

CEO stock ownership requirements, risk-taking, and compensation

Neil Brisley,^{*} Jay Cai,^{**} Tu Nguyen^{***}

First draft: 8th May 2015

This version: 14th Jan 2016

Abstract

Most large U.S. public firms have adopted executive stock ownership requirements ('SORs') in recent years. Compared to CEOs already in compliance, CEOs not in compliance at SOR adoption subsequently increase stock holdings, exposing them to more company-specific risk, which may provide a risk-reducing incentive and diminish their subjective valuation of equity holdings and compensation. Using changes in state capital gains tax rates as an instrument, we find that these CEOs reduce their firm's idiosyncratic risk profile, but not market risk, through investment allocations and M&A across industries; reduce earnings volatility and financial leverage; and receive increased compensation. A placebo test further addresses endogeneity.

Keywords: *Stock ownership requirement, Managerial diversification, Risk-taking, Executive compensation*

^{*} Associate professor of finance, School of Accounting and Finance, University of Waterloo, 200 University Ave. W., Waterloo, ON, N2L 3G1. Phone: 1-519-888-4567. Email: nbrisley@uwaterloo.ca

^{**} Corresponding author, Associate professor of finance, Lebow College of Business, Drexel University, 3141 Chestnut St, Philadelphia, PA 19104. Phone: 1-215-895-1755. Email: jaycai@drexel.edu

^{***} Assistant professor of finance, School of Accounting and Finance, University of Waterloo, 200 University Ave. W., Waterloo, ON, N2L 3G1. Phone: 1-519-888-4567. Email: tu.nguyen@uwaterloo.ca

We thank Todd Gormley, Raymond Kan, Duane Kennedy, Michelle Lowry, Patricia O'Brien, Andrew Winton, and seminar participants at Drexel University, Hong Kong University of Science and Technology, and University of Waterloo for helpful comments.

CEO stock ownership requirements, risk-taking, and compensation

1. Introduction

Stock ownership requirements (henceforth SORs) for top executives of U.S. public firms have become widespread in recent years. In 1998, fewer than 11% of the S&P 500 firms required their CEOs to own a certain amount of company stock, yet by 2013 over 82% had adopted such rules. The rationale often advanced for SORs is to address agency and corporate governance concerns by tying manager wealth and incentives to shareholder outcomes; however, the empirical evidence of the performance effects of SORs is quite mixed. For example, Core and Larcker (2002) find that SORs are associated with a significant increase in firm accounting and stock returns, whereas Cao, Gu, and Yang (2010) document that significant improvement in firm performance is experienced by the early (pre-2002) adopters of SORs, but not by post-SOX adopters.

We examine the effects of stock ownership requirements from a different angle. Specifically, the *initiation* of an SOR introduces a formal constraint on the CEO's portfolio allocation. In some cases this new constraint is 'non-binding', insofar as the CEO's holding *already* exceeds the new threshold prescribed by the SOR. In other cases the constraint is 'binding', and the CEO is led to allocate a greater amount of her personal wealth to company stock than she would otherwise choose.

When a CEO is exposed to more company-specific risk that cannot easily be diversified or hedged, she may have the incentive to take actions that reduce the risk of the stock, in particular the idiosyncratic risk. Moreover, it is well established that undiversified CEOs may value their company stock holdings lower than do diversified outside investors (e.g., Ingersoll, 2006; Hall and Murphy, 2002; and Kahl, Liu, and Longstaff, 2003). A binding SOR can further reduce the CEO's subjective valuation of her holdings and future equity compensation, so the CEO may receive higher pay to compensate. In this paper, we therefore exploit cross-sectional variation in the terms of the SORs when introduced, *relative* to CEOs' pre-existing equity holdings, to examine the consequences for risk-taking (specifically,

investment weight allocation across industries of varying risks, M&A, and financial leverage) and for the composition and level of CEO pay.

It is possible that firms adopting a binding SOR are fundamentally different from firms adopting a non-binding SOR. Further, CEOs may be more willing to accept a binding SOR if they anticipate a reduction in firm-specific risk in the future. To address these potential endogeneity concerns, we use the change in capital gains tax rates of the state where the firm has its headquarter as an instrument for the probability that an adopted SOR is binding. When capital gains tax rates decrease, it becomes more profitable for executives to sell their company stock, and we find this results in lower stock holdings.¹ Hence, subsequent SOR adoptions are more likely to be binding, and so the instrument satisfies the ‘relevance’ condition.² However, there is no apparent reason why a change in state capital gains tax rate should be related to corporate risk-taking, so the instrument also satisfies the ‘exclusion’ condition. In addition to the instrumental variables (IV) approach, we use the Heckman (1979) method to control for potential selection bias.

Analyzing a sample of 412 S&P 500 firms that adopt SORs for their CEOs during 1993-2013, we compare the changes in subsequent risk-taking and in CEO compensation of the firms that adopt binding requirements, to those adopting non-binding SORs. A CEO’s portfolio allocation to her own company stock is determined by many factors not observable to econometricians, such as her risk aversion, wealth, tax situation, and private information or optimism about future stock performance. We therefore take an empirical approach by identifying a sample of CEOs whose stock holding in the year prior to SOR-adoption was *below* the level envisaged in the SOR, as our ‘binding’ treatment group. The CEOs who had already met the ownership requirement *before* SOR-adoption comprise our ‘non-binding’ control group.

¹ The correlation between the change in state capital gains tax and the change in CEO holdings in the year before SOR adoption is 0.41 and statistically significant ($p < 0.0001$), suggesting that higher tax rates are related to stock retention.

² A decrease in capital gains tax rate could lead to an increase in the adoption of SORs in general (Bekkum, Verwijmeren, and Zhang, 2015). We focus on the subset of firms that adopt SORs, and contrast the binding SORs to the non-binding ones, thus avoiding a potential selection bias between firms that adopt an SOR and firms that do not.

In the five years after an SOR-adoption, we find that CEOs subject to a binding requirement increase their stock holding significantly and become less diversified, compared to those subject to a non-binding SOR.

To analyze the risk-taking behavior of the treatment group and the control group, we first employ a direct imputed investment-risk measure following Armstrong and Vashishtha (2012). This measure is based on the cross-product of a firm's investment weights in different industries and the risk of each industry. The firm's investment weight in each industry is arguably a direct result of the CEO's decisions, while industry risk is relatively stable over time and less likely to be influenced by a specific firm's information environment. Using this imputed risk measure, a CEO subject to a binding SOR reduces her firm's idiosyncratic risk by an average of 9.2%, compared to CEOs with non-binding ownership requirements.³

In contrast to the significant reduction in idiosyncratic risk by firms adopting binding SORs, we document no significant difference in the change in market risk between these firms and the control group. This result is consistent with the notion that undiversified CEOs can hedge the market risk of their personal portfolio and consequently do not need to alter the market risk of their firms (Armstrong and Vashishtha, 2012). We next examine whether having a binding SOR influences a CEO's financing decisions. Compared to the control group, our treatment firms experience a 2.2% to 2.9% average reduction in their leverage ratios after the adoption of an SOR. They also experience economically significant lower earnings (i.e., ROA) volatility.

Next, in the context of M&A, we hypothesize that CEOs facing a binding SOR make more diversifying acquisitions to reduce the idiosyncratic risk of their companies. Using the correlation between the industry returns of the acquirer and target as a proxy for diversifying mergers, we find that CEOs subject to a binding SOR tend to acquire targets in industries having lower return correlation with their own industry.

³ A reduction in idiosyncratic risk may have a negative impact on firm value, since idiosyncratic risk is likely to be related to innovation and the pursuit of growth options (Cao, Simin, and Zhao, 2008; Vassalou and Apedjinou, 2004; Pastor and Veronesi, 2009). We do not examine the market value reaction to SOR initiation, since SORs are typically not immediately publicly announced, but rather appear subsequently within the proxy statement alongside much other information.

CEOs subject to a binding SOR experience a significant increase in equity compensation after the adoption, amounting to double the equity pay increase of the control group. Also, the effect of a binding SOR on compensation is stronger for less diversified CEOs (i.e. CEOs with lower outside wealth). While a proportion of the pay increase could be interpreted as compensation for bearing the higher risk of a less diversified portfolio, higher equity grants also facilitate the accumulation of sufficient stock to satisfy the SOR.⁴ Our evidence on CEO pay illustrates potential extra costs of stock ownership requirements, borne by shareholders.

Our results are robust to alternative characterizations of ‘binding’ SORs, taking into account the size of holding shortfall, the stock return volatility, and the CEO’s compensation or total outside wealth. Further, we perform a placebo test. Specifically, for each of the 412 sample firms, we randomly select a year *outside* the SOR adoption window. For each of these random firm-years we determine whether the SOR would have been binding had it been adopted during that year. Any potential omitted variables, e.g., CEO tenure or stock ownership, correlated with the actual binding SOR indicator are also likely to be correlated with this pseudo-indicator. Nevertheless, this pseudo-indicator has no significant association with the change in firms’ risk-taking measures or CEO pay around the pseudo-adoption year, reinforcing the inference that the documented changes in firm risk-taking behaviors and CEO pay are a (perhaps unintended) consequence of the binding SOR.

Guided by theoretical predictions of how undiversified executives may value their stock holdings and compensation at a discount, and the risk-reduction incentives that those holdings and compensation may introduce, we contribute to the corporate governance literature by providing empirical evidence of the consequences of imposing a binding stock ownership requirement on CEOs. Since the seminal work

⁴ The magnitude of this permanent compensation increase, coinciding as it does with the initiation of the SOR, raises the question of whether SORs provide yet another cover for managerial rent extraction (e.g., Bebchuk and Fried, 2004). In section 4.2, we examine whether CEOs of weaker governance firms (i.e. firms with higher CEO power over the board or compensation committee) receive higher pay after the adoption of a binding SOR. Although our results do not show evidence of a more positive change in CEO compensation for weak governance firms, we do not rule out the possibility that a binding SOR is a result of negotiations between CEOs and boards to increase CEO compensation. Given that the way boards and CEOs may negotiate compensation packages is unobservable, our IV of changes in state capital gains tax rates allows us to focus on the exogenous component of a binding SOR.

of Jensen and Meckling (1973), higher managerial stock ownership is often presented as a cure for agency conflicts in public companies, and SORs have accordingly been adopted broadly by large US public firms. Consistent with theoretical predictions, we provide empirical evidence that mandating higher managerial stock ownership can create its own agency conflicts and potential welfare loss to shareholders. To the extent that risk reduction and pay increases are unintended consequences of such requirements, our evidence suggests that boards should exercise judgment and caution in adopting a popular (but somewhat uniformly applied) governance initiative.

The next Section reviews the extant literature, Section 3 describes our data, Section 4 presents the empirical results, and Section 5 concludes.

2. Literature

Our study contributes to two streams of the literature. First, we build on the theory and evidence of how undiversified executives value their equity compensation and holdings, and what risk-taking behavior they may motivate. Second, we study the specific effects of the introduction of an SOR, which potentially represents a further mandated increase in the concentration of the CEO's equity risk exposure. Contributing to the understanding of SORs, we provide fresh empirical evidence on how they influence managerial risk-taking decisions and compensation.

