as $C = \eta v - D(N) \times q_1' - K = \eta v - D(N)q_1 + G(N) \times q(K) - K$. Because K affects neither ηv nor $G(N)q_1$, the maximization problem, as well as its FOC, can be written as follows:

$$Max_K\ C = \eta v - D(N)q_1 + D(N)q(K) - K; \Leftrightarrow Max_K\ C' = D(N)q(K) - K;$$

$$\Rightarrow FOC: \quad D(N)q_K'(K^*) - 1 = 0. \qquad (A5)$$

The first line indicates that the investor faces a tradeoff between her governance spending and the net damage saved as a result of the spending. The second line is the FOC from which the investor can compute her optimal governance spending (denoted as K^*). Because the second-order derivative of consumption with respect to K is negative, K^* maximizes the consumption of the investor.

More importantly, when competition increases, the overall consumption loss (due to the bad managerial action) increases. This fact should incentivize the investor to invest more in corporate governance. To verify this intuition, we can differentiate both sides of equation (A5), which leads to $D_N' dN q_K' + D q_K'' dK^* = 0$. This implies that $\frac{dK^*}{dN} = \frac{D'(N)/D(N)}{-q_K''(K^*)/q_K'(K^*)} > 0$.

The impact of short selling on governance spending is intuitive. The numerator, $D'(N)/D(N)$, can be interpreted as the marginal impact of competition on the net damage. A higher marginal impact, which implies a larger net consumption loss from the bad managerial action, induces the investor to invest more in governance to prevent the bad action from occurring. The denominator, $-q_K''(K^*)/q_K'(K^*)$, describes the degree of diseconomies of scale in governance investments. The higher the degree of diseconomies of scale, the less the investor invests in governance. Most importantly, because the derivative is positive, an increase in short selling competition increases the optimal amount of capital that the investor should invest in internal governance. Q.E.D.■

Below, we prove the two corollaries as well as Proposition 2.

Proof (Corollary 1): To demonstrate the average effect, we can define $\overline{D} = E[D(N)]$ as the unconditional average or expected net consumption loss. Thus, $\overline{D} = \eta\delta_0 - \frac{1}{(N+1)\sqrt{N}}\sqrt{\Sigma_0 \sigma_u^2}$. In this case, the FOC of (A5), $G(N)q_K' + 1 = 0$, implies that $\overline{D}q_K' = 1$. For equity-dependent firms, the net consumption loss comes from two sources: price competition and the additional damage that price competition does to the value of the firm by increasing its cost of capital. This intuition is captured by the following derivative, in which we assume that the value of δ_0 varies across firms: $d\overline{D} = \overline{D}_N' dN + \overline{D}_{\delta_0}' d\delta_0$, where $\overline{D}_{\delta_0}'$ is the first order derivative of $\overline{D}$ with respect to δ_0. Furthermore, for equity-dependent firms, we can assume that $d\delta_0 = -s' dP_1'$, where $s' > 0$ describes the degree of equity dependence, i.e., the sensitivity of additional value damage to price drops (i.e., negative price changes

damage firm value). Because competition negatively affects price, we can further derive $d\delta_0 = -s' \frac{\partial P_1'}{\partial N} dN \equiv sdN$, where the coefficient $s = -s' \frac{\partial P_1'}{\partial N} > 0$ describes the sensitivity of the value of the firm to competition (strong competition causes greater value damage due to lower price).

Differentiating both sides of $\overline{D} q_K' = 1$, we have $dDq_K' + Dd(q_K') = \left(\overline{D}_N' dN + \overline{D}_{\delta_0}' d\delta_0\right) q_K' + Dq_K'' dK = \left(\overline{D}_N' + \overline{D}_{\delta_0}' s\right) dN \times q_K' + Dq_K'' dK = 0$. This can be used to derive the impact of competition on the optimal governance investment as $\frac{dK^*}{dN} = \frac{\left(\overline{D}_N' + \overline{D}_{\delta_0}' s\right)/D}{-q_K''(K^*)/q_K'(K^*)}$. Similarly to Proposition 1, $\frac{dK^*}{dN} > 0$, because $\overline{D}_N', \overline{D}_{\delta_0}', s, D, q_K'(K^*) > 0$ and $q_K''(K^*) < 0$. The difference is that $\frac{dK^*}{dN}$ is now further affected by equity dependence, $\overline{D}_{\delta_0}' s$. Easy to see, $\frac{dK^*}{dN}$ increases in s (i.e., $\frac{d^2K^*}{dNds} > 0$). Hence, equity dependence increases the incentive for the investor to invest in governance when competition is high. Q.E.D.■

Proof (Corollary 2): The net loss for firms in countries with better country-level governance also deviates from its average, which can be written as $d\overline{D} = \overline{D}_N' dN + \overline{D}_{\delta_0}' d\delta_0$. The difference is that, conditional on the same level of competition, better country-level governance imposes another layer of protection of shareholder value. Hence, without loss of generality, we can assume that $d\delta_0 = -s(g)dN$, where g is country governance (a higher value means better governance) and $s(g)$ is shareholder value that can be protected by country governance at any given level of competition, which is an increasing function of country governance. In this case, $\frac{dK^*}{dN} = \frac{\left(\overline{D}_N' - \overline{D}_{\delta_0}' s(g)\right)/D}{-q_K''(K^*)/q_K'(K^*)}$. Thus, any improvements in country governance reduce the impact of competition on optimal firm governance investment. Q.E.D.■

Proof (Proposition 2): Assume that the investor can choose to pay ω_2 shares of stock to the manager in the liquidation period (in addition to any normal cash payments that are not modeled here) after she observes the value that could be destroyed (i.e., $\tilde{\delta}$) but before the manager takes the value-destroying action. In this case, if no bad action is taken, the manager receives $f_0 = \omega_2 P_2 = \omega_2 v$ as his compensation. When the manager takes the bad action, he enjoys some private benefit β but bears the cost of a lower price in the second period: $f_1 = \beta + \omega_2 P_2' = \beta + \omega_2(v - \tilde{\delta})$. Thus, the bad action will be taken, provided $\tilde{\delta} < \frac{\beta}{\omega_2}$. In this case, the probability that the bad action occurs is $q_1 = \int^{\delta_m} g(\tilde{\delta}) d\tilde{\delta}$, where $\delta_m = \frac{\beta}{\omega_2}$ and $g(\tilde{\delta})$ is the probability density function of $\tilde{\delta}$.

Applying the principle of differentiation integrations (i.e., $\frac{\partial}{\partial b}\int_a^b f(x)dx = f(b)$), we see that q_1 increases in δ_m (i.e., $\frac{\partial q_1}{\partial \delta_m} = g(\delta_m) > 0$). Hence, an increase in equity compensation, ω_2, indeed reduces the probability that the manager will take the bad action through the negative effect on δ_m. This benefit, however, comes at a cost. Assuming that the cost is proportional to ownership, we can write the cost as $K = \omega_2 v\eta(1 - q_1) + \omega_2(v - \tilde{\delta})\eta q_1 = \omega_2(v - \tilde{\delta}q_1)\eta$. Hence, the investor solves the following optimization problem (conditional on her optimal trading strategy), which is in spirit very similar to (A5):

$$Max_{\omega_2}\, C = \eta v - D(N) \times q_1(\omega_2) - K(\omega_2). \qquad (A6)$$

The FOC for this problem is $D(N)\frac{\partial q_1(\omega_2)}{\partial \omega_2} + \frac{\partial K(\omega_2)}{\partial \omega_2} = 0$. This is equivalent to $\frac{D(N)g\beta}{\omega_2^2} = (v - \tilde{\delta}q_1)\eta$, which allows us to solve for optimal CEO compensation as $\omega_2 = \sqrt{\frac{D(N)g\beta}{(v-\tilde{\delta}q_1)\eta}}$. The first order effect is that, as competition causes net consumption damage to increase, ω_2 increases accordingly. Note that the FOCs for equity compensation and optimal trading are separable, which implies that the two corollaries apply to equity compensation in the same way that they apply to internal governance. Q.E.D.■

Proposition 2 can be further extended by allowing an equity payment of ω_1 shares of stock at the first-period price (in addition to the ω_2 shares of stock paid on the liquidation date) as well as a simultaneous expenditure on equity compensation and internal governance. The Internet Appendix provides the details. In particular, the payment of ω_1 would further allow short selling to discipline managers based on its impact on the stock price, in the spirit of Admati and Pfleiderer (2009). Although the disciplining effect further improves the efficiency of equity compensation, the combined effects of ω_1 and ω_2 are imperfect. Hence, governance spending still makes its marginal contribution. Similarly, governance spending is also unlikely to be perfect. Hence, equity compensation can help maximize the consumption of the investor. In either case, the effects of competition from short selling, as described in Propositions 1 and 2, remain unchanged.