2.1. Undiversified CEO portfolios

Compared to outside shareholders who can hold a diversified portfolio, CEOs of U.S. public firms usually have a disproportionately large fraction of their personal wealth (and human capital) invested in the company they work for. Restricted stock and executive stock options typically cannot be sold or exercised for several years until they vest (Murphy, 2012; Kahl, Liu, and Longstaff, 2003). Once vested, a CEO's ability to sell her stocks may be further limited by tax considerations, stock illiquidity, blackout periods, insider trading regulations, and public or peer pressure. SORs add a further *formal* limit

to a CEO's ability to sell her vested stockholdings (Bettis, Coles, and Lemmon, 2000; Core and Larcker, 2002, among others).

A number of papers have studied the effects of an undiversified portfolio on CEOs. Lambert, Larcker, and Verrecchia (1991), Meulbroek (2001), Hall and Murphy (2002), Kahl, Liu, and Longstaff (2003), Cai and Vijh (2005), and Ingersoll (2006) find that an undiversified executive attaches a lower value to her equity holdings than would a diversified outside shareholder. This discount on a CEO's subjective value of her equity holdings from their objective value is an increasing function of the stock volatility, the fraction of her wealth invested in the firm, and her risk aversion. This difference can also explain empirical regularities such as the early exercise of stock options (Huddart and Lang, 1996; Ofek and Yermack, 2000; Bettis, Bizjak, and Lemmon, 2005), M&A behavior (Cai and Vijh, 2007), and risk-taking decisions (Armstrong and Vashishtha, 2012).

An SOR potentially obliges a CEO to hold a greater proportion of her personal wealth in company stock, which further exposes her to the risk of that stock and reduces her subjective value of these holdings and future equity compensation. A lower stock return volatility helps to offset some of the valuation effects of the lack of diversification (Kahl, Liu, and Longstaff, 2003) and it is well established that stock ownership can give managers the incentive proactively to reduce firm risk (e.g., Grossman and Hart, 1983; Gormley and Matsa, 2015). Therefore, we predict reduced risk-taking if an SOR forces a CEO to invest more in company stock.⁵ In addition, the CEO may receive higher pay to compensate for her greater exposure to company risk resulting from a binding SOR.

CEOs may face practical, reputational or formal restrictions on hedging their exposure to the idiosyncratic risk of the company. In contrast, CEOs can hedge the systematic risk of their companies by trading the market portfolio (Jin, 2002; Garvey and Milbourn, 2003). In theoretical models, Tian (2004), Henderson (2005), and Duan and Wei (2005) show that a greater proportion of idiosyncratic risk (i.e.,

⁵ The literature finds mixed results on the risk-taking incentives of stock options. See, for example, Lambert, Larcker, and Verrecchia (1991), Core and Guay (1999), Carpenter (2000), Brisley (2006), Ross (2004), Lewellen (2006), Coles, Daniel, and Naveen (2006), Low (2009), and Brick, Palmon, and Wald (2012). Armstrong and Vashishtha (2012) provide an excellent summary of this literature.

rather than systematic risk) leads to lower executive subjective value of their equity holdings. Armstrong and Vashishtha (2012) document empirical evidence that CEOs with stronger risk incentives tend to increase the market risk of their companies, but not the idiosyncratic risk. Since a binding SOR increases exposure to company stock, we predict that these CEOs will reduce the idiosyncratic risk, but not necessarily the market risk, of their companies.

2.2. Stock ownership requirements

Studies on SORs provide mixed evidence as to their consequences. Core and Larcker (2002) find that managerial equity ownership, firm accounting performance, and stock returns, all increase significantly in the two years after the adoption of SORs. Brown and Caylor (2006) develop a governance score including a stock ownership requirement as one component, and show that the score is positively related to Tobin's Q. Chung, Elder, and Kim (2013) show that the adoption of executive SORs, along with director SORs and director equity compensation, are positively correlated with stock market liquidity. Specifically, they find that firms with these governance policies have narrower spreads, a higher market quality index, and lower probability of information-based trading. There is also evidence of lower accruals and real earnings management (Brown, Chen, and Kennedy, 2014), as well as lower agency costs of debt (Kang and Xu, 2015) after their adoption. Nevertheless, Cao, Gu, and Yang (2010) document that significant improvements in firm performance are experienced by early (pre-2002) adopters, but not by recent (post-SOX) adopters, arguing that the latter are driven primarily by a herding tendency.

An important motive for the adoption of an SOR is to limit the offloading of incentives when executives cash out their equity holdings upon vesting. Using a sample of UK FTSE 350 companies from 2000 to 2009, Korczak and Liu (2014) show that executives whose stock ownership is below the required level retain more newly-vested equity after the adoption. On the other hand, Shilon (2014) argues that the SORs of S&P 500 firms adopted during 1998 - 2008 are ineffective because most policies do not enforce the minimum ownership levels until the end of a 'grace period', which is often five years. In addition,

most firms neither specify the sanctions for breaching the requirements nor disclose the inclusion policies (e.g., whether unvested stock is counted towards the requirements).

Our paper contributes to existing studies of SORs by providing evidence of previously undocumented effects of SOR adoption: risk reduction and pay increases. We show that CEOs reduce risk-taking and receive higher compensation after the adoption of a binding SOR, namely one that imposes an increase in the CEOs portfolio allocation to her own firm's stock.

3. Data

We collect the formal stock ownership requirements of 885 firms in the S&P 500 index from 1993 to 2013 by manually searching all DEF-14A filings on the SEC website to determine the first year an SOR is mentioned. We initially identify 731 firms that adopt the requirement, 631 of which have clear information on the adoption year and amount of share ownership required. We then require that the incumbent CEO holds her position for at least one year before the adoption year and one year after.⁶ We also require available data from the Center for Research in Security Prices (CRSP), Compustat, Risk Metrics, and Execucomp databases. The final sample consists of 412 firms that adopt ownership requirements for their CEOs between 1993 and 2013. Figure 1 shows how the use of SORs has evolved over time; in 1993 SORs were very rare; by 2002, still less than a fifth of our sample had adopted an SOR; new adoptions increased rapidly in the years following the 2002 enactment of SOX, until for S&P500 firms at least, SORs are now ubiquitous.

Of the 412 firms in our sample, 354 firms (86%) specify the minimum ownership requirement as a multiple of CEO base salary, 52 firms require a fixed number of shares, and 6 firms require a fixed dollar value of shares. We classify a requirement to be binding if, at the time of the adoption, the CEO

⁶ This longevity requirement may lead to a survival bias which would work against our finding significant results.

owns less than the minimum requirement and non-binding if the CEO already fulfills it.⁷ This classification results in 127 firms (31%) with binding SORs and 285 firms with non-binding requirements.⁸

Table 1 reports firm and CEO characteristics at the end of the year before the SOR was adopted for the 412 firms in our sample. CEO median stock holdings (\$8.7m) represent ten times CEO median base salary (\$0.87m) and two and a half times CEO median equity compensation (\$3.6m); Even before SOR adoption, the majority of CEOs exceed the minimum ownership multiple (usually 4 or 5 times base salary) which can often be achieved with just two or three years' worth of equity compensation.⁹ The 31% of our sample not already in compliance with the SOR at adoption represent our 'binding' treatment group.¹⁰

In Table 2, we estimate a Probit regression where the dependent variable equals one if a firm in our sample adopts a binding SOR and zero if it adopts a non-binding SOR. Independent variables include firm size, profitability, book-to-market equity, leverage, and other board characteristics at the end of the fiscal year preceding the adoption of an SOR. We also control for CEO base salary and CEO holdings since these variables are directly related to whether an SOR is binding or non-binding. We use the change of capital gains tax rates (in the year preceding an SOR adoption) in the state where a firm is headquartered as an instrument for the probability of a SOR adoption binding. When capital gain tax rates decrease it becomes more profitable for executives to sell their company stock, resulting in lower stock holdings. Subsequently-adopted SORs then have a higher probability of binding. This change in tax rate,

⁷ In an unreported robustness test, we find no evidence of differences in risk-reduction incentives across alternative specifications of the SOR conditions (salary multiple; number of shares; dollar value).

⁸ In classifying binding and non-binding requirements, we compare the number of shares held by CEOs to the number of shares required. To get the number of shares required in the cases where a salary multiple is used, we multiply it by the base salary of the CEO in the adoption year, then divide it by the stock price of the day before the announcement of the adoption. If only the month of the adoption year is available, we use the stock price of the first day of the month. If we do not know the date and the month of the adoption, we use the stock price at the beginning of the adoption year. To get the number of shares required in the cases where the SOR is expressed in a fixed dollar amount, we divide the dollar amount by the similarly defined stock price at adoption.

⁹ The mean (median) salary multiple requirements for binding and non-binding SORs are respectively 4.8 (5.0) and 4.9 (5.0) and are not statistically different from each other.

¹⁰ The average share shortfall is 50% of the SOR for the binding group. In Section 4.4 we perform additional tests using alternative measures of the 'level of binding'.

therefore, satisfies the ‘relevance’ condition for being an instrument. On the other hand, there is no obvious reason to believe that a firm’s corporate policies (such as risk-taking) would be influenced by the exogenous change in state capital gains tax rates.

Consistent with our hypothesis, we find that a one standard deviation (0.74%) decrease in the state capital gains tax rate is associated with an increase of 6.2% in the probability that an adopted SOR is binding. Firms with binding requirements have higher total assets. Interestingly, they also have a lower fraction of independent directors and higher probability of the CEO also being chair of the board. This finding may indicate a substitution between board oversight and a stricter ownership requirement (to potentially align managers’ and shareholders’ interests); or may imply that a binding SOR is a cover for weak monitoring. As expected, CEOs of firms with non-binding requirements have longer tenure and hold more shares in the firm. To address the possibility that some of the differences in firm performance and corporate governance may be driving our results, we control for firm, CEO, and board characteristics in subsequent tests. We use the fitted value estimated from this model as a proxy for the probability of an adopted SOR binding, and include this variable as the main independent variable in all subsequent tests where we contrast the firms adopting a binding versus non-binding SOR. The inverse Mills ratio (Heckman, 1979) is used to control for potential selection bias in another specification of subsequent tests. Finally, we conduct a placebo analysis to further address the potential problem of omitted variables.

4. Main results

4.1. Binding stock ownership requirements and changes in risk-taking

4.1.1. Change in idiosyncratic and systematic risk based on imputed returns

Our first proxy for risk-taking attempts to capture directly the level and composition of risk that CEOs undertake through their allocation of capital across industries of different risks. Armstrong and Vashishtha (2012) argue that measures of risk using realized returns do not necessarily reflect managers’ anticipated risk profiles. They propose an imputed measure of firm risk based on the cross-product of a

firm's investment weights in different industries and the risk of each industry. The investment weights of a firm are arguably a direct result of the CEO's decisions and risk preferences, while industry risk is relatively stable over time and is less likely to be influenced by a specific firm's information environments. This measure, therefore, is likely to capture the CEOs' risk-taking decisions and is relatively free of endogeneity issues associated with the information environment of a firm.