Appendix B: Variable Definitions

Variable	Acronym	Definition	Data Source
A. Firm-level variable			
A1. Short selling variables			
Lendable shares	*Lendable*	Annual average fraction of shares of a firm available to lend	Dataexplorers
ETF ownership	*ETF*	Annual average holdings by ETF as a percentage of total number of outstanding shares	FactSet
A2. Corporate governance variables			
Corporate governance index	*CGI*	RiskMetrics's composite corporate governance index based on 41 firm-level governance attributes across four broad subcategories: board (24 attributes), audit (3 attributes), anti-takeover provisions (6 attributes), and compensation and ownership (8 attributes)	Aggarwal et al. (2011)
CEO equity compensation ratio	*CEOEqRatio*	Ratio of a CEO's equity, option, and LTIP compensation to the CEO's total compensation	BoardEx
CEO equity compensation	*CEOEqComTA*	Log of a CEO's equity, option, and LTIP compensation scaled by a firm's total assets	BoardEx
CEO total compensation	*CEOTotComTA*	Log of a CEO's total compensation scaled by a firm's total assets	BoardEx
Executive equity compensation ratio	*ExeEqRatio*	Ratio of top executives' average equity, option, and LTIP compensation to their total compensation	BoardEx
Executive equity compensation	*ExeEqComTA*	Log of top executives' average equity, option, and LTIP compensation scaled by a firm's total assets	BoardEx
Executive total compensation	*ExeTotComTA*	Log of top executives' average total compensation scaled by a firm's total assets	BoardEx
Busy board	*BoardBusy*	Average number of directorships of both public and private firms held by directors on the board.	BoardEx
Busy board dummy	*BoardBusyD*	A dummy variable which equals one if average number of directorships of both public and private firms held by directors on the board is larger than three	BoardEx
Board independence	*BoardInd*	Ratio of independent directors on the board	BoardEx
Board independence dummy	*BoardIndD*	A dummy variable which equals one if ratio of independent directors on the board is larger than 50%	BoardEx
Board size	*BoardSize*	Number of directors on the board	BoardEx
Board size dummy	*BoardSizeD*	A dummy varaible which equals one if number of directors one the board is greater than five but less than 16	BoardEx
A3. Control variables			
American Depository Receipts	*ADR*	An ADR dummy equals one if the firm was cross-listed on a U.S. stock exchange	Multiple sources**
Closely-held ownership	*CH*	Fraction of shares closely held by insiders and controlling shareholders	Worldscope
Firm size	*Size*	Log of total assets in U.S. $.	Datastream
Financial leverage	*Leverage*	Ratio of total debt to total assets	Worldscope
Return-on-asset ratio	*ROA*	Ratio of net income before extraordinary items plus interest expenses to total assets	Worldscope
Research and Development	*R&D*	Ratio of research and development expenses to total assets	Worldscope
Institutional ownership	*IO*	Aggregate equity holdings by institutional investors as a percentage of total number of outstanding shares	FactSet
Annual stock return	*Return*	Log of annual stock return	Datastream
Stock return volatility	*STD*	Annualized standard deviation of monthly stock returns	Datastream

** The information on U.S. cross-listings is gathered from three data sources: Depository banks (such as Bank of New York), U.S. stock exchanges and Datastream.

Appendix B: Variable Definitions - Continued

Variable	Acronym	Definition	Data Source
A4. Other variables			
KZ index	*KZ*	Kaplan and Zingales (1997)'s financial constraint index based on five variables: KZ=-1.002 cash flow-39.368 cash dividends-1.315 cash+3.139 leverage+0.283Q	Worldscope
Four-variable KZ index	*KZ4*	Kaplan and Zingales (1997)'s financial constraint index based on four variables: KZ=-1.002 cash flow-39.368 cash dividends-1.315 cash+3.139 leverage	Worldscope
Cash flows	*CF*	Cash flows scaled by total assets	Worldscope
Cash holdings	*Cash*	Cash and short-term investments scaled by total assets	Worldscope
Abnormal annual stock return	*AbnReturn*	Log of annual stock return adjusted by its country portfolio return	Datastream
Number of analysts following	*Analyst*	Number of financial analysts following a firm	IBES
News coverage	*NewsCoverage*	Log of one plus number of news realeases recorded in Dow Jones Newswire	RavenPack
Amihud's (2002) illiquidity	*Illiquidity*	Log of the average of daily Amihud's (2002) measure calculated as the absolute value of stock return divided by dollar trading volume on a given day	Datastream
B.Country-level variable			
Common law	*ComLaw*	A dummy variable that equals one when a country has common law legal origin	La Porta et al. (1998)
Disclosure requirement index	*DisReq*	Disclosure is the average score of six sub-indexes: prospectus delivering, insider compensations, large shareholder ownership, insider ownership, contracts outside the normal course of business, and related parties transactions. All these sub-indexes are dummy variables, and for each sub-index, the value of 1 is assigned to the index if it signifies high quality disclosure	La Porta et al. (2006)
Securities regulation index	*SecReg*	The score of securities regulation is calculated as the average of the disclosure requirement, liability standards, and public enforcement indexes	La Porta et al. (2006)
Accounting standard index	*AccSta*	The index examines and rates companies' 1990 annual reports on 90 items for 36 countries, covering general information, income statements, balance sheets, fund flow statements, accounting standards, stock data, and other special items.	La Porta et al. (1998)
Anti-director index	*AntiDir*	Anti-director index	Pagano and Volpin (2005)

Appendix C: Number of Stocks by Country and Year

This table summarizes the number of our sample stocks for each country over the 2003 to 2009 sample period. The first column reports the name of the country. Column "N" reports the total number of stocks across all sample periods for each country. The rest of the columns report the number of stocks in each year.

Country	N	2003	2004	2005	2006	2007	2008	2009
Australia	1,120	163	255	333	387	552	880	784
Austria	61	17	29	30	40	50	55	51
Belgium	108	28	42	53	71	79	93	92
Canada	1,079	173	238	351	609	707	802	781
Denmark	122	22	30	42	68	93	102	97
Finland	103	31	45	64	71	88	95	91
France	553	184	221	251	305	394	460	421
Germany	584	135	164	242	361	402	471	404
Greece	57	2	22	3	4	30	34	44
Hong Kong	515	90	117	177	200	275	441	432
Ireland	51	20	23	27	27	33	40	40
Italy	303	96	136	163	199	225	250	241
Japan	2,699	1,467	1,611	1,827	2,024	2,247	2,353	2,276
Netherlands	126	57	73	76	95	98	96	91
New Zealand	59	12	19	25	28	29	45	41
Norway	178	27	44	62	87	109	128	126
Portugal	38	11	14	17	25	29	31	33
Singapore	293	51	66	94	112	145	227	238
Spain	139	57	68	82	92	108	119	116
Sweden	275	65	101	125	148	207	228	221
Switzerland	245	78	126	160	182	197	212	206
United Kingdom	1,430	609	653	652	821	906	886	826
United States	5,312	1,185	3,442	3,772	3,994	3,956	4,088	4,006
All	15,450	4,580	7,539	8,628	9,950	10,959	12,136	11,658

Table 1: Summary Statistics

This table presents the summary statistics and Pearson correlation coefficients of the main variables used in this study. The variables are corporate governance index (*CGI*), CEO equity compensation ratio (*CEOEqRatio*), lendable shares (*Lendable*), American Depository Receipts (*ADR*), closely-held ownership (*CH*), log of firm size (*Size*), financial leverage (*Leverage*), return-on-asset ratio (*ROA*), research and development expenses (*R&D*), institutional ownership (*IO*), log of annual stock return (*Return*), and stock return volatility (*STD*). Panel A reports the number of observations (N), mean, median, standard deviation (STD), and deciles (90% and 10%) and quartiles (75% and 25%) distribution of the variables. Panel B reports the correlation coefficients among the variables above. The sample is between 2003 and 2009. All the variables are defined in Appendix A.

Panel A: Summary Statistics

Variable	N	Mean	STD	90%	75%	Median	25%	10%
CGI	20,957	0.561	0.132	0.732	0.659	0.561	0.463	0.366
CEOEqRatio	14,917	0.428	0.328	0.849	0.729	0.470	0.000	0.000
Lendable	65,450	0.063	0.090	0.198	0.083	0.022	0.004	0.000
ADR	65,450	0.033	0.179	0.000	0.000	0.000	0.000	0.000
CH	65,450	0.303	0.244	0.654	0.487	0.268	0.089	0.001
Size	65,277	13.366	2.068	16.114	14.596	13.247	11.990	10.813
Leverage	65,231	0.207	0.192	0.477	0.329	0.171	0.030	0.000
ROA	64,051	0.026	0.146	0.136	0.083	0.041	0.009	-0.085
R&D	65,424	0.024	0.065	0.073	0.015	0.000	0.000	0.000
IO	64,923	0.257	0.291	0.767	0.393	0.133	0.029	0.000
Return	62,999	-0.039	0.632	0.576	0.313	0.057	-0.290	-0.818
STD	65,262	0.408	0.301	0.716	0.501	0.334	0.230	0.167

Table 1: Summary Statistics – Continued

Panel B: Correlation Coefficients											
Variable	*CGI*	*CEOEqRatio*	*Lendable*	*ADR*	*CH*	*Size*	*Leverage*	*ROA*	*R&D*	*IO*	*Return*
CEOEqRatio	0.411										
Lendable	0.269	0.169									
ADR	-0.076	-0.087	0.103								
CH	-0.331	-0.297	-0.240	-0.082							
Size	-0.056	0.213	0.263	0.185	-0.064						
Leverage	0.012	0.037	0.042	0.010	0.013	0.298					
ROA	0.035	0.019	0.093	-0.005	0.059	0.209	0.030				
R&D	0.038	0.063	0.013	0.026	-0.068	-0.240	-0.183	-0.358			
IO	0.563	0.440	0.432	-0.029	-0.275	0.213	0.023	0.087	0.070		
Return	-0.053	-0.018	-0.017	-0.006	0.041	0.039	-0.010	0.217	-0.083	-0.008	
STD	0.021	-0.073	-0.106	-0.012	-0.007	-0.361	-0.073	-0.268	0.178	-0.064	0.037