We use the Compustat Industry Segment Database to identify the two-digit SIC industry segments a firm operates in at the end of the fiscal year. We calculate the monthly return of each industry segment as the average monthly stock return of each single-segment firm in the Compustat database, weighted by book value of assets. Next, we impute the monthly return for each firm as the average of these industry segment returns, weighted by the firm's book value of assets in each segment.¹¹ We then calculate the firm's total risk for a fiscal year as the standard deviation of its imputed returns over the previous 60 months.¹² The firm's idiosyncratic risk is the standard deviation of the residuals from a regression of its imputed monthly returns over the previous 60 months on the market return; and the firm's systematic risk is the standard deviation of the predicted values from the same regression.¹³ The asset weights for imputed returns of each firm-year are always the weights at the end of the year (even though they can vary over the previous 60 months) to reflect the CEO's allocation across industry segments in that year, to achieve her desired level and composition of risk.

Table 3 reports the OLS regressions of changes in total risk (models (1) and (2)), systematic risk (models (3) and (4)), and idiosyncratic risk (models (5) and (6)), based on firms' imputed returns from the year before an SOR adoption to the year after. The instrumented variable for a binding SOR in models (1), (3), and (5) is the predicted probability of a firm adopting a binding SOR, estimated from Table 2. In models (2), (4), and (6), the binding requirement indicator variable equals one if the SOR is binding, and

¹¹ It is possible that capital structure influences industry selection and debt level in each segment reflects managers' risk-taking preferences (see, for example, Campello, 2003; Miao, 2005; MacKay and Phillips, 2005); however we do not have data on segment leverage. We therefore use book value of assets as segment weights.

¹² Our results are very similar if we use daily stock returns over one year to estimate imputed risks. A 60-month window, however, is more likely to capture stable expected risk components of industry segments.

¹³ Our results are robust to using the Fama-French (1993) three-factor model instead of the CAPM model.

zero if non-binding; we include the inverse Mills ratio estimated from Table 2 in these regressions to control for potential selection bias. The coefficients on each of these two binding requirement variables are negative and statistically significant in models (1), (2), (5), and (6), suggesting that CEOs who deviate from their optimal portfolio to meet the ownership requirement *do* subject their firms to lower total risk, in particular, lower idiosyncratic risk. The coefficient is negative but not statistically significant in models (3) and (4), indicating that these CEOs do not reduce systematic risk, consistent with the intuition that CEOs can hedge systematic risk on their own account, by trading the market portfolio. Recalling that the mean level of idiosyncratic risk in our sample is 4.24%, the coefficient on the binding ownership requirement in model (5) represents a proportional 9.2% reduction in idiosyncratic risk, compared to a CEO under a non-binding SOR.

In Table 4, we augment the measure of total risk in Table 3 by taking into account return correlations between different segments. We treat each firm as a portfolio of different business segments and calculate the standard deviation of that portfolio. The correlations between segments are based on imputed returns over the previous 60 months - the average monthly returns of all single-segment firms in the Compustat database, weighted by book value of assets. The results in Table 4 are very similar to models (1) and (2) in Table 3, supporting our prediction of less risk-taking by CEOs who are subject to a binding SOR.

4.1.2. Change in firm leverage

We next examine whether a binding SOR influences CEO capital structure decisions. In Table 5, the dependent variables are the total debt scaled by market value of assets (models (1) and (2)) or book value of assets (models (3) and (4)). The main independent variable in Table 5 is either the instrumented variable for a binding SOR (models (1) and (3)) or the binding requirement indicator (models (2) and (4)). We control for a number of firm, CEO and governance characteristics. Further, since leverage ratios are highly persistent over the long run (Lemmon, Roberts, and Zender, 2008), we control for the deviation of

leverage (in the year before adoption) from the 10-year prior rolling average leverage.¹⁴ As expected, this variable is negative and highly significant, suggesting that firm leverage is mean reverting. Consistent with the literature on firm capital structure (for example, Lemmon et al, 2008, Chang and Dasgupta, 2009, and Malmendier, Tate, and Yan, 2011), we find a negative association between leverage and profitability.

Models (1) and (3) report a negative coefficient on the instrumented binding requirement variable, and this coefficient is statistically significant at the 5% level. The coefficient of the indicator variable for binding is also negative and significant at the 5%-10% level in models (2) and (4). The results in models (1) to (4) suggest that firms that adopt a binding SOR for CEOs experience a 2.2% to 2.9% reduction in leverage after the adoption, compared to firms adopting a non-binding SOR. This evidence is consistent with the literature on the relationship between CEOs' personal preferences and corporate financing behavior (for example, Cronqvist, Makhija, and Yonker, 2012).

4.1.3. Change in M&A activities

Given the potential for mergers and acquisitions to substantially alter a firm's risk exposure, we next examine CEO decisions in M&A. We hypothesize that the acquisitions made by CEOs forced to increase stock holdings will be more diversifying than those made by CEOs with a non-binding SOR. In Table 6, Panel A, we examine the 216 CEOs in our sample who make at least one acquisition in both the five-year period before and the five-year period after the adoption of an ownership requirement.¹⁵ As a proxy for the risk-reduction effect of diversifying mergers, we use the simple correlation between imputed industry returns of acquirer and target firm, where imputed returns are measured as above, using the primary SIC code of acquirer and target and abstracting from size differences between acquirer and target firm. The dependent variable in models (1) and (2) is the change of the average target-acquirer correlation from the acquisitions made before the adoption of SOR to that after the adoption, while in

¹⁴ That is, the leverage at the year before SOR adoption year minus the 10-year prior rolling average leverage.

¹⁵ We count the deals made by the 412 sample CEOs only during their tenure with the sample firm. Of the 216 CEOs with at least one such deal in the five years before and at least one such deal in the five years after SOR adoption, 68 of their firms (31.5%) adopt a binding SOR.

models (3) to (4) we use deal-value-weighted target-acquirer correlation. The coefficients on our binding requirement variables are negative and statistically significant in all four models. Model (1) shows that, compared to a CEO with a non-binding SOR, a CEO with a binding SOR acquires firms from industries on average 0.1255 less correlated with her own.

Given that some acquirers and targets in our sample are multi-segment firms, and that acquirer and target relative firm size also affects diversification, in Panel B we construct an alternative measure of the change in portfolio risk. This measure now considers the pre-merger asset-weighted primary and secondary segments of acquiring firm and calculates the imputed portfolio risk, versus the post-merger imputed portfolio risk of asset-weighted segments of the combined acquirer and target. We then calculate the merger-induced *change* in the imputed portfolio risk. The dependent variable of the tests in Panel B of Table 6 is the difference between the average merger-induced risk change in the five years before an SOR adoption and that in the five years after.¹⁶ In models (1) and (2), the portfolio risk is equally weighted, while in models (3) and (4), it is weighed by deal values.

The coefficients on the binding variables are negative and significant in all four models, suggesting that CEOs under a binding SOR are more likely to make a risk-reducing acquisition. The economic magnitude of the risk reduction effect is meaningful. For example, the risk reduction of 0.0013 (model (1)) accounts for 1.56% of the average pre-merger portfolio risk (0.0835). This effect is non-trivial, given that target firms on average are only 13.7% of the size of their acquirer.

4.1.4. Change in earnings volatility

If the CEOs facing a binding SOR take less risk, we should expect a reduction in earnings volatility after the adoption. Table 7 reports regressions of changes in the standard deviation of quarterly ROAs, from three years before an SOR adoption to three years after. As predicted, we find that firms with

¹⁶ The number of observations in Panel B reduces to 178 firms, since some target firms do not have assets data available in the SDC or Compustat database. Of these 178 firms, 55 (30.9%) adopt a binding SOR.

a binding SOR are associated with a greater reduction in earnings volatility. The significant coefficient on the instrumented variable for binding requirement in model (1) indicates that such a CEO reduces the firm's earnings volatility by 1% on average, compared to a CEO under a non-binding SOR. The evidence in Table 7 is consistent with that in Tables 3 to 6; CEOs reduce risk after being required to have a greater personal exposure to firm risk as a result of a binding SOR.

4.2. Binding ownership requirements and changes in CEO compensation and holdings

CEOs are typically undiversified and may value their company stock holdings lower than diversified outside investors would. Adoption of a binding SOR leads to even poorer diversification for the CEO, and consequently lower subjective valuation of company stock. As a result, the CEO may receive higher pay to compensate for holding additional company stock. We hypothesize that CEO compensation will increase more for firms that adopt binding requirements compared to firms that adopt non-binding ones.

Table 8 reports OLS regressions of changes in CEO compensation from the year before SOR adoption to the year after. Dependent variables in both Panels of Table 8 are the changes in the natural logarithms of total compensation (models (1) and (2)), cash compensation (models (3) and (4)), and equity compensation (models (5) and (6)), respectively. We control for firm performance measured by the change in ROA and for other characteristics of the firm, CEO, and board.

In Panel A, our variables of interest include the instrumented binding requirement (models (1), (3), and (5)) or the binding requirement indicator (models (2), (4), and (6)). The coefficient on binding requirement variables is positive and significant at the 10% level in models (1) and (2), suggesting that CEOs who are subject to a binding SOR experience a higher increase in total compensation. The coefficient is positive and statistically significant at the 5% level in models (5) and (6) and is positive but not significant in models (3) to (4), indicating that the higher total pay for CEOs facing binding SORs originates from the increase in equity-based compensation but not cash compensation. This evidence is

consistent with the notion that CEOs are compensated for the reduction in diversification, and consequently the reduction in their subjective value of equity compensation and holdings resulting from the binding SOR. The effect is also economically meaningful. In model (5), on average, a CEO subject to a binding requirement will receive approximately double the increase in equity compensation of her peer CEOs with a non-binding SOR.¹⁷ CEOs in firms with binding requirements do not receive more cash compensation, potentially because an increase in base salary would make the binding requirement even stricter.¹⁸ In an (unreported) robustness test we confirm that the change in total compensation and equity pay of CEOs under a binding SOR is not lower than that of CEOs under a non-binding SOR, for *each* of the five years subsequent to adoption, suggesting that there is no reversion in compensation for the binding group.

Our variables of interest in Panel B include the instrumented ‘binding level’ (models (1), (3), and (5)) or the ‘binding level’ (models (2), (4), and (6)). ‘Binding level’ equals zero if a CEO satisfies the SOR, and otherwise equals the shortfall difference between the value required and the value owned by the CEO, scaled by her outside wealth.¹⁹ The results in Panel B suggest that the impact of a binding SOR on CEO compensation is stronger for less diversified CEOs, which is consistent with our prediction.

An alternative explanation for more positive pay changes for CEOs under a binding SOR is that firms may increase equity compensation to help a CEO fulfill the binding SOR; or that a binding SOR is a cover for managerial rent extraction, which is costly for shareholders. If that is the case, we should observe a stronger effect of binding SORs on CEO pay in firms with weak governance. In unreported tests, we repeat the compensation regressions, adding interaction terms between an (un-instrumented) binding SOR indicator and measures of firm governance, such as board independence, compensation

¹⁷ $((e^{1.1042} - 1) \approx 2)$

¹⁸ The majority (86%) of our sample firms base the SOR on a multiple of base salary.

¹⁹ We estimate a CEO’s outside wealth as the aggregate cash flows, excluding base salary, she receives from all of her reported S&P1500 executive positions prior to the SOR adoption. Annual cash flows are measured as the CEO’s bonus plus the net cash from equity sales and purchases during the year. (Equity sales and purchases are obtained from the Thomson Insider Database.) Total outside wealth is the sum of all cash flows, compounded using the average of the annual market return and risk free rate. Our test results are similar if we count base salary towards outside wealth.

committee independences, and CEO-chairman duality. We find no evidence of a stronger effect of binding SORs on CEO pay for firms with weak governance. Nevertheless, we cannot completely rule out the possibility that a binding SOR is the result of some negotiation process between CEOs and boards to increase CEO pay. Our use of IV throughout this paper focuses on effects of the exogenous component of a binding SOR.

We next examine the evolution of CEO holdings in the five years after the adoption of an SOR, given that five years is the typical grace period for a CEO to fulfil the requirement. Figure 2 shows that the increase in stock holdings of a CEO subject to a binding SOR is significantly higher than that of a CEO under a non-binding requirement.²⁰ Similarly, 87.3%, 90.4%, and 93.3% of the CEOs in our sample have achieved their stock ownership requirements after respectively three, four, and five years of an SOR adoption. This evidence is consistent with our prediction that a binding requirement leads to CEOs increasing their company holdings and becoming more undiversified.

4.3. Placebo test

To further address the potential endogeneity concern that firms (and their CEOs) adopting a binding SOR may be fundamentally different from those adopting a non-binding requirement, we perform a placebo analysis. Specifically, for each of the 412 firms that adopt an SOR, we assign a random ‘pseudo-adoption year’. The pseudo-adoption year is drawn from the period 1993-2013, excluding the period one year before and after the actual adoption year, and excluding any years where the CEO is not employed in the year before and after.²¹ The placebo sample consists of 410 firms. We then estimate for

²⁰ The sample size reduces to 345, 293, 232, and 182 CEOs in the year’s t+2, t+3, t+4, and t+5, respectively, due to CEO turnover and/or unavailable data from Execucomp after 2014. It is possible that CEOs who increase their stock holdings significantly after SOR adoption are more likely to stay longer in the firm.

²¹ Our results do not change if we exclude the period two (or three) years immediately before and after the actual adoption year.

each of the pseudo-adoption years whether the SOR would then have been binding.²² We also use the change in state capital gains tax rate as an instrument for pseudo-adoption of a binding SOR.

Table 9 summarizes the results for the placebo sample when we repeat the analyses of Table 3 to Table 8, yet none of the original results are replicated. This evidence suggests that our findings on the changes in risk-taking and CEO pay of the firms with binding SORs are *not* driven by differing characteristics of binding versus non-binding firms, or by other omitted variables that are correlated with risk-taking and CEO pay.

4.4. Alternative definitions for binding stock ownership requirements

4.4.1. Accounting for stock return volatility

A CEO satisfying the ownership requirement at the time of its adoption will not necessarily meet the requirement in the following years, since the firm's stock price may fall sufficiently that she breaches the specified SOR salary multiple. Therefore, to address the effect of stock return volatility, we develop a more stringent condition to identify binding and non-binding ownership requirements. We calculate the stock return volatility of the adopting firms as the standard deviation of monthly returns over the three years before the adoption of the ownership requirement. We classify a requirement to be binding if:

$$\text{Number of shares held} \leq \text{Number of shares required} \times (1 + \text{stock return volatility})$$

We then repeat our analyses from Table 3 to Table 8, also using the changes in state capital gains tax rates as instruments for binding SORs, and the test results are summarized in Panel A of Table 10. Our findings are robust to the alternative definition of binding requirements.

²² We apply the actual salary multiples of the adopting firms to identify the CEOs who meet the requirement and those who do not meet the requirement in the placebo sample. For 58 cases where a fixed number (or value) of shares was required instead of a base salary multiple, we convert the number (or value) of shares into salary multiples. Our results do not change if we use the fixed number (or value) of shares in these cases to identify binding requirements in the placebo test.

4.4.2. Accounting for additional stock required, to satisfy SOR

We next construct a series of variables that equal zero if a CEO owns more shares than required in the SOR, and equal the shortfall (i.e. the difference between the number of shares required and the number of shares actually owned by the CEO), if the CEO holds fewer than the required number of shares. These variables measure ‘how binding’ or relatively onerous the binding SOR is - the additional dollar amount of shares a CEO needs to satisfy the ownership requirement, relative to (a) the requirement itself; (b) total compensation in the year prior to SOR adoption; or (c) estimated Total Outside Wealth in the year prior to SOR adoption. We also construct an instrumented variable for each of these binding measures, similarly to Table 2, and use it as the main control variable in Panels B, C, and D of Table 10.

(a) Scaling the shortfall by the total share value of the SOR, Panel B of Table 10 reports a summary of test results from Tables 3 to 8. Most of our results hold under this binding measure. For example, we find that CEOs further from satisfying the SOR are more likely to expose the firm to projects with lower (idiosyncratic) risk, to make more risk-reducing acquisitions, to reduce firm leverage, and to receive higher compensation. This measure, however, gives inconclusive evidence on ROA volatility.

(b) Scaling the shortfall by total CEO compensation in the year prior to SOR adoption, i.e., to capture how many years of total compensation are needed to fulfill the shortfall, Panel C of Table 10 reports a summary of test results from Tables 3 to 8. Our findings on idiosyncratic risk, leverage, M&A, and compensation are robust to this definition.

(c) Scaling the shortfall by estimated CEO Total Outside Wealth in the year prior to SOR adoption, Panel D of Table 10 summarizes the test results from Tables 3 to 8. Our main findings related to imputed risk, leverage, M&A, and compensation do not change, while the result of ROA volatility does not hold under this alternative definition.

5. Conclusion

The alignment of managerial interests with that of the shareholders has been the focus of corporate governance research since the seminal work of Jensen and Meckling (1976). The lack of substantial CEO ownership in the companies they manage has often been argued as the root cause of various kinds of agency conflicts. In the last decade, CEO stock ownership requirements have gained popularity and are now present in over 80% of the S&P 500 firms. Advocates argue that such requirements help to align managerial interests with those of shareholders.

We provide new evidence on the perhaps unintended consequences of SORs. As they make some CEOs more undiversified in their personal portfolio than they would otherwise choose to be, these CEOs have the incentive to reduce the idiosyncratic risk of their companies. Using changes in state capital gains tax rates as identification, we find supporting empirical evidence using several measures of risk. CEOs who are required to increase their stock holdings under the ownership requirements on average adjust investment allocations so as to decrease the idiosyncratic risk of their companies by over 9%, compared to a control group of CEOs who do not have to increase their stock holdings. In contrast, these CEOs do not reduce the firms' exposure to market risk, which can be hedged via trading the market portfolio. Further, these CEOs use less leverage, make more risk-reducing diversifying acquisitions, and reduce earnings volatility. In addition, the CEOs who have to increase their investment allocation to company stock to satisfy ownership requirements receive higher pay, possibly to compensate for the reduced subjective value of their equity holdings. This additional compensation represents a previously unidentified cost of these ownership requirements.

Our results are robust after controlling for various firm and CEO characteristics. Placebo tests verify that our findings are unlikely to be driven by endogeneity issues. This study provides evidence of important and previously undocumented consequences of stock ownership requirements, a governance policy widely adopted by many U.S. public firms. This evidence suggests that boards should exercise judgment and caution in adopting a popular governance initiative.

References

- Armstrong, C. S., Vashishtha, R., 2012. Executive stock options, differential risk-taking incentives, and firm value. *Journal of Financial Economics* 104(1), 70-88.
- Bebchuk, Lucian, Fried, J., 2004. *Pay without performance: The unfulfilled promise of executive Compensation* (Cambridge, MA: Harvard University Press).
- Bekkum, S., Verwijmeren, P., Zhang, D., 2015. How do compensation policies spread? Evidence from executive ownership guidelines. Working paper
- Bettis, J. C., Bizjak, J. M., Lemmon, M. L., 2005. Exercise behavior, valuation, and the incentive effects of employee stock options. *Journal of Financial Economics* 76(2), 445-470.
- Bettis, J. C., Coles, J., Lemmon, M. L., 2000. Corporate policies restricting trading by insiders. *Journal of Financial Economics* 57(2), 191-220.
- Brick, I. E., Palmon, O., Wald, J. K., 2012. *The Review of Economics and Statistics* 94(1), 287-303.
- Brisley, N., 2006. Executive stock options: early exercise provisions and risk-taking incentives. *Journal of Finance* 61, 2487-2509.
- Brown, L. D., Caylor, M. L., 2006. Corporate governance and firm valuation. *Journal of Accounting and Public Policy* 25, 409-434.
- Brown, K., Chen, C., Kennedy, D., 2014. Target ownership plans and earnings management. Working paper.
- Cai, J., Vijh, A. M., 2005. Executive stock and option valuation in a two state-variable framework. *The Journal of Derivatives* 12(3), 9-27.
- Cai, J., Vijh, A. M., 2007. Incentive effects of stock and option holdings of target and acquirer CEOs. *The Journal of Finance* 62(4), 1891-1933.
- Campello, M., 2003. Capital structure and product market interactions: evidence from business cycles. *Journal of Financial Economics* 69(3), 353-378.
- Cao, Y., Gu, Z., Yang, Y. G., 2010. Adoption of executive ownership guidelines: a new look. Working paper.
- Cao, C., Simin, T., Zhao, J., 2008. Can growth options explain the trend in idiosyncratic risk? *Review of Financial Studies* 21(6), 2599-2633.
- Carpenter, J. N., 2000. Does option compensation increase managerial risk appetite? *The Journal of Finance* 55(5), 2311-2331.
- Chang, X., Dasgupta, S., 2009. Target behavior and financing: how conclusive is the evidence? *Journal of Finance* 64 (4), 1767-1796.
- Chung, K. H., Elder, J., Kim, J., 2010. Corporate governance and liquidity. *Journal of Financial and Qualitative Analysis* 45, 265-291.