Table 2: Short Selling and Corporate Governance

This table presents a panel regression of a firm's corporate governance index (*CGI*) on lendable shares (*Lendable*), and firm-level control variables (*X*) in addition to unreported industry-, country-, and year-fixed effects (ICY) on the full samples and different subsamples. The regression model is

$$CGI_{i,t+1} = \alpha + \beta_1 Lendable_{i,t} + \beta_2 X_{i,t} + \varepsilon_{i,t},$$

where $Lendable_{i,t}$ refers to the fraction of shares of a firm available to lend and $X_{i,t}$ includes American Depository Receipts (*ADR*), closely-held ownership (*CH*), log of firm size (*Size*), financial leverage (*Leverage*), return-on-asset ratio (*ROA*), research and development expenses (*R&D*), institutional ownership (*IO*), log of annual stock return (*Return*), and stock return volatility (*STD*). The construction of these variables is detailed in Appendix A. NUS refers to firms from non-US countries. Crisis refers to the global financial crisis period from 2007 to 2008, whereas Ex.Crisis excludes the global financial crisis period. *t*-statistics shown in parentheses are based on standard errors adjusted for heteroskedasticity and firm-level clustering. Obs denotes the number of firm-year observations, and AdjRsq is adjusted R^2. The sample period is from 2004 to 2008.

			US	NUS	Ex. Crisis	Crisis
Variable	Model	Model	Model	Model	Model	Model
	(1)	(2)	(3)	(4)	(5)	(6)
Lendable	**0.381**	**0.093**	**0.102**	**0.191**	**0.167**	**0.109**
	(30.73)	**(8.03)**	**(6.81)**	**(6.25)**	**(5.99)**	**(5.91)**
ADR		-0.001		0.019	-0.002	0.001
		(-0.17)		(4.72)	(-0.54)	(0.26)
CH		-0.047	-0.055	-0.021	-0.051	-0.039
		(-9.72)	(-8.27)	(-3.77)	(-9.64)	(-6.60)
Size		0.016	0.020	0.003	0.016	0.014
		(23.34)	(23.28)	(3.74)	(22.03)	(18.33)
Leverage		0.006	0.011	-0.001	0.008	0.003
		(1.02)	(1.36)	(-0.21)	(1.24)	(0.52)
ROA		0.018	0.007	0.033	0.020	0.011
		(2.32)	(0.80)	(2.25)	(2.28)	(1.09)
R&D		0.026	0.035	0.032	0.014	0.029
		(1.40)	(1.84)	(0.64)	(0.66)	(1.32)
IO		0.043	0.035	0.013	0.037	0.046
		(9.36)	(7.13)	(1.08)	(7.69)	(7.14)
Return		-0.007	-0.007	-0.002	-0.007	-0.004
		(-4.23)	(-3.55)	(-0.81)	(-3.62)	(-1.68)
STD		-0.003	0.007	-0.006	-0.010	0.014
		(-0.66)	(1.66)	(-0.93)	(-2.10)	(2.42)
Fixed Effects	ICY	ICY	ICY	ICY	ICY	ICY
Obs	20,957	20,407	13,781	6,626	11,908	8,499
AdjRsq	60.8%	67.1%	33.8%	73.9%	66.1%	67.4%

Table 3: Equity-market Dependence and Impact of SSP on Corporate Governance

This table presents a panel regression of a firm's corporate governance index (*CGI*) on lendable shares (*Lendable*), its interaction with investor horizon (equity-market dependence), and firm-level control variables (*X*) in addition to unreported industry-, country-, and year-fixed effects (ICY). The regression model is

$$CGI_{i,t+1} = \alpha + \beta_1 Lendable_{i,t} \times Dependence_{i,t} + \beta_2 Lendable_{i,t} + \beta_3 Dependence_{i,t} + \beta_4 X_{i,t} + \varepsilon_{i,t},$$

where $Lendable_{i,t}$ refers to the fraction of shares of a firm available to lend; $Dependence_{i,t}$ refers to equity-market dependence proxied by KZ index (*KZ*), four-variable KZ index (*KZ4*), cash flows (*CF*), cash holdings (*Cash*), and financial leverage (*Leverage*) in the next columns; and $X_{i,t}$ includes American Depository Receipts (*ADR*), closely-held ownership (*CH*), log of firm size (*Size*), financial leverage (*Leverage*), return-on-asset ratio (*ROA*), research and development expenses (*R&D*), institutional ownership (*IO*), log of annual stock return (*Return*), and stock return volatility (*STD*). The construction of these variables is detailed in Appendix A. *t*-statistics shown in parentheses are based on standard errors adjusted for heteroskedasticity and firm-level clustering. Obs denotes the number of firm-year observations, and AdjRsq is adjusted R^2. The sample period is from 2004 to 2008.

	KZ	*KZ4*	*CF*	*Cash*	*Leverage*
Variable	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
Lendable	**0.047**	**0.060**	**0.107**	**0.085**	**0.071**
	(3.11)	**(4.75)**	**(7.76)**	**(6.49)**	**(5.09)**
*Lendable*Dependence*	**0.030**	**0.030**	**-0.138**	**-0.097**	**0.105**
	(3.08)	**(3.29)**	**(-1.98)**	**(-2.67)**	**(2.96)**
Dependence	0.012	0.005	0.054	-0.004	-0.003
	(4.49)	(1.08)	(2.64)	(-0.51)	(-0.45)
ADR	-0.003	-0.002	-0.001	-0.002	-0.001
	(-0.62)	(-0.47)	(-0.26)	(-0.47)	(-0.20)
CH	-0.059	-0.059	-0.047	-0.059	-0.047
	(-11.57)	(-11.67)	(-9.78)	(-11.61)	(-9.75)
Size	0.017	0.017	0.016	0.017	0.016
	(22.66)	(21.68)	(23.37)	(21.73)	(23.41)
Leverage	-0.059	-0.040	0.007	-0.017	
	(-5.67)	(-2.22)	(1.28)	(-2.63)	
ROA	0.009	0.015	-0.015	0.006	0.019
	(1.16)	(1.72)	(-0.83)	(0.79)	(2.38)
R&D	0.024	0.033	-0.003	0.021	0.026
	(1.28)	(1.63)	(-0.14)	(1.11)	(1.40)
IO	0.027	0.028	0.042	0.029	0.043
	(5.56)	(5.86)	(9.25)	(5.96)	(9.32)
Return	-0.011	-0.007	-0.007	-0.007	-0.007
	(-6.21)	(-4.26)	(-4.26)	(-4.35)	(-4.19)
STD	-0.011	-0.011	-0.004	-0.009	-0.003
	(-2.66)	(-2.51)	(-1.01)	(-2.13)	(-0.70)
Fixed Effects	ICY	ICY	ICY	ICY	ICY
Obs	17,526	17,535	20,326	17,616	20,407
AdjRsq	69.3%	69.1%	67.3%	69.0%	67.1%

Table 4: Institutions, Short Selling, and Corporate Governance

This table presents a panel regression of a firm's corporate governance index (*CGI*) on lendable shares (*Lendable*), and firm-level control variables (*X*) in addition to unreported industry-, country-, and year-fixed effects (ICY) by splitting countries into high or low institutions. The regression model is

$$CGI_{i,t+1} = \alpha + \beta_1 Lendable_{i,t} + \beta_2 X_{i,t} + \varepsilon_{i,t},$$

where $Lendable_{i,t}$ refers to fraction of shares of a firm available to lend and $X_{i,t}$ includes American Depository Receipts (*ADR*), closely-held ownership (*CH*), log of firm size (*Size*), financial leverage (*Leverage*), return-on-asset ratio (*ROA*), research and development expenses (*R&D*), institutional ownership (*IO*), log of annual stock return (*Return*), and stock return volatility (*STD*). The sample is split into the following subsamples by using institution variables: common law (*ComLaw*), disclosure requirement index (*DisReq*), securities regulation index (*SecReg*), accounting standard index (*AccSta*), and anti-director index (*AntiDir*).The construction of these variables is detailed in Appendix A. *t*-statistics shown in parentheses are based on standard errors adjusted for heteroskedasticity and firm-level clustering. Obs denotes the number of firm-year observations, and AdjRsq is adjusted R^2. The sample period is from 2004 to 2008.

	ComLaw		*DisReq*		*SecReg*		*AccSta*		*AntiDir*	
	Yes	No	High	Low	High	Low	High	Low	High	Low
Variable	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)	Model (7)	Model (8)	Model (9)	Model (10)
Lendable	**0.099**	**0.242**	**0.094**	**0.231**	**0.097**	**0.225**	**0.098**	**0.231**	**0.095**	**0.297**
	(7.26)	**(5.05)**	**(7.91)**	**(2.53)**	**(7.35)**	**(5.10)**	**(7.41)**	**(4.28)**	**(7.91)**	**(3.99)**
Diff in Lendable	**0.143**		**0.137**		**0.128**		**0.133**		**0.202**	
[p-value]	**[0.004]**		**[0.133]**		**[0.005]**		**[0.017]**		**[0.007]**	
ADR	-0.005	0.025	-0.007	0.035	-0.002	0.022	-0.001	0.030	-0.010	0.025
	(-0.66)	(5.35)	(-1.54)	(3.96)	(-0.26)	(4.09)	(-0.22)	(5.60)	(-1.97)	(3.87)
CH	-0.056	-0.006	-0.047	-0.012	-0.056	0.001	-0.056	-0.000	-0.049	-0.009
	(-9.42)	(-1.05)	(-9.06)	(-0.98)	(-9.86)	(0.19)	(-9.82)	(-0.01)	(-9.06)	(-0.88)
Size	0.019	0.002	0.017	0.005	0.018	0.001	0.018	-0.000	0.017	0.006
	(23.90)	(1.91)	(23.24)	(2.56)	(24.31)	(0.55)	(24.35)	(-0.13)	(23.33)	(3.53)
Leverage	0.012	-0.003	0.006	0.005	0.012	-0.002	0.012	-0.001	0.005	0.003
	(1.64)	(-0.57)	(0.95)	(0.32)	(1.73)	(-0.32)	(1.65)	(-0.19)	(0.86)	(0.20)
ROA	0.012	0.022	0.014	0.049	0.016	0.007	0.014	0.003	0.013	0.040
	(1.43)	(1.21)	(1.77)	(2.00)	(1.88)	(0.38)	(1.73)	(0.18)	(1.58)	(1.67)
R&D	0.034	0.033	0.018	0.123	0.035	0.025	0.035	0.002	0.019	0.106
	(1.81)	(0.66)	(0.98)	(1.92)	(1.89)	(0.46)	(1.89)	(0.04)	(1.07)	(1.55)
IO	0.037	0.010	0.042	0.021	0.037	0.007	0.037	0.002	0.041	0.008
	(7.75)	(0.60)	(9.02)	(0.92)	(7.92)	(0.39)	(7.87)	(0.12)	(8.93)	(0.35)
Return	-0.006	-0.006	-0.007	-0.004	-0.006	-0.005	-0.006	-0.004	-0.006	-0.012
	(-3.33)	(-2.55)	(-4.09)	(-0.77)	(-3.53)	(-2.18)	(-3.58)	(-1.62)	(-3.85)	(-2.10)
STD	0.005	0.001	-0.001	0.021	0.005	-0.011	0.005	-0.006	0.000	0.009
	(1.16)	(0.12)	(-0.35)	(1.34)	(1.13)	(-1.56)	(1.11)	(-0.83)	(0.11)	(0.60)
Fixed Effects	ICY	ICY	ICY	ICY	ICY	ICY	ICY	ICY	ICY	ICY
Obs	15,550	4,857	18,988	1,419	16,268	4,139	16,199	4,208	18,462	1,945
AdjRsq	43.1%	52.7%	65.6%	49.7%	48.6%	56.4%	47.8%	55.1%	65.1%	49.1%

Table 5: Short Selling and Managerial Equity Compensation

This table presents a panel regression of a firm's managerial equity compensation (*MEC*) on lendable shares (*Lendable*), and firm-level control variables (*X*) in addition to unreported industry-, country-, and year-fixed effects (ICY) on the full samples and different subsamples. The regression model is

$$MEC_{i,t+1} = \alpha + \beta_1 Lendable_{i,t} + \beta_2 X_{i,t} + \varepsilon_{i,t},$$

where $MEC_{i,t+1}$ refers to CEO equity compensation ratio (*CEOEqRatio*) in Panel A, log value of CEO equity compensation (*CEOEqComTA*) in Panel B, executive equity compensation ratio (*ExeEqRatio*) in Panel C, and log value of executive equity compensation (*ExeEqCom*) in Panel D, $Lendable_{i,t}$ refers to the fraction of shares of a firm available to lend; and $X_{i,t}$ includes American Depository Receipts (*ADR*), closely-held ownership (*CH*), log of firm size (*Size*), financial leverage (*Leverage*), return-on-asset ratio (*ROA*), research and development expenses (*R&D*), institutional ownership (*IO*), log of annual stock return (*Return*), and stock return volatility (*STD*). The construction of these variables is detailed in Appendix A. NUS refers to firms from non-US countries. Crisis refers to the global financial crisis period from 2007 to 2008, whereas Ex.Crisis excludes the global financial crisis period. *t*-statistics shown in parentheses are based on standard errors adjusted for heteroskedasticity and firm-level clustering. Obs denotes the number of firm-year observations, and AdjRsq is adjusted R^2. The sample period is from 2003 to 2009.

Panel A: CEO equity compensation ratio (*CEOEqRatio*)					
		US	NUS	Ex. Crisis	Crisis
Variable	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
Lendable	**0.499**	**0.376**	**0.451**	**0.536**	**0.259**
	(12.10)	**(4.79)**	**(6.20)**	**(5.45)**	**(4.48)**
ADR	0.028		0.046	0.018	0.045
	(1.82)		(2.93)	(1.01)	(1.81)
CH	-0.116	-0.157	-0.075	-0.118	-0.130
	(-6.77)	(-5.78)	(-3.75)	(-6.12)	(-5.65)
Size	0.027	0.028	0.024	0.028	0.024
	(11.57)	(8.03)	(7.89)	(10.74)	(7.82)
Leverage	0.016	0.037	-0.019	0.012	0.024
	(0.84)	(1.44)	(-0.72)	(0.58)	(0.93)
ROA	-0.018	-0.009	-0.027	-0.030	0.021
	(-0.68)	(-0.22)	(-0.75)	(-0.87)	(0.50)
R&D	0.293	0.360	0.200	0.292	0.306
	(4.56)	(3.90)	(2.23)	(3.79)	(3.47)
IO	0.067	0.063	0.080	0.057	0.122
	(4.73)	(4.04)	(2.43)	(3.92)	(4.73)
Return	0.038	0.035	0.040	0.027	0.062
	(6.27)	(3.72)	(5.24)	(3.49)	(6.60)
STD	-0.009	-0.042	0.019	0.010	-0.057
	(-0.63)	(-1.73)	(1.02)	(0.62)	(-2.70)
Fixed Effects	ICY	ICY	ICY	ICY	ICY
Obs	14,523	9,087	5,436	9,313	5,210
AdjRsq	42.6%	14.6%	24.3%	34.6%	54.5%

Table 5: Short Selling and Managerial Equity Compensation – Continued

Panel B: CEO equity compensation (*CEOEqComTA*)					
		US	NUS	Ex. Crisis	Crisis
Variable	Model	Model	Model	Model	Model
	(1)	(2)	(3)	(4)	(5)
Lendable	**1.362**	**1.857**	**2.455**	**2.746**	**1.058**
	(5.93)	**(5.74)**	**(4.37)**	**(5.95)**	**(3.25)**
Control Variables	Yes	Yes	Yes	Yes	Yes
Fixed Effects	ICY	ICY	ICY	ICY	ICY
Obs	10,837	8,052	2,785	6,868	3,969
AdjRsq	60.6%	58.3%	62.5%	60.7%	61.1%

Panel C: Executive equity compensation ratio (*ExeEqRatio*)					
		US	NUS	Ex. Crisis	Crisis
Variable	Model	Model	Model	Model	Model
	(1)	(2)	(3)	(4)	(5)
Lendable	**0.266**	**0.289**	**0.102**	**0.143**	**0.016**
	(8.28)	**(4.00)**	**(2.20)**	**(2.45)**	**(0.32)**
Control Variables	Yes	Yes	Yes	Yes	Yes
Fixed Effects	ICY	ICY	ICY	ICY	ICY
Obs	17,462	9,368	8,094	11,113	6,349
AdjRsq	52.0%	14.5%	18.0%	45.8%	61.8%

Panel D: Executive equity compensation (*ExeEqComTA*)					
		US	NUS	Ex. Crisis	Crisis
Variable	Model	Model	Model	Model	Model
	(1)	(2)	(3)	(4)	(5)
Lendable	**1.055**	**2.012**	**1.840**	**1.716**	**0.791**
	(4.65)	**(6.03)**	**(3.48)**	**(3.56)**	**(2.49)**
Control Variables	Yes	Yes	Yes	Yes	Yes
Fixed Effects	ICY	ICY	ICY	ICY	ICY
Obs	12,057	8,437	3,620	7,649	4,408
AdjRsq	60.3%	51.4%	64.5%	60.2%	60.9%

Table 6: Firm Performance, Short Selling, and Managerial Compensation

This table presents a panel regression of a firm's total managerial compensation (*MC*) on lendable shares (*Lendable*), its interaction with firm performance (*PF*), and firm-level control variables (*X*) in addition to unreported industry-, country-, and year-fixed effects (ICY). The regression model is

$$MC_{i,t+1} = \alpha + \beta_1 Lendable_{i,t} + \beta_2 Lendable_{i,t} \times PF_{i,t} + \beta_3 PF_{i,t} + \beta_4 X_{i,t} + \varepsilon_{i,t},$$

where $MC_{i,t+1}$ refers to CEO's total compensation (*CEOTotComTA*) in Panel A and executives' total compensation (*ExeTotComTA*) in Panel B; $PF_{i,t}$ includes return-on-asset ratio (*ROA*), abnormal annual stock return (*AbnReturn*), and log of annual stock return (*Return*), $Lendable_{i,t}$ refers to the fraction of shares of a firm available to lend; and $X_{i,t}$ includes American Depository Receipts (*ADR*), closely-held ownership (*CH*), log of firm size (*Size*), financial leverage (*Leverage*), return-on-asset ratio (*ROA*), research and development expenses (*R&D*), institutional ownership (*IO*), log of annual stock return (*Return*), and stock return volatility (*STD*). The construction of these variables is detailed in Appendix A. *t*-statistics shown in parentheses are based on standard errors adjusted for heteroskedasticity and firm-level clustering. Obs denotes the number of firm-year observations, and AdjRsq is adjusted R^2. The sample period is from 2003 to 2009.