- Coles, J., Daniel, N., Naveen, L., 2006. Managerial incentives and risk-taking. *Journal of Financial Economics* 79, 431-468.
- Core, J., Guay, W., 1999. The use of equity grants to manage optimal equity incentive levels. *Journal of Accounting and Economics* 28, 151-184.
- Core, J., Larcker, D., 2002. Performance consequences of mandatory increases in executive stock ownership. *Journal of Financial Economics* 64, 317-340.
- Cronqvist, H., Makhija, A. K., Yonker, S. E., 2012. Behavior consistency in corporate finance: CEO personal and corporate leverage. *Journal of Financial Economics* 103(1), 20-40.
- Duan, J., Wei, J., 2005. Executive stock options and incentive effects due to systematic risk. *Journal of Banking and Finance* 29, 1185-1211.
- Fama, E. F., French, K. R., 1993. Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics* 33 (1), 3-56.
- Fama, E. F., French, K. R., 1997. Industry costs of equity. *Journal of Financial Economics* 43, 153-193.
- Garvey, G., Milbourn, T., 2003. Incentive compensation when executives can hedge the market: Evidence of relative performance evaluation in the cross section. *Journal of Finance* 58, 1557-1582.
- Gormley, T. A., Matsa, D. A., 2015. Playing it safe? Managerial preferences, risk, and agency conflicts. Working paper.
- Grossman, S. J., Hart, O. D., 1983. An analysis of the principal-agent problem. *Econometrica* 51, 7-45.
- Hall, B. J., Murphy, K. J., 2002. Stock options for undiversified executives. *Journal of Accounting and Economics* 33(1), 3-42.
- Heckman, J., 1979. Sample selection bias as a specification error. *Econometrica* 47, 153-161.
- Henderson, V., 2005. The impact of the market portfolio on the valuation, incentives, and optimality of executive stock options. *Quantitative Finance* 5, 35-47.
- Huddart, S., Lang, M., 1996. Employee stock option exercises an empirical analysis. *Journal of Accounting and Economics* 21(1), 5-43.
- Ingersoll, J. E., 2006. The subjective and objective evaluation of incentive stock options. *Journal of Business* 79(2).
- Jensen, M., Meckling, W., 1976. Theory of the firm: managerial behavior, agency costs and ownership structure. *Journal of Financial Economics* 3, 305-360.
- Jin, Li, 2002. CEO Compensation, Diversification, and Incentives. *Journal of Financial Economics* 66, 29-63.
- Kahl, M., Liu, J., Longstaff, F. A., 2003. Paper millionaires: how valuable is stock to a stockholder who is restricted from selling it? *Journal of Financial Economics* 67(3), 385-410.

- Kang, J., Xu., L., 2015. Executive stock ownership guidelines and the agency cost of debt. Working paper.
- Korczak, P., Liu, X., 2014. Managerial shareholding policies and retention of vested equity incentives. *Journal of Empirical Finance* 27, 116-129.
- Lambert, R.A., Larcker, D.F., and Verrecchia, R.E., 1991. Portfolio considerations in valuing executive compensation. *Journal of Accounting Research* 29, 129-149.
- Lemmon, M., Roberts, M., Zender, J., 2008. Back to the beginning: Persistence and the cross-section of corporate capital structure. *Journal of Finance* 60, 1575-1608.
- Lewellen, K., 2006. Financing decisions when managers are risk averse. *Journal of Financial Economics* 82(3), 551-589.
- Low, A., 2009. Managerial risk-taking behavior and equity-based compensation. *Journal of Financial Economics* 92(3), 470-490.
- MacKay, P., Phillips, G. M., 2005. How does industry affect firm financial structure? *Review of Financial Studies* 18(4), 1433-1466.
- Malmendier, U., Tate, G., Yan, J., 2011. Overconfidence and early-life experiences: the effects of managerial traits on corporate financial policies. *Journal of Finance* 66 (5), 1687-1733.
- Miao, J., 2005. Optimal capital structure and industry dynamics. *Journal of Finance* 60(6), 2621-2659.
- Meulbroek, L. K., 2001. The efficiency of equity-linked compensation: Understanding the full cost of awarding executive stock options. *Financial Management* 30(2), 5-30.
- Murphy, K. J., 2012. The politics of pay: a legislative history of executive compensation. Working paper.
- Ofek, E., Yermack, D., 2000. Taking stock: Equity based compensation and the evolution of managerial ownership. *Journal of Finance* 55 (3), 1367-1384
- Pastor, L., Veronesi, P., 2009. Technological revolutions and stock prices. *American Economic Review* 99(4), 1451-1483.
- Ross, S. A., 2004. Compensation, incentives, and the duality of risk aversion and riskiness. *The Journal of Finance* 59(1), 207-225.
- Shilon, N., 2014. CEO stock ownership policies – rhetoric and reality. *Indiana Law Journal* 90(1).
- Tian, Y., 2004. Too much of a good incentive? The case of executive stock options. *Journal of Banking and Finance* 28, 1225-1245.
- Vassalou, M., Apedjinou, K., 2004. Corporate innovation, price momentum, and equity returns. Working paper.

Figure 1: Distribution of stock ownership requirements (SORs) by year

This Figure illustrates yearly distribution of stock ownership requirements (SORs) in our sample. We collect the formal SORs of 885 firms in the S&P 500 index from 1993 to 2013 by manually searching DEF-14A filings on the SEC website. We initially identify 731 firms that adopt the requirement, 631 of which have clear information on the adoption year and amount of share ownership required. We then require that the incumbent CEO holds her position for at least one year before the SOR adoption year and one year after. We also require available data from the Center for Research in Security Prices (CRSP), Compustat, Risk Metrics, and Execucomp databases. The final sample consists of 412 firms that adopt SORs for their CEOs between 1993 and 2013.

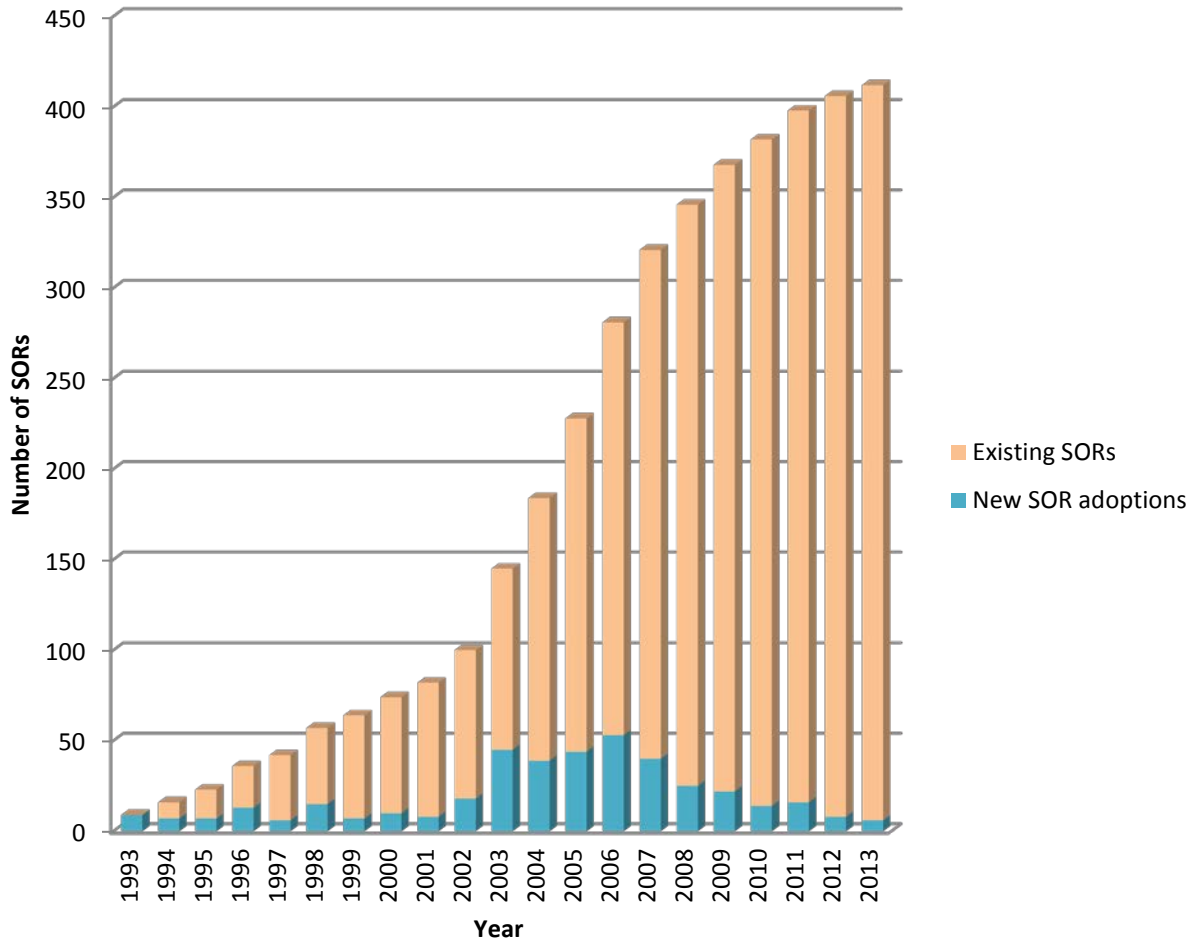


Table 1: Descriptive Statistics

This table reports firm and CEO characteristics at the yearend before the SOR adoption year of 412 firms in our sample. An SOR is binding if, at the time of the adoption, the CEO holds less than the minimum value of shares required. All variables are defined in Appendix 1.

	Mean	1st Quartile	Median	3rd Quartile
Market value of equity (mil)	16,834	3,932	7,873	17,166
Assets (mil)	22,125	3,360	8,302	20,564
ROA	0.0513	0.0200	0.0497	0.0924
Book-to-market	0.4308	0.2388	0.3658	0.6003
Leverage (market)	0.1596	0.0540	0.1260	0.2409
Leverage (book)	0.2320	0.1194	0.2190	0.3376
Total risk (imputed)	0.0687	0.0473	0.0637	0.0854
Systematic risk (imputed)	0.0518	0.0357	0.0461	0.0649
Idiosyncratic risk (imputed)	0.0424	0.0274	0.0392	0.0513
Imputed portfolio risk	0.0675	0.0468	0.0625	0.0849
ROA volatility	0.0152	0.0035	0.0078	0.0157
Board size	10.818	9	11	12
Fraction of independent directors	0.7350	0.6364	0.7500	0.8333
Busy board (1/0)	0.0364	0	0	0
Co-opted board (1/0)	0.3398	0	0	1
Poison pill (1/0)	0.3956	0	0	1
Classified board (1/0)	0.4854	0	0	1
CEO chairman (1/0)	0.6444	0	1	1
CEO founder (1/0)	0.0374	0	0	0
CEO tenure (years)	5.6551	1	4	8
CEO age (years)	55.0241	51	55	59
CEO holding (mil)	54.6505	2.9375	8.6725	33.1125
CEO base salary (mil)	0.9248	0.7000	0.8742	1.0126
CEO cash compensation (mil)	2.0851	0.9661	1.5021	2.4678
CEO equity compensation (mil)	6.1307	1.4598	3.5700	6.8805
CEO total compensation (mil)	9.1065	3.5119	6.1642	10.2955
CEO salary multiple requirement	4.8828	4	5	5
Binding requirement (1/0)	0.3083	0	0	1
Change in state capital gains tax rate (%)	0.0126	0	0	0

Table 2: Which firms adopt a binding SOR?