	Panel A: *CEOTotComTA*			**Panel B: *ExeTotComTA***		
	ROA	*AbnReturn*	*Return*	*ROA*	*AbnReturn*	*Return*
Variable	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)	Model (6)
Lendable	**0.494**	**0.643**	**0.606**	**0.120**	**0.295**	**0.269**
	(3.43)	**(4.91)**	**(4.74)**	**(0.79)**	**(2.08)**	**(1.93)**
*Lendable*PF*	**1.454**	**0.471**	**0.590**	**2.192**	**0.346**	**0.405**
	(1.59)	**(2.77)**	**(3.71)**	**(2.43)**	**(2.08)**	**(2.56)**
PF	0.100	0.036	0.026	0.070	0.001	-0.003
	(0.93)	(1.46)	(1.11)	(0.63)	(0.05)	(-0.13)
ADR	0.138	0.137	0.137	0.169	0.169	0.169
	(2.14)	(2.13)	(2.13)	(2.68)	(2.67)	(2.67)
CH	-0.336	-0.335	-0.332	-0.344	-0.345	-0.344
	(-5.41)	(-5.36)	(-5.32)	(-5.51)	(-5.52)	(-5.50)
Size	-0.655	-0.655	-0.656	-0.653	-0.654	-0.654
	(-74.90)	(-74.98)	(-75.05)	(-75.44)	(-75.46)	(-75.52)
Leverage	-0.024	-0.024	-0.024	-0.057	-0.060	-0.059
	(-0.35)	(-0.35)	(-0.34)	(-0.81)	(-0.84)	(-0.84)
ROA		0.200	0.199		0.215	0.215
		(2.14)	(2.13)		(2.23)	(2.22)
R&D	0.907	0.915	0.911	0.801	0.819	0.817
	(4.79)	(4.85)	(4.83)	(3.91)	(4.01)	(4.00)
IO	0.335	0.332	0.331	0.329	0.326	0.325
	(7.47)	(7.38)	(7.37)	(6.86)	(6.77)	(6.76)
Return	0.073			0.026		
	(3.72)			(1.26)		
STD	-0.020	-0.007	-0.004	0.018	0.028	0.029
	(-0.43)	(-0.15)	(-0.09)	(0.42)	(0.68)	(0.71)
Fixed Effects	ICY	ICY	ICY	ICY	ICY	ICY
Obs	14,666	14,666	14,666	17,646	17,646	17,646
AdjRsq	75.2%	75.2%	75.2%	74.9%	74.9%	74.9%

Table 7: Alternative Specifications on Short Selling and Corporate Governance

This table addresses the endogeneity problem and presents a panel regression of a firm's corporate governance index (*CGI*) in Panel A and CEO equity compensation ratio (*CEOEqRatio*) in Panel B on lendable shares (*Lendable*), and firm-level control variables (*X*) in addition to unreported industry-, country-, and year-fixed effects (ICY) on a variation of the following models:

$$CGI_{i,t+1}\left(CEOEqRatio_{i,t+1}\right) = \alpha + \beta_1 Lendable_{i,t} + \beta_2 X_{i,t} + \varepsilon_{i,t},$$
$$\Delta CGI_{i,t+1}\left(\Delta CEOEqRatio_{i,t+1}\right) = \alpha + \beta_1 \Delta Lendable_{i,t} + \beta_2 \Delta X_{i,t} + \varepsilon_{i,t},$$
$$\Delta Lendable_{i,t+1} = \alpha + \beta_1 \Delta CGI_{i,t}\left(\Delta CEOEqRatio_{i,t}\right) + \beta_2 \Delta X_{i,t} + \varepsilon_{i,t},$$

where $Lendable_{i,t}$ refers to the fraction of shares of a firm available to lend and $X_{i,t}$ includes American Depository Receipts (*ADR*), closely-held ownership (*CH*), log of firm size (*Size*), financial leverage (*Leverage*), return-on-asset ratio (*ROA*), research and development expenses (*R&D*), institutional ownership (*IO*), log of annual stock return (*Return*), and stock return volatility (*STD*). The construction of these variables is detailed in Appendix A. Models (2) and (3) regress *CGI* (*CEOEqRatio*) on *Lendable* with firm-fixed effects *as* controls. Models (4) and (5) regress Δ*CGI* (Δ*CEOEqRatio*) on Δ*Lendable*. Models (6) and (7) regress Δ*Lendable* on Δ*CGI* (Δ*CEOEqRatio*). *t*-statistics shown in parentheses are based on standard errors adjusted for heteroskedasticity and firm-level clustering. Obs denotes the number of firm-year observations, and AdjRsq is adjusted R^2. The sample period in Panel A is from 2004 to 2008, and the sample period in Panel B is from 2003 to 2009.

Panel A: Corporate Governance Index (*CGI*)

	CGI, Firm FE				*ΔCGI*			*ΔLendable*	
Variable	Model (1)	Model (2)	Model (3)	Variable	Model (4)	Model (5)	Variable	Model (6)	Model (7)
Lendable	**0.013**	**0.034**	**0.018**	*ΔLendable*	**0.015**	**0.098**	*ΔCGI*	**0.007**	**0.007**
	(2.19)	**(3.70)**	**(2.06)**		**(1.64)**	**(9.89)**		**(0.86)**	**(0.88)**
Lagged CGI	0.820		0.135	*Lagged CGI*		-0.151	*Lagged Lendable*		-0.023
	(146.64)		(9.96)			(-29.86)			(-6.35)
ADR	0.001	0.011	0.014	*ΔADR*	0.024	0.022	*ΔADR*	-0.015	-0.015
	(0.55)	(0.35)	(0.39)		(1.29)	(1.20)		(-2.96)	(-2.99)
CH	-0.007	-0.011	-0.004	*ΔCH*	-0.009	-0.007	*ΔCH*	-0.013	-0.013
	(-3.99)	(-2.15)	(-0.80)		(-2.37)	(-1.92)		(-3.74)	(-3.76)
Size	0.002	0.002	0.000	*ΔSize*	-0.001	-0.003	*ΔSize*	0.012	0.012
	(10.01)	(1.11)	(0.00)		(-0.63)	(-1.90)		(6.15)	(6.07)
Leverage	-0.001	0.004	0.002	*ΔLeverage*	0.005	0.007	*ΔLeverage*	-0.026	-0.025
	(-0.35)	(0.51)	(0.29)		(0.85)	(1.45)		(-4.73)	(-4.65)
ROA	0.003	0.014	0.004	*ΔROA*	0.007	0.006	*ΔROA*	0.008	0.008
	(0.87)	(2.26)	(0.54)		(1.47)	(1.43)		(2.10)	(1.98)
R&D	-0.000	0.006	-0.002	*ΔR&D*	-0.004	-0.004	*ΔR&D*	0.014	0.013
	(-0.04)	(0.34)	(-0.13)		(-0.27)	(-0.33)		(1.03)	(0.91)
IO	0.010	0.026	0.015	*ΔIO*	0.009	0.005	*ΔIO*	0.129	0.130
	(5.95)	(3.72)	(2.03)		(1.65)	(1.08)		(21.44)	(21.54)
Return	-0.002	-0.003	-0.001	*ΔReturn*	-0.002	0.000	*ΔReturn*	0.013	0.013
	(-1.53)	(-2.44)	(-1.02)		(-1.81)	(0.04)		(18.98)	(18.99)
STD	0.007	-0.004	-0.001	*ΔSTD*	-0.002	0.000	*ΔSTD*	-0.009	-0.008
	(2.72)	(-1.24)	(-0.18)		(-1.07)	(0.11)		(-3.87)	(-3.47)
Fixed Effects	ICY	FY	FY	Fixed Effects	ICY	ICY	Fixed Effects	ICY	ICY
Obs	16,028	20,407	16,028	Obs	15,078	15,078	Obs	15,298	15,298
AdjRsq	89.5%	91.3%	93.4%	AdjRsq	8.8%	16.1%	AdjRsq	45.4%	45.6%

Table 7: Alternative Specifications on Short Selling and Corporate Governance - Continued

Panel B: CEO equity compensation ratio (*CEOEqRatio*)									
	CEOEqRatio, Firm FE				*ΔCEOEqRatio*			*ΔLendable*	
Variable	Model (1)	Model (2)	Model (3)	Variable	Model (4)	Model (5)	Variable	Model (6)	Model (7)
Lendable	**0.325**	**0.401**	**0.400**	*ΔLendable*	**0.194**	**0.665**	*ΔCEOEqRatio*	**0.002**	**0.002**
	(11.08)	**(8.20)**	**(7.46)**		**(3.25)**	**(10.75)**		**(1.51)**	**(1.81)**
Lagged	0.382		-0.049	*Lagged*		-0.554	*Lagged*		-0.058
CEOEqRatio	(32.13)		(-3.62)	*CEOEqRatio*		(-44.03)	*Lendable*		(-12.27)
ADR	0.017	0.037	0.045	*ΔADR*	-0.007	-0.049	*ΔADR*	-0.005	-0.005
	(1.59)	(0.85)	(0.88)		(-0.25)	(-1.80)		(-0.96)	(-0.90)
CH	-0.065	0.011	-0.001	*ΔCH*	0.036	0.022	*ΔCH*	-0.007	-0.007
	(-5.33)	(0.43)	(-0.02)		(1.36)	(1.08)		(-1.89)	(-2.05)
Size	0.016	-0.014	-0.017	*ΔSize*	-0.015	-0.001	*ΔSize*	0.010	0.008
	(9.64)	(-1.29)	(-1.39)		(-1.17)	(-0.06)		(5.78)	(4.97)
Leverage	0.012	-0.041	-0.046	*ΔLeverage*	-0.012	0.006	*ΔLeverage*	-0.019	-0.018
	(0.87)	(-1.10)	(-1.17)		(-0.31)	(0.19)		(-4.25)	(-4.17)
ROA	0.002	-0.036	-0.035	*ΔROA*	0.015	0.042	*ΔROA*	0.003	0.002
	(0.10)	(-0.91)	(-0.84)		(0.37)	(1.41)		(0.70)	(0.43)
R&D	0.182	0.101	0.091	*ΔR&D*	0.107	0.059	*ΔR&D*	0.021	0.017
	(3.94)	(0.97)	(0.81)		(1.32)	(0.88)		(1.75)	(1.46)
IO	0.042	0.072	0.085	*ΔIO*	-0.069	-0.026	*ΔIO*	0.085	0.085
	(4.26)	(1.72)	(1.97)		(-1.59)	(-0.74)		(14.53)	(14.77)
Return	0.022	0.020	0.021	*ΔReturn*	0.010	0.022	*ΔReturn*	0.007	0.007
	(3.47)	(2.80)	(2.90)		(1.48)	(4.18)		(10.90)	(11.40)
STD	-0.012	-0.015	-0.013	*ΔSTD*	-0.022	-0.023	*ΔSTD*	-0.004	-0.003
	(-0.98)	(-0.81)	(-0.66)		(-1.15)	(-1.60)		(-2.15)	(-1.56)
Fixed Effects	ICY	FY	FY	Fixed Effects	ICY	ICY	Fixed Effects	ICY	ICY
Obs	13,729	14,523	13,729	Obs	10,822	10,822	Obs	14,944	14,944
AdjRsq	51.0%	61.6%	61.2%	AdjRsq	4.0%	32.5%	AdjRsq	49.1%	49.7%

Table 8: ETFs, Short Selling, and Corporate Governance

This table addresses the endogeneity problem using ETF ownership (*ETF*) as an instrument variable and presents a panel regression of a firm's corporate governance index (*CGI*) in Panel A and CEO equity compensation ratio (*CEOEqRatio*) in Panel B on ETF ownership (ETF), predicted shares on lendable shares (*Lendable*), and firm-level control variables (*X*) in addition to unreported industry-, country-, and year-fixed effects (ICY) on the variation of the following models

$$The\ first\ stage: Lendable_{i,t} = \alpha + \beta_1 ETF_{i,t} + \beta_2 X_{i,t} + \varepsilon_{i,t},$$

$$The\ second\ stage: CGI_{i,t+1}(CEOEqRatio_{i,t+1}) = \alpha + \beta_1 Predicted\ Lendable\ on\ ETF_{i,t} + \beta_2 X_{i,t} + \varepsilon_{i,t},$$

where $Lendable_{i,t}$ refers to the fraction of shares of a firm available to lend, $X_{i,t}$ includes American Depository Receipts (*ADR*), closely-held ownership (*CH*), log of firm size (*Size*), financial leverage (*Leverage*), return-on-asset ratio (*ROA*), research and development expenses (*R&D*), institutional ownership (*IO*), log of annual stock return (*Return*), and stock return volatility (*STD*). The construction of these variables is detailed in Appendix A. Model (1) regresses *lendable* on ETF ownership. Model (2) regresses *CGI* (*CEOEqRatio*) on predicted *lendable*. Models (3) and (4) conduct a similar instrumental variable regression, except that the instrument variable is now the residuals of ETF ownership from the following pre-stage regression:

$$The\ pre\text{-}stage: ETF_{i,t} = \alpha + \beta_0 M_{i,t} + e_{i,t},$$

where $M_{i,t}$ includes attention and liquidity variables such as the number of analysts following (*Analyst*), news coverage (*NewsCoverage*), and Amihud's (2002) illiquidity (*Illiquidity*). The pre-stage regression is unreported. Its residual, *ETF-Res*, is used to replace ETF ownership in the above two-stage regressions. Models (5) to (8) provide the diagnostic analyses on the impact of ETF ownership (*ETF*) and institutional ownership (*IO*) on *CGI (CEOEqRatio)*. Model (5) provides the entire sample regression between *CGI (CEOEqRatio)* and *ETF*. Model (6) examines the regression between *CGI (CEOEqRatio)* and *ETF* on the subsample of the stocks for which *Lendable*=0. Models (7) and (8) explore the reverse constraint by regressing *CGI (CEOEqRatio)* on *lendable* on the sample of stocks whose *ETF*=0 or *IO*=0. *t*-statistics shown in parentheses are based on standard errors adjusted for heteroskedasticity and firm-level clustering. Obs denotes the number of firm-year observations, and AdjRsq is adjusted R^2. The sample period in Panel A is from 2004 to 2008, and the sample period in Panel B is from 2003 to 2009.

Panel A: Corporate Governance Index (*CGI*)								
	ETF Ownership as an Instrumental Variable				Diagnostics on *ETF/IO* Ownership			
	Lendable	*CGI*	*Lendable*	*CGI*	*CGI*			
	(1st Stage)	(2nd Stage)	(1st Stage)	(2nd Stage)	Full Sample	*Lendable*=0	*ETF*=0	*IO*=0
Variable	Model	Model	Model	Model	Model	Model	Model	Model
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ETF	**2.320**				**0.645**	**-0.561**		
	(45.92)				**(8.40)**	**(-0.80)**		
Lendable-Pre		**0.278**						
		(8.40)						
ETF-Res			**2.202**					
			(39.21)					
Lendable-ResPre				**0.165**				
				(4.41)				
Lendable							**0.189**	**0.173**
							(6.77)	**(3.09)**
ADR	0.006	-0.002	0.006	-0.002	-0.000	0.007	0.004	0.007
	(2.77)	(-0.43)	(2.57)	(-0.52)	(-0.03)	(0.25)	(0.43)	(0.53)
CH	-0.030	-0.042	-0.042	-0.049	-0.051	-0.019	-0.042	-0.042
	(-11.86)	(-8.24)	(-16.17)	(-9.36)	(-10.38)	(-1.01)	(-4.92)	(-3.30)
Size	0.005	0.015	0.012	0.016	0.016	0.009	0.017	0.016
	(16.34)	(20.05)	(37.34)	(20.83)	(24.46)	(2.03)	(12.56)	(7.41)
Leverage	0.004	0.004	0.001	0.003	0.005	0.016	0.048	0.019
	(1.60)	(0.68)	(0.31)	(0.60)	(0.89)	(0.61)	(4.46)	(1.15)
ROA	0.028	0.013	0.046	0.017	0.020	-0.029	-0.000	-0.013
	(7.01)	(1.58)	(10.51)	(2.06)	(2.59)	(-1.21)	(-0.00)	(-0.69)
R&D	0.000	0.026	0.025	0.028	0.026	-0.075	0.007	-0.058
	(0.04)	(1.39)	(2.83)	(1.49)	(1.40)	(-1.09)	(0.22)	(-1.27)
IO	0.086	0.032	0.093	0.038	0.056	0.019	0.037	
	(26.58)	(6.58)	(27.26)	(7.62)	(11.37)	(0.67)	(4.38)	
Return	-0.007	-0.006	-0.008	-0.006	-0.008	-0.004	-0.005	-0.001
	(-6.15)	(-3.54)	(-6.55)	(-3.93)	(-4.80)	(-0.44)	(-1.80)	(-0.25)
STD	0.008	-0.004	0.011	-0.004	-0.002	-0.004	-0.001	-0.019
	(3.63)	(-1.03)	(4.43)	(-0.91)	(-0.46)	(-0.50)	(-0.12)	(-1.70)
Fixed Effects	ICY	ICY	ICY	ICY	ICY	ICY	ICY	ICY
Obs	20,387	20,387	20,157	20,157	20,387	540	4,620	1,959
AdjRsq	68.7%	67.0%	66.9%	66.7%	67.0%	17.0%	54.9%	51.3%