This table reports a Probit regression where the dependent variable equals one if the firm adopts a binding SOR, and zero if it adopts a non-binding SOR. Firm and CEO characteristics are measured at the yearend before SOR adoption year. All variables are defined in Appendix 1. The t-values are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Dependent Variable: Binding requirement (1/0)
Intercept	83.8404 (2.35)**
Δ state capital gains tax rate, from t-1 to t	-3.7977 (-2.28)**
Assets (log)	1.4652 (3.73)***
ROA	-0.6347 (-0.18)
Book-to-market	0.2863 (0.25)
Leverage (book)	-0.5557 (-0.33)
Board size	-0.0683 (-0.58)
Fraction of independent directors	-5.0187 (-2.06)**
Busy board (1/0)	0.3839 (0.11)
Co-opted board (1/0)	1.4674 (1.77)*
Classified board (1/0) x Poison pill (1/0)	0.5963 (1.07)
CEO chairman (1/0)	2.7036 (2.95)***
CEO founder (1/0)	2.0682 (0.01)
CEO tenure (log)	-0.9175 (-1.93)*
CEO age (log)	-5.4023 (-1.63)
CEO base salary (log)	0.2220 (1.87)*
CEO holding (log)	-4.9537 (-4.52)***
N	412
Adjusted Pseudo R-sq	0.9184
Fixed Effects (Year, Industry)	Yes

Table 3: Binding SOR and firm risk (imputed returns)

This table reports ordinary least squares (OLS) regressions of changes in firm risk, from one year before to one year after the SOR adoption year. The dependent variables are total risk, systematic risk, and idiosyncratic risk in models (1)-(2), (3)-(4), and (5)-(6), respectively, and are estimated from the imputed stock return regressions similar to Armstrong and Vashishtha (2012). ‘Binding requirement’ in models (1), (3), and (5) is the predicted probability of adopting a binding SOR estimated from Table 2. ‘Binding requirement’ in models (2), (4), and (6) equals one if a CEO holds less than the minimum shares required in the SOR at the time of the adoption, and zero otherwise. Firm and CEO characteristics are measured at the yearend before the SOR adoption year. All variables are defined in Appendix 1. All models control for adoption year and industry fixed effects, with industry defined by the Fama-French 48-industry classification. The t-values are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Dependent Variable: Δ Risk t-1 to t+1					
	Δ Total risk		Δ Systematic risk		Δ Idiosyncratic risk	
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	-0.0083 (-0.28)	-0.0136 (-0.46)	-0.0215 (-1.08)	-0.0230 (-0.79)	-0.0473 (-1.47)	-0.0484 (-1.49)
Binding requirement	-0.0067 (-2.78)***	-0.0047 (-2.20)**	-0.0016 (-1.60)	-0.0013 (-1.17)	-0.0039 (-2.47)**	-0.0030 (-2.07)**
Assets (log)	-0.0002 (-0.22)	-0.0003 (-0.36)	-0.0002 (-0.42)	0.0001 (0.23)	-0.0003 (-0.41)	-0.0003 (-0.54)
Δ ROA from t-1 to t+1	-0.0114 (-0.65)	-0.0145 (-0.82)	-0.0034 (-0.45)	0.0029 (0.30)	-0.0228 (-1.85)*	-0.0238 (-1.91)*
Book-to-market	0.0009 (0.26)	0.0009 (0.26)	0.0008 (0.52)	0.0012 (0.64)	-0.0004 (-0.16)	-0.0003 (-0.12)
Leverage (book)	0.0161 (2.83)***	0.0162 (2.81)***	0.0062 (2.49)**	0.0052 (1.69)*	0.0078 (1.94)*	0.0080 (1.99)**
Board size	0.0000 (-0.08)	0.0000 (0.02)	-0.0003 (-1.52)	-0.0002 (-0.88)	0.0002 (0.68)	0.0002 (0.85)
Fraction of independent directors	-0.0104 (-1.78)*	-0.0106 (-1.81)*	-0.0029 (-1.14)	-0.0030 (-0.96)	-0.0045 (-1.10)	-0.0049 (-1.18)
Busy board (1/0)	0.0058 (1.27)	0.0059 (1.28)	0.0012 (0.61)	0.0024 (0.98)	-0.0028 (-0.86)	-0.0019 (-0.57)
Co-opted board (1/0)	0.0019 (0.90)	0.0017 (0.82)	0.0002 (0.25)	0.0008 (0.68)	-0.0003 (-0.20)	-0.0001 (-0.10)
Classified board (1/0) x Poison pill (1/0)	0.0011 (0.74)	0.0012 (0.78)	0.0013 (2.08)**	0.0019 (2.37)**	0.0006 (0.58)	0.0007 (0.68)
CEO chairman (1/0)	0.0003 (0.15)	0.0002 (0.11)	0.0008 (1.12)	0.0011 (1.16)	-0.0010 (-0.88)	-0.0012 (-1.01)
CEO founder (1/0)	-0.0018 (-0.46)	-0.0024 (-0.60)	0.0015 (0.89)	0.0011 (0.23)	-0.0025 (-0.93)	-0.0027 (-0.99)
CEO tenure (log)	-0.0004 (-0.33)	-0.0002 (-0.16)	-0.0003 (-0.50)	-0.0005 (-0.70)	0.0002 (0.26)	0.0003 (0.30)
CEO age (log)	0.0008 (0.11)	0.0018 (0.26)	-0.0003 (-0.11)	-0.0006 (-0.15)	-0.0001 (-0.03)	0.0004 (0.08)
CEO base salary (log)	0.0002 (0.71)	0.0002 (0.57)	0.0011 (0.82)	0.0008 (0.39)	0.0035 (1.68)*	0.0034 (1.60)
CEO holding (log)	-0.0013 (-3.06)***	-0.0012 (-2.33)**	-0.0003 (-1.63)	-0.0003 (-1.33)	-0.0007 (-2.32)**	-0.0006 (-1.97)**
Heckman self-selectivity		0.0000 (0.18)		0.0000 (-0.70)		-0.0002 (-1.43)
N	412	412	412	412	412	412
Adj R-sq	0.7519	0.7519	0.9094	0.9126	0.6965	0.6942
Fixed Effects (Year, Industry)	Yes	Yes	Yes	Yes	Yes	Yes

Table 4: Binding SOR and firm risk (portfolio variance)

This table reports OLS regressions of changes in firm risk from one year before to one year after the SOR adoption year. The dependent variable, imputed portfolio risk, is calculated as the standard deviation of a portfolio of business segments, where the volatility of each segment and the correlations between segments are based on the monthly return series of the average single segment firms in a particular industry (Armstrong and Vashishtha, 2012) over the previous 60 months, and the weights are based on segment book value of assets. ‘Binding requirement’ in model (1) is the predicted probability of adopting a binding SOR, estimated from Table 2. ‘Binding requirement’ in model (2) equals one if a CEO holds less than the minimum shares required in the SOR at the time of the adoption, and zero otherwise. Firm and CEO characteristics are measured at the yearend before the SOR adoption year. All variables are defined in Appendix 1. All models control for adoption year and industry fixed effects, with industry defined by the Fama-French 48-industry classification. The t-values are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Dependent Variable: Δ Imputed portfolio risk t-1 to t+1	
	(1)	(2)
Intercept	0.0588 (1.34)	0.0765 (1.38)
Binding requirement	-0.0099 (-2.73)***	-0.0075 (-1.83)*
Assets (log)	0.0017 (1.58)	0.0006 (0.47)
Δ ROA from t-1 to t+1	0.0043 (0.31)	-0.0073 (-0.43)
Book-to-market	-0.0083 (-1.72)*	-0.0114 (-1.81)*
Leverage (book)	0.0256 (3.20)***	0.0276 (2.60)***
Board size	0.0007 (1.24)	0.0013 (1.99)**
Fraction of independent directors	-0.0226 (-2.75)***	-0.0138 (-1.32)
Busy board (1/0)	-0.0049 (-0.71)	-0.0083 (-0.92)
Co-opted board (1/0)	0.0025 (0.80)	0.0057 (1.52)
Classified board (1/0) x Poison pill (1/0)	0.0046 (2.08)**	0.0017 (0.58)
CEO chairman (1/0)	0.0012 (0.47)	-0.0002 (-0.05)
CEO founder (1/0)	0.0030 (0.51)	0.0115 (1.50)
CEO tenure (log)	-0.0016 (-0.89)	-0.0016 (-0.70)
CEO age (log)	-0.0122 (-1.18)	-0.0155 (-1.16)
CEO base salary (log)	0.0001 (0.31)	-0.0004 (-0.68)
CEO holding (log)	-0.0014 (-2.29)**	-0.0007 (-0.80)
Heckman self-selectivity		-0.0002 (-0.49)
N	412	412
Adj R-sq	0.6313	0.6317
Fixed Effects (Year, Industry)	Yes	Yes

Table 5: Binding SOR and firm leverage

This table reports OLS regressions of changes in firm leverage from one year before to one year after the SOR adoption year. The dependent variable in models (1) and (2) is the change in market leverage, while the dependent variable in models (3) and (4) is the change in book leverage. ‘Binding requirement’ in models (1) and (3) is the predicted probability of adopting a binding SOR estimated from Table 2. ‘Binding requirement’ in models (2) and (4) equals one if a CEO holds less than the minimum share value required in the SOR at the time of the adoption, and zero otherwise. Firm and CEO characteristics are measured at the yearend before the SOR adoption year. All variables are defined in Appendix 1. All models control for adoption year and industry fixed effects, with industry defined by the Fama-French 48-industry classification. The t-values are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Dependent Variable: Δ Leverage t-1 to t+1			
	Δ Leverage (Market)		Δ Leverage (Book)	
	(1)	(2)	(3)	(4)
Intercept	0.1498 (0.82)	0.1181 (0.64)	0.3552 (1.73)*	0.3454 (1.67)*
Binding requirement	-0.0265 (-2.03)**	-0.0241 (-2.11)**	-0.0288 (-1.97)**	-0.0219 (-1.72)*
Assets (log)	-0.0032 (-0.78)	-0.0034 (-0.85)	-0.0026 (-0.56)	-0.0029 (-0.64)
Δ ROA from t-1 to t+1	-0.3471 (-6.41)***	-0.3533 (-6.50)***	-0.2539 (-4.20)***	-0.2572 (-4.23)***
Book-to-market	-0.0225 (-1.32)	-0.0254 (-1.48)	-0.0080 (-0.43)	-0.0082 (-0.43)
Deviation of market leverage from 10-year average	-0.1857 (-2.59)***	-0.1775 (-2.46)**		
Deviation of book leverage from 10-year average			-0.1727 (-3.13)***	-0.1724 (-3.10)***
Board size	-0.0027 (-1.50)	-0.0026 (-1.48)	-0.0016 (-0.79)	-0.0016 (-0.77)
Fraction of independent directors	-0.0264 (-0.85)	-0.0273 (-0.87)	-0.0375 (-1.07)	-0.0374 (-1.06)
Busy board (1/0)	-0.0022 (-0.11)	-0.0013 (-0.06)	0.0017 (0.07)	0.0029 (0.12)
Co-opted board (1/0)	-0.0351 (-3.37)***	-0.0358 (-3.43)***	-0.0209 (-1.78)*	-0.0208 (-1.77)*
Classified board (1/0) x Poison pill (1/0)	-0.0107 (-1.26)	-0.0115 (-1.36)	-0.0135 (-1.42)	-0.0133 (-1.38)
CEO chairman (1/0)	-0.0026 (-0.29)	-0.0040 (-0.44)	0.0029 (0.28)	0.0030 (0.30)
CEO founder (1/0)	0.0350 (1.54)	0.0357 (1.57)	0.0308 (1.21)	0.0290 (1.13)
CEO tenure (log)	0.0017 (1.77)*	0.0020 (1.99)**	0.0012 (1.10)	0.0012 (1.01)
CEO age (log)	-0.0147 (-0.38)	-0.0139 (-0.36)	-0.0581 (-1.33)	-0.0564 (-1.29)
CEO base salary (log)	0.0015 (0.89)	0.0015 (0.85)	0.0014 (0.74)	0.0015 (0.75)
CEO holding (log)	-0.0024 (-1.08)	-0.0006 (-0.22)	-0.0016 (-0.64)	-0.0014 (-0.47)
Heckman self-selectivity		-0.0008 (-0.83)		0.0003 (0.26)
N	412	412	412	412
Adj R-sq	0.3535	0.3549	0.2349	0.2331
Fixed Effects (Year, Industry)	Yes	Yes	Yes	Yes

Table 6: Binding SOR and M&A

This table reports OLS regressions of the changes in the correlation between the acquirer and target industry (Panel A) and the changes in the merger-induced risk (Panel B) from the five-year period before an SOR adoption to the five-year period after. To be included in the tests, the CEO has to make at least one acquisition in both periods. ‘Binding requirement’ in models (1) and (3) of both panels is the predicted probability of adopting a binding SOR, estimated from Table 2. ‘Binding requirement’ in models (2) and (4) of both panels equals one if a CEO holds less than the minimum shares required in the SOR at the time of the adoption, and zero otherwise. Firm and CEO characteristics are measured at the yearend before the SOR adoption year. All variables are defined in Appendix 1. All models control for adoption year and industry fixed effects, with industry defined by the Fama-French 48-industry classification. The t-values are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A:

	Dep. Var.: Δ Correlation between acquirer and target industry			
	Δ Equally weighted correlation		Δ Value weighted correlation	
	(1)	(2)	(3)	(4)
Intercept	0.6743 (0.44)	0.6416 (0.41)	0.5364 (0.35)	0.5024 (0.32)
Binding requirement	-0.1255 (-2.09)**	-0.1140 (-1.73)*	-0.1313 (-1.88)*	-0.1200 (-1.82)*
Assets (log)	0.0011 (0.04)	0.0012 (0.04)	-0.0102 (-0.35)	-0.0102 (-0.35)
ROA	0.2950 (0.92)	0.2732 (0.85)	0.1694 (0.53)	0.1464 (0.46)
BM	0.0439 (0.32)	0.0398 (0.29)	0.0133 (0.10)	0.0093 (0.07)
Leverage (book value)	0.2209 (1.07)	0.2307 (1.11)	0.2018 (0.98)	0.2121 (1.03)
Board size	0.0108 (0.88)	0.0107 (0.87)	0.0108 (0.88)	0.0106 (0.87)
Fraction of independent directors	-0.0027 (-0.01)	-0.0037 (-0.02)	0.0318 (0.14)	0.0311 (0.14)
Busy board (1/0)	0.2920 (1.95)*	0.2901 (1.93)*	0.4245 (2.83)***	0.4223 (2.81)***
Co-opted board (1/0)	0.0841 (1.11)	0.0754 (1.00)	0.1016 (1.34)	0.0926 (1.23)
Classified board (1/0) x Poison pill (1/0)	0.0120 (0.22)	0.0117 (0.21)	0.0114 (0.21)	0.0111 (0.20)
CEO chairman (1/0)	-0.0500 (-0.84)	-0.0493 (-0.83)	-0.0970 (-1.64)	-0.0962 (-1.62)
CEO founder (1/0)	0.1972 (1.42)	0.1970 (1.42)	0.1592 (1.15)	0.1590 (1.14)
CEO tenure (log)	0.0493 (1.09)	0.0547 (1.23)	0.0598 (1.32)	0.0653 (1.47)
CEO age (log)	-0.0730 (-0.30)	-0.0716 (-0.29)	-0.1427 (-0.58)	-0.1416 (-0.57)
Base salary (log)	-0.0672 (-0.73)	-0.0656 (-0.71)	-0.0480 (-0.52)	-0.0463 (-0.50)
CEO holding (log)	-0.0034 (-2.06)**	-0.0034 (-2.04)**	-0.0032 (-1.93)*	-0.0032 (-1.92)*
Heckman self-selectivity		-0.0007 (-0.18)		-0.0002 (-0.04)
N	216	216	216	216
Adj R-sq	0.4353	0.4342	0.4634	0.4624
Fixed Effects (Year, Industry)	Yes	Yes	Yes	Yes

Panel B:

	Dep. Var.: Δ Merger-induced risk			
	Δ Equally weighted risk		Δ Value weighted risk	
	(1)	(2)	(3)	(4)
Intercept	-0.0026 (-0.13)	0.0008 (0.02)	-0.0013 (-0.07)	0.0034 (0.10)
Binding requirement	-0.0013 (-1.86)*	-0.0014 (-2.11)**	-0.0013 (-1.83)*	-0.0014 (-2.01)**
Assets (log)	-0.0004 (-0.96)	-0.0001 (-0.19)	-0.0004 (-1.18)	-0.0002 (-0.27)
ROA	-0.0014 (-0.32)	-0.0033 (-0.62)	-0.0018 (-0.43)	-0.0026 (-0.50)
BM	0.0028 (1.61)	0.0012 (0.46)	0.0032 (1.92)*	0.0016 (0.62)
Leverage (book value)	-0.0033 (-1.26)	0.0006 (0.16)	-0.0028 (-1.10)	0.0004 (0.12)
Board size	0.0001 (0.54)	-0.0001 (-0.38)	0.0001 (0.79)	-0.0001 (-0.35)
Fraction of independent directors	0.0002 (0.06)	0.0016 (0.40)	-0.0007 (-0.26)	0.0012 (0.31)
Busy board (1/0)	0.0018 (0.89)	0.0016 (0.67)	0.0022 (1.12)	0.0016 (0.69)
Co-opted board (1/0)	-0.0007 (-0.72)	-0.0005 (-0.33)	-0.0004 (-0.39)	-0.0005 (-0.36)
Classified board (1/0) x Poison pill (1/0)	0.0012 (1.71)*	0.0015 (1.52)	0.0008 (1.19)	0.0012 (1.22)
CEO chairman (1/0)	0.0000 (0.04)	-0.0004 (-0.38)	0.0000 (-0.02)	-0.0002 (-0.21)
CEO founder (1/0)	-0.0019 (-1.01)	-0.0020 (-1.35)	-0.0017 (-0.94)	-0.0018 (-1.12)
CEO tenure (log)	0.0017 (2.80)***	0.0017 (2.17)**	0.0015 (2.60)***	0.0016 (2.08)**
CEO age (log)	-0.0045 (-1.32)	-0.0088 (-1.74)*	-0.0042 (-1.28)	-0.0088 (-1.78)*
Base salary (log)	0.0011 (0.95)	0.0018 (0.78)	0.0010 (0.84)	0.0017 (0.75)
CEO holding (log)	-0.0019 (-0.95)	0.0042 (0.24)	-0.0018 (-0.98)	0.0019 (0.11)
Heckman self-selectivity		-0.0001 (-1.43)		-0.0001 (-1.23)
N	178	178	178	178
Adj R-sq	0.5818	0.6147	0.5788	0.6090
Fixed Effects (Year, Industry)	Yes	Yes	Yes	Yes

Table 7: Binding SOR and earnings volatility

This table reports OLS regressions of changes in firm earnings (ROA) volatility from three years before to three years after the SOR adoption year. ‘Binding requirement’ in model (1) is the predicted probability of adopting a binding SOR estimated from Table 2. ‘Binding requirement’ in model (2) equals one if a CEO holds less than the minimum share value required in the SOR at the time of the adoption, and zero otherwise. Firm and CEO characteristics are measured at the yearend before the SOR adoption year. All variables are defined in Appendix 1. All models control for adoption year and industry fixed effects, with industry defined by the Fama-French 48-industry classification. The t-values are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Dependent Variable: Δ ROA volatility	
	(1)	(2)
Intercept	-0.0360 (-0.56)	-0.0372 (-0.57)
Binding requirement	-0.0101 (-1.98)**	-0.0095 (-2.13)**
Assets (log)	-0.0023 (-1.45)	-0.0024 (-1.48)
ROA	0.1046 (4.78)***	0.1029 (4.66)***
Book-to-market	0.0187 (2.64)***	0.0189 (2.67)***
Leverage (book)	0.0249 (2.31)**	0.0239 (2.23)**
Board size	-0.0002 (-0.26)	-0.0002 (-0.23)
Fraction of independent directors	0.0016 (0.13)	0.0013 (0.11)
Busy board (1/0)	0.0052 (0.47)	0.0062 (0.57)
Co-opted board (1/0)	0.0053 (1.24)	0.0056 (1.29)
Classified board (1/0) x Poison pill (1/0)	-0.0020 (-0.62)	-0.0018 (-0.56)
CEO chairman (1/0)	0.0037 (1.10)	0.0036 (1.06)
CEO founder (1/0)	0.0105 (1.28)	0.0098 (1.19)
CEO tenure (log)	-0.0049 (-1.88)*	-0.0051 (-1.90)*
CEO age (log)	0.0144 (0.94)	0.0152 (0.99)
CEO base salary (log)	-0.0007 (-1.12)	-0.0008 (-1.25)
CEO holding (log)	-0.0006 (-0.83)	-0.0007 (-0.70)
Heckman self-selectivity		0.0000 (0.13)
N	412	412
Adj R-sq	0.5754	0.5770
Fixed Effects (Year, Industry)	Yes	Yes

Table 8: Binding SOR and CEO compensation

This table reports OLS regressions of the changes in CEO compensation from one year before to one year after the SOR adoption year. Dependent variables in models (1)-(2), (3)-(4), and (5)-(6) are the changes in the natural logarithms of total compensation, cash compensation, and equity compensation, respectively. In Panel A, ‘binding requirement’ in models (1), (3), and (5) is the predicted probability of adopting a binding SOR, estimated from Table 2; ‘binding requirement’ in models (2), (4), and (6) equals one if a CEO holds less than the minimum share value required in the SOR at the time of the adoption, and zero otherwise. In Panel B, ‘binding level’ in models (2), (4), and (6) equals the shortfall difference between the share value required and the share value owned by the CEO, scaled by her outside wealth; ‘binding level’ in models (1), (3), and (6) is the predicted binding level estimated using state capital gains tax change as an IV. Firm and CEO characteristics are measured at the yearend before the SOR adoption year. All variables are defined in Appendix 1. All models control for adoption year and industry fixed effects, with industry defined by the Fama-French 48-industry classification. The t-values are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A:

	Dependent Variable: Δ Compensation t-1 to t+1					
	Δ Total compensation		Δ Cash compensation		Δ Equity compensation	
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.1614 (0.34)	0.1509 (0.32)	-0.2866 (-0.35)	-0.2548 (-0.31)	-16.3598 (-1.56)	-13.9645 (-0.90)
Binding requirement	0.1397 (1.66)*	0.1715 (1.88)*	0.1485 (1.24)	0.0111 (0.09)	1.0442 (2.13)**	1.0260 (1.98)**
Assets (log)	-0.0304 (-0.92)	-0.0326 (-0.97)	-0.0722 (-1.50)	-0.0613 (-1.23)	-0.0272 (-0.12)	-0.2451 (-0.83)
Δ ROA from t-1 to t+1	2.7707 (3.31)***	2.7810 (3.32)***	3.1900 (2.71)***	3.1364 (2.64)***	11.7551 (2.28)**	4.9752 (0.85)
Book-to-market	0.0130 (0.09)	0.0227 (0.16)	0.2806 (1.42)	0.2546 (1.20)	-0.4692 (-0.55)	0.6530 (0.66)
Leverage (book)	0.2785 (1.16)	0.2922 (1.21)	-0.4486 (-1.34)	-0.4736 (-1.40)	-0.9240 (-0.67)	0.5630 (0.35)
Board size	0.0195 (1.22)	0.0195 (1.23)	0.0130 (0.57)	0.0112 (0.49)	0.0161 (0.16)	-0.0526 (-0.44)
Fraction of independent directors	-0.0629 (-0.23)	-0.0794 (-0.29)	0.1085 (0.29)	0.1534 (0.41)	0.4106 (0.25)	0.0002 (0.00)
Busy board (1/0)	-0.1314 (-0.79)	-0.1228 (-0.74)	-0.2733 (-1.16)	-0.2985 (-1.27)	0.9894 (0.67)	0.8739 (0.60)
Co-opted board (1/0)	0.0547 (0.61)	0.0584 (0.66)	0.2764 (2.19)**	0.2686 (2.11)**	-0.6242 (-1.16)	-0.0942 (-0.14)
Classified board (1/0) x Poison pill (1/0)	-0.0125 (-0.18)	-0.0098 (-0.14)	0.0822 (0.87)	0.0771 (0.81)	-0.1729 (-0.45)	-0.5730 (-1.35)
CEO chairman (1/0)	-0.0425 (-0.56)	-0.0344 (-0.44)	-0.1921 (-1.82)*	-0.2081 (-1.88)*	-0.1416 (-0.33)	-0.4198 (-0.81)
CEO founder (1/0)	-0.2512 (-1.23)	-0.2656 (-1.30)	0.2433 (0.93)	0.2728 (1.03)	-1.5938 (-1.48)	-4.9785 (-1.66)*
CEO tenure (log)	-0.0016 (-0.03)	-0.0025 (-0.05)	-0.1190 (-1.61)	-0.1225 (-1.64)	0.5503 (1.72)*	0.6072 (1.60)
CEO age (log)	0.0026 (0.38)	0.0025 (0.36)	0.0091 (1.00)	0.0093 (1.01)	0.0537 (1.32)	0.0169 (0.33)
Base salary (log)	-0.0096 (-0.65)	-0.0097 (-0.66)	0.0108 (0.55)	0.0101 (0.51)	0.9736 (1.16)	1.0814 (0.83)
CEO holding (log)	0.0191 (0.37)	-0.0034 (-0.05)	-0.0706 (-1.05)	-0.0242 (-0.24)	0.0339 (1.19)	0.0946 (0.12)
Heckman self-selectivity		0.0043 (0.55)		-0.0095 (-0.75)		0.0028 (0.11)
N	412	412	412	412	412	412
Adj R-sq	0.5651	0.5688	0.3479	0.3461	0.5936	0.6029
Fixed Effects (Year, Industry)	Yes	Yes	Yes	Yes	Yes	Yes

Panel B:

	Dep. Var.: Δ Compensation t-1 to t+1					
	Δ Total compensation		Δ Cash compensation		Δ Equity compensation	
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	1.4129 (0.56)	2.3735 (0.87)	3.6086 (1.50)	3.6357 (1.60)	-14.0428 (-1.32)	-16.4273 (-1.44)
Binding level	0.2306 (0.63)	0.4072 (2.05)**	0.2944 (0.72)	0.0387 (0.23)	3.4113 (2.24)**	1.3972 (1.69)*
Assets (log)	0.1015 (1.83)*	0.1257 (2.05)**	-0.0214 (-0.39)	-0.0480 (-0.91)	0.0531 (0.23)	0.0251 (0.10)
Δ ROA from t-1 to t+1	2.6816 (2.19)**	1.6194 (1.20)	3.0817 (2.62)***	3.2147 (2.87)***	11.8289 (2.30)**	8.2330 (1.46)
Book-to-market	0.2063 (0.94)	0.1762 (0.71)	0.2678 (1.29)	0.2992 (1.61)	-0.7598 (-0.85)	-0.0511 (-0.05)
Leverage (book value)	-0.1209 (-0.36)	-0.0030 (-0.01)	-0.3749 (-1.11)	-0.2036 (-0.65)	-0.4486 (-0.32)	-0.8354 (-0.56)
Board size	-0.0213 (-0.89)	-0.0280 (-1.06)	0.0152 (0.67)	0.0005 (0.02)	-0.0008 (-0.01)	0.0258 (0.23)
Fraction of independent directors	-0.0082 (-0.02)	0.0351 (0.08)	0.1398 (0.37)	0.0730 (0.21)	0.2261 (0.14)	0.1477 (0.08)
Busy board (1/0)	0.3223 (0.93)	0.4026 (1.15)	-0.3128 (-1.35)	-0.3801 (-1.80)*	0.5418 (0.37)	0.7545 (0.51)
Co-opted board (1/0)	-0.0334 (-0.25)	-0.1031 (-0.72)	0.2335 (1.78)*	0.2541 (2.11)**	-0.8556 (-1.55)	-0.7049 (-1.19)
Classified board (1/0) x Poison pill (1/0)	0.0471 (0.50)	0.0541 (0.53)	0.0966 (1.00)	0.0344 (0.39)	-0.0301 (-0.08)	-0.2805 (-0.66)
CEO chairman (1/0)	-0.0846 (-0.82)	-0.0631 (-0.56)	-0.1726 (-1.61)	-0.1498 (-1.49)	-0.2345 (-0.54)	0.0577 (0.12)
CEO founder (1/0)	-0.3062 (-1.19)	-0.2141 (-0.78)	0.2141 (0.82)	0.1212 (0.50)	-1.8293 (-1.68)*	-1.0869 (-0.94)
CEO tenure (log)	0.0965 (1.07)	0.1270 (1.50)	-0.0894 (-0.96)	-0.1338 (-1.85)*	0.8782 (2.31)**	0.5981 (1.68)*
CEO age (log)	0.0001 (0.01)	0.0023 (0.22)	0.0105 (1.10)	0.0095 (1.13)	0.0686 (1.65)*	0.0475 (1.06)
Base salary (log)	-0.1757 (-0.85)	-0.2684 (-1.23)	-0.3269 (-1.67)*	-0.2868 (-1.62)	0.6627 (0.76)	0.9401 (1.03)
CEO holding (log)	2.0443 (0.30)	-3.5303 (-0.49)	-7.8696 (-1.14)	-3.7722 (-0.62)	40.0622 (1.38)	-1.9002 (-0.06)
N	412	412	412	412	412	412
Adj R-sq	0.5482	0.5617	0.3503	0.4292	0.5901	0.6303
Fixed Effects (Year, Industry)	Yes	Yes	Yes	Yes	Yes	Yes

Figure 2: Binding SOR and CEO ownership

This Figure illustrates median natural logarithm of CEO holdings in the five years after the SOR adoption year (year t). Note that the sample size reduces to 345, 293, 232, and 182 CEOs in the year's $t + 2$, $t + 3$, $t + 4$, and $t + 5$, respectively, due to CEO turnover and/or unavailable data from Execucomp after 2014.

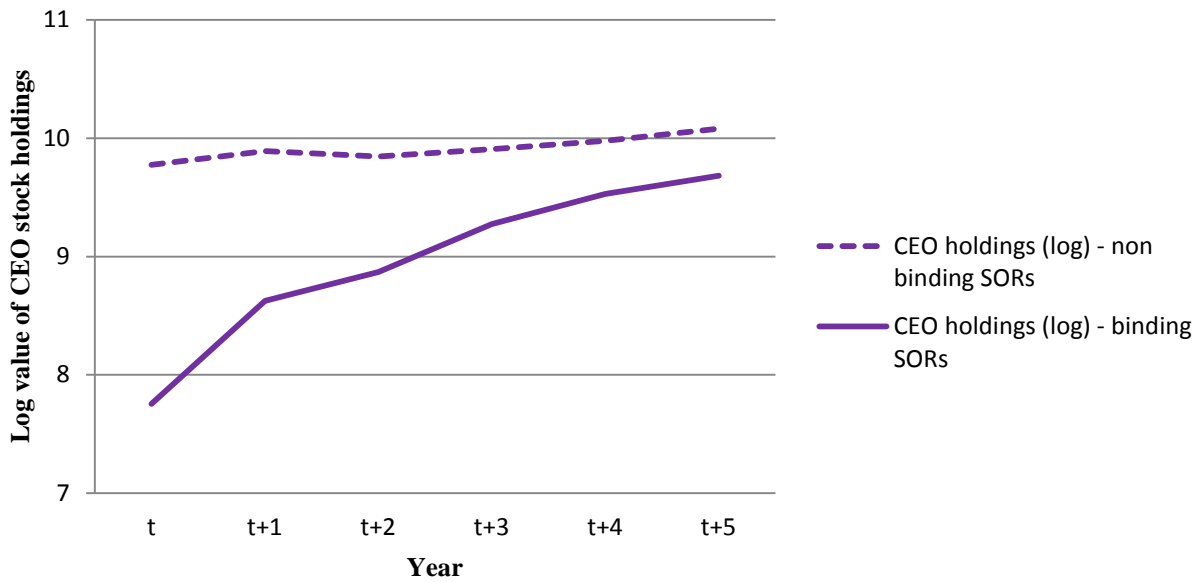


Table 9: Placebo analysis

This table reports the results of a placebo analysis. For each of the 412 firms that adopt SORs, we assign a random year from 1993 to 2013 to be the pseudo-adoption year, excluding any years where a CEO does not hold her position in the year before and after. We require that the pseudo adoption years be different from the years $t-1$, t , and $t+1$, where t is the year when the SOR was actually adopted. The placebo sample consists of 410 firms. We apply the actual share requirement of the adopting firms to identify the CEOs who meet the ownership requirement and those who do not meet the requirement in the placebo sample. ‘Binding requirement’ is the instrumented variable of a pseudo binding SOR estimated similarly to Table 2. This table summarizes the test results when we repeat the analyses from Table 3 to Table 8 for the placebo sample. The t -values are reported in parentheses. All variables are defined in Appendix 1. All models control for pseudo-adoption year and industry fixed effects, with industry defined by the Fama-French 48-industry classification. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Dependent variable: Δ from $t-1$ to $t+1$	Binding requirement	t -value	Other control variables as in	N	R-sq	Fixed Effects (Year, Industry)
Δ Total risk (imputed)	0.00212	(0.90)	Table 3, Model (1)	410	0.7306	Yes
Δ Systematic risk (imputed)	0.00124	(1.33)	Table 3, Model (3)	410	0.9187	Yes
Δ Idiosyncratic risk (imputed)	0.00106	(0.60)	Table 3, Model (5)	410	0.4980	Yes
Δ Total risk (portfolio variance