Table 8: ETFs, Short Selling, and Corporate Governance – Continued

Panel B: CEO Equity Compensation Ratio (*CEOEqRatio*)								
	ETF ownership as an instrumental variable				Diagnostics on *ETF/IO* Ownership			
	Lendable	*CEOEqRatio*	*Lendable*	*CEOEqRatio*	*CEOEqRatio*			
	(1st Stage)	(2nd Stage)	(1st Stage)	(2nd Stage)	Full Sample	*Lendable*=0	*ETF*=0	*IO*=0
Variable	Model	Model	Model	Model	Model	Model	Model	Model
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ETF	**1.999**				**1.568**	**-4.866**		
	(29.66)				**(6.26)**	**(-1.08)**		
Lendable-Pre		**0.785**						
		(6.26)						
ETF-Res			**1.939**					
			(28.54)					
Lendable-ResPre				**0.752**				
				(5.73)				
Lendable							**0.477**	**0.590**
							(5.95)	**(3.72)**
ADR	0.020	0.024	0.024	0.028	0.040	-0.144	0.069	0.028
	(6.52)	(1.50)	(6.98)	(1.61)	(2.54)	(-1.43)	(3.10)	(0.78)
CH	-0.053	-0.101	-0.052	-0.106	-0.142	-0.361	-0.100	-0.116
	(-15.26)	(-5.40)	(-14.76)	(-5.57)	(-8.45)	(-3.53)	(-4.30)	(-2.93)
Size	0.007	0.025	0.007	0.025	0.030	0.030	0.027	0.034
	(14.25)	(9.79)	(14.88)	(9.78)	(12.83)	(0.86)	(8.11)	(5.94)
Leverage	0.020	0.009	0.020	0.008	0.025	-0.196	-0.062	-0.019
	(4.83)	(0.48)	(4.70)	(0.39)	(1.32)	(-1.17)	(-2.08)	(-0.38)
ROA	0.033	-0.029	0.034	-0.028	-0.003	-0.235	-0.063	-0.087
	(5.27)	(-1.02)	(5.40)	(-0.99)	(-0.11)	(-1.35)	(-1.73)	(-1.38)
R&D	0.008	0.294	0.009	0.297	0.300	-0.144	0.127	0.326
	(0.75)	(4.56)	(0.79)	(4.58)	(4.66)	(-0.44)	(1.52)	(2.31)
IO	0.051	0.062	0.050	0.064	0.102	0.048	0.039	
	(13.28)	(4.28)	(13.17)	(4.36)	(6.69)	(0.30)	(1.81)	
Return	-0.006	0.038	-0.006	0.038	0.034	-0.006	0.031	0.045
	(-4.13)	(6.29)	(-4.03)	(6.18)	(5.54)	(-0.16)	(3.67)	(2.91)
STD	-0.004	-0.009	-0.003	-0.010	-0.012	0.176	0.007	0.016
	(-1.19)	(-0.64)	(-0.94)	(-0.65)	(-0.84)	(1.58)	(0.42)	(0.43)
Fixed Effects	ICY	ICY	ICY	ICY	ICY	ICY	ICY	ICY
Obs	14,494	14,494	14,077	14,077	14,494	134	5,471	1,745
AdjRsq	66.7%	41.7%	66.2%	41.1%	41.7%	23.3%	39.7%	34.8%

Table 9: Short Selling and Board Characteristics

This table presents a panel regression of a firm's board characteristics (*Board*) on lendable shares (*Lendable*), and firm-level control variables (*X*) in addition to unreported industry-, country-, and year-fixed effects (ICY) on the full samples and different subsamples. The regression model is

$$Board_{i,t+1} = \alpha + \beta_1 Lendable_{i,t} + \beta_2 X_{i,t} + \varepsilon_{i,t},$$

where $Board_{i,t+1}$ refers to busy board (*BoardBusyD* or *BoardBusy*) in Panel A, board independence (*BoardIndD* or *BoardInd*) in Panel B, board size (*BoardSizeD* or *BoardSize*) in Panel C; $Lendable_{i,t}$ refers to the fraction of shares of a firm available to lend and $X_{i,t}$ includes American Depository Receipts (*ADR*), closely-held ownership (*CH*), log of firm size (*Size*), financial leverage (*Leverage*), return-on-asset ratio (*ROA*), research and development expenses (*R&D*), institutional ownership (*IO*), log of annual stock return (*Return*), and stock return volatility (*STD*). The construction of these variables is detailed in Appendix A. NUS refers to firms from non-US countries. Crisis refers to the global financial crisis period from 2007 to 2008, whereas Ex.Crisis excludes the global financial crisis period. *t*-statistics shown in parentheses are based on standard errors adjusted for heteroskedasticity and firm-level clustering. Obs denotes the number of firm-year observations, and AdjRsq is adjusted R^2. The sample period is from 2003 to 2009.

Panel A: Busy Board (*BoardBusyD* or *BoardBusy*)						
	BoardBusyD					*BoardBusy*
		US	NUS	Ex. Crisis	Crisis	
Variable	Model	Model	Model	Model	Model	Model
	(1)	(2)	(3)	(4)	(5)	(6)
Lendable	**-0.975**	**-0.997**	**-0.796**	**-0.848**	**-1.358**	**-1.414**
	(-6.40)	**(-4.96)**	**(-2.26)**	**(-5.20)**	**(-5.50)**	**(-4.66)**
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	ICY	ICY	ICY	ICY	ICY	ICY
Obs	34,831	21,155	13,676	23,008	11,823	34,831
AdjRsq	16.7%	10.5%	16.6%	16.9%	16.5%	23.5%

Panel B: Board Independence (*BoardIndD* or *BoardInd*)						
	BoardIndD					*BoardInd*
		US	NUS	Ex. Crisis	Crisis	
Variable	Model	Model	Model	Model	Model	Model
	(1)	(2)	(3)	(4)	(5)	(6)
Lendable	**1.031**	**-0.247**	**1.547**	**0.937**	**1.266**	**0.044**
	(3.09)	**(-0.42)**	**(3.70)**	**(2.51)**	**(2.53)**	**(3.50)**
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	ICY	ICY	ICY	ICY	ICY	ICY
Obs	34,001	20,308	12,846	22,466	11,422	34,831
AdjRsq	41.1%	15.2%	25.9%	41.9%	39.9%	-84.5%

Panel C: Board Size (*BoardSizeD* or *BoardSize*)						
	BoardSizeD					*BoardSize*
		US	NUS	Ex. Crisis	Crisis	
Variable	Model	Model	Model	Model	Model	Model
	(1)	(2)	(3)	(4)	(5)	(6)
Lendable	**1.580**	**1.298**	**3.279**	**1.718**	**1.747**	**0.688**
	(7.56)	**(4.81)**	**(7.24)**	**(7.30)**	**(5.47)**	**(2.75)**
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects	ICY	ICY	ICY	ICY	ICY	ICY
Obs	34,804	21,155	13,649	22,986	11,807	34,831
AdjRsq	10.5%	9.3%	8.1%	10.8%	10.7%	52.7%

Table 10: Short Selling and Firm Performance

This table presents a panel regression of a firm's return-on-asset ratio (*ROA*) on lendable shares (*Lendable*) in Models (1) to (5), predicted corporate governance index (*CGI*) instrumented on lendable shares (*Lendable*) in Models (6) to (10), predicted CEO equity compensation ratio (*CEOEqRatio*) instrumented on lendable shares (*Lendable*) in Models (11) to (15), and firm-level control variables (*X*) in addition to unreported industry-, country-, and year-fixed effects (ICY) on the full samples and different subsamples. The regression model is

$$ROA_{i,t+1} = \alpha + \beta_1 Lendable_{i,t}(CGI - Pre_{i,t}, CEOEqRatio - Pre_{i,t}) + \beta_2 X_{i,t} + \varepsilon_{i,t},$$

where $Lendable_{i,t}$ refers to the fraction of shares of a firm available to lend, $CGI - Pre_{i,t}$ is the predicted corporate governance index instrumented on *Lendable*, $CEOEqRatio - Pre_{i,t}$ is predicted CEO equity compensation ratio instrumented on *lendable*; and $X_{i,t}$ includes American Depository Receipts (*ADR*), closely-held ownership (*CH*), log of firm size (*Size*), financial leverage (*Leverage*), return-on-asset ratio (*ROA*), research and development expenses (*R&D*), institutional ownership (*IO*), log of annual stock return (*Return*), and stock return volatility (*STD*). The construction of these variables is detailed in Appendix A. NUS refers to firms from non-US countries. Crisis refers to the global financial crisis period from 2007 to 2008, whereas Ex.Crisis excludes the global financial crisis period. *t*-statistics shown in parentheses are based on standard errors adjusted for heteroskedasticity and firm-level clustering. Obs denotes the number of firm-year observations, and AdjRsq is adjusted R^2. The sample period is from 2003 to 2009, while from 2004 to 2008 for Models (6) to (10).

	Lendable					*CGI* Instrumented on *Lendable*					*CEOEqRatio* Instrumented on *Lendable*				
		US	NUS	Ex. Crisis	Crisis		US	NUS	Ex. Crisis	Crisis		US	NUS	Ex. Crisis	Crisis
Variable	Model	Model	Model	Model	Model	Model	Model	Model	Model	Model	Model	Model	Model	Model	Model
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Lendable	**0.039**	**0.046**	**0.165**	**0.044**	**0.116**										
	(3.78)	**(2.74)**	**(7.77)**	**(3.77)**	**(5.64)**										
CGI-Pre						**0.134**	**0.162**	**0.183**	**0.227**	**0.179**					
						(3.05)	**(2.57)**	**(3.85)**	**(3.28)**	**(3.01)**					
CEOEqRatio-Pre											**0.097**	**-0.192**	**0.237**	**0.157**	**0.091**
											(3.22)	**(-3.01)**	**(4.84)**	**(4.17)**	**(2.27)**
ADR	-0.007		-0.010	-0.010	-0.004	0.008		0.009	0.008	0.010	0.012		0.009	0.016	0.002
	(-1.48)		(-2.02)	(-1.94)	(-0.60)	(1.45)		(1.63)	(1.37)	(1.68)	(1.50)		(1.08)	(1.71)	(0.16)
CH	0.030	0.022	0.043	0.031	0.034	0.032	0.034	0.048	0.045	0.036	0.019	-0.033	0.078	0.031	0.015
	(9.00)	(2.98)	(11.41)	(8.68)	(6.94)	(3.92)	(2.85)	(5.52)	(4.19)	(3.18)	(2.26)	(-2.69)	(5.22)	(3.12)	(1.27)
Size	0.006	0.004	0.004	0.005	0.004	-0.005	-0.004	-0.011	-0.009	-0.006	-0.002	0.002	-0.006	-0.006	0.001
	(10.18)	(4.08)	(5.75)	(8.82)	(4.95)	(-2.45)	(-1.36)	(-4.62)	(-2.74)	(-2.89)	(-1.49)	(1.01)	(-2.32)	(-3.95)	(0.66)
Leverage	0.003	0.002	0.009	-0.002	0.019	-0.018	-0.008	-0.036	-0.033	0.005	-0.027	-0.032	-0.009	-0.038	-0.007
	(0.92)	(0.29)	(2.10)	(-0.53)	(3.51)	(-2.91)	(-0.98)	(-4.67)	(-4.24)	(0.60)	(-3.75)	(-3.40)	(-0.77)	(-4.36)	(-0.69)
R&D	-0.544	-0.603	-0.454	-0.513	-0.596	-0.563	-0.569	-0.294	-0.517	-0.607	-0.577	-0.493	-0.649	-0.594	-0.578
	(-19.83)	(-16.29)	(-11.00)	(-16.57)	(-15.69)	(-13.16)	(-12.53)	(-1.82)	(-9.33)	(-11.29)	(-11.55)	(-7.29)	(-8.45)	(-10.51)	(-7.94)
IO	0.040	0.026	0.101	0.043	0.021	0.020	0.010	0.049	0.012	0.011	0.015	0.035	0.052	0.013	0.017
	(9.02)	(5.26)	(10.41)	(9.49)	(2.64)	(2.60)	(0.95)	(3.00)	(1.15)	(0.94)	(2.58)	(4.69)	(2.59)	(2.04)	(1.53)
Return	0.063	0.075	0.058	0.064	0.085	0.085	0.094	0.053	0.080	0.097	0.072	0.086	0.056	0.059	0.091
	(40.14)	(25.98)	(30.95)	(34.40)	(24.86)	(22.58)	(20.22)	(13.01)	(16.64)	(15.76)	(19.14)	(18.14)	(9.40)	(13.57)	(13.08)
STD	-0.088	-0.096	-0.084	-0.078	-0.113	-0.107	-0.105	-0.072	-0.101	-0.119	-0.101	-0.116	-0.083	-0.105	-0.096
	(-17.74)	(-11.86)	(-13.51)	(-13.65)	(-11.88)	(-10.08)	(-8.67)	(-6.07)	(-8.08)	(-6.93)	(-7.52)	(-7.94)	(-3.99)	(-8.00)	(-3.53)
Fixed Effects	ICY	ICY	ICY	ICY	ICY	ICY	ICY	ICY	ICY	ICY	ICY	ICY	ICY	ICY	ICY
Obs	62,100	23,066	39,034	40,578	21,522	20,429	13,789	6,640	11,919	8,510	14,542	9,092	5,450	9,317	5,225
AdjRsq	22.8%	26.3%	21.2%	23.8%	23.4%	23.9%	25.3%	19.8%	22.6%	25.3%	24.0%	24.4%	25.4%	26.0%	22.3%

Internet Appendix

A More General Model of Equity Compensation, Disciplining Effects, and Governance Spending

We can generalize equity compensation by allowing the manager to receive ω_1 shares of the stock at the market price of the first period (as in Admati and Pfleiderer, 2009). In this case, if the bad action is not taken, the manager receives $f_0 = \omega_1 P_1 + \omega_2 P_2 = (\omega_1 + \omega_2)v$ from the firm. When the manager takes the bad action, he enjoys some private benefit β but bears the cost of the lower price in the first and second period: $f_1 = \beta + \omega_1 P_1^{'} + \omega_2 P_2^{'} = \beta + \omega_1 P_1^{'} + \omega_2(v - \tilde{\delta})$. This compensation scheme is similar to that of Admati and Pfleiderer, (2009), which helps demonstrate the impacts of equity payment and governance spending within a same framework.

Following Admati and Pfleiderer (2009), the bad action is taken, provided $\tilde{\delta} < \frac{\beta}{\omega_2} - \frac{\omega_1}{\omega_2} \times (v - P_1^{'})$. Let $\Delta P_1 = v - P_1^{'}$ and $\delta_m = \frac{\beta}{\omega_2} - \frac{\omega_1}{\omega_2}\Delta P_1$ to simplify notation. In this case, the probability that the bad action is taken is endogenous: $q_1(\omega_1, \omega_2) = \int^{\delta_m} g(\tilde{\delta})d\tilde{\delta}$, where $g(\tilde{\delta})$ is the probability density function. Because $\frac{\partial q_1}{\partial \delta_m} = g(\delta_m) > 0$, not only can ω_2 reduce the probability of the bad action, but also any positive value of $\frac{\omega_1}{\omega_2}\Delta P_1$ can achieve the same goal. This implies that an efficient price in the first period, i.e., a positive price drop of ΔP_1 when the bad action is taken, reduces the incentive for the manager to take the bad action. This establishes a disciplining mechanism though market price, as shown by Admati and Pfleiderer (2009).

Next, we continue to assume that direct governance spending K_g reduces q_1. However, because q_1 is now endogenous, we also assume that the reduction is large when q_1 is high. That is, we assume that $q_1^{'} = q_1(1 - q)$, where $q_{K_g}^{'} > 0$ and $q_{K_g}^{''} < 0$. The assumption does not change any results in our previous propositions and corollaries.

In this case, the cost of equity compensation becomes $K = (\omega_1 + \omega_2)v(1 - q_1)\eta + \left(\omega_1 P_1^{'} + \omega_2\left(v - \tilde{\delta}\right)\right)q_1\eta = (\omega_1 + \omega_2)v\eta - \left(\omega_1\Delta P_1 + \omega_2\tilde{\delta}\right)q_1\eta$. Conditional on her optimal trading strategy, the investor chooses the optimal amount of equity compensation as well as governance spending to maximize her consumption:

$$Max_{\omega_1,\omega_2,K}\ C = \eta v - D \times q_1(\omega_1, \omega_2) \times (1 - q) - K(\omega_1, \omega_2) - K_g$$

$$FOCs: \begin{cases} D\dfrac{\partial q_1}{\partial \omega_1}(1-q)+\dfrac{\partial K}{\partial \omega_1}=D(1-q)g(\delta_m)\dfrac{\partial \delta_m}{\partial \omega_1}+\dfrac{\partial K}{\partial \omega_1}=0; \\ D(1-q)g(\delta_m)\dfrac{\partial \delta_m}{\partial \omega_2}+\dfrac{\partial K}{\partial \omega_2}=0; \\ Dq_1\times q'_{K_g}-1=0. \end{cases}$$

Hence, we can derive the first FOC as

$$FOC\ 1: D(1-q)g(\delta_m)\frac{\Delta P_1}{\omega_2}-(v-\Delta P_1 q_1)\eta=0 \Rightarrow \omega_2=\frac{D(1-q)g(\delta_m)\Delta P_1}{(v-\Delta P_1 q_1)\eta}$$

The first order effect is that when competition N increases, both $-G^*$ and ΔP_1 increase. Hence, ω_2 increases, which confirms the intuition of Proposition 2 that increased short-selling competition incentivizes the investor to pay more long-term equity compensation. Of course, the FOC also implies an additional substitution effect between equity compensation and direct governance spending: more effective monitoring (a higher q) reduces equity compensation. However, as long as monitoring is imperfect ($q<1$), equity compensation helps maximize the investor's total consumption.

The second FOC is as follows: $\frac{D(1-q)g(\delta_m)(\beta-\omega_1\Delta P_1)}{\omega_2^2}=\left(v-\tilde{\delta}q_1\right)\eta$. This equation implies that $\beta-\omega_1\Delta P_1=\frac{\omega_2^2(v-\tilde{\delta}q_1)\eta}{D(1-q)g(\delta_m)}=\left[\frac{D(1-q)g(\delta_m)\Delta P_1}{(v-\Delta P_1 q_1)\eta}\right]^2\frac{(v-\tilde{\delta}q_1)\eta}{D(1-q)g(\delta_m)}=-\frac{(v-\tilde{\delta}q_1)D(1-q)g(\delta_m)\Delta P_1^2}{(v-\Delta P_1 q_1)^2\eta}$ and that $\omega_1=\frac{\beta}{\Delta P_1}+\frac{D(1-q)g(\delta_m)(v-\tilde{\delta}q_1)\Delta P_1}{(v-\Delta P_1 q_1)^2\eta}$. Here we see two opposing effects of ΔP_1 on short-term compensation. The first term indicates that because of its disciplining impact, a larger ΔP_1 allows for less compensation. The second term illustrates that the investor remains willing to pay more short-term equity compensation to avoid a consumption loss.

The last FOC implies that $q'_{K_g}=1/Dq_1$. Thus, when the equity compensation channel is more effective (i.e., when q_1 is smaller), q'_{K_g} becomes larger, suggesting that optimal governance spending is smaller. Again, we observe that equity compensation and governance spending are substitutes. Meanwhile, conditional on equity compensation, competition still enhances optimal governance spending, as Proposition 1 states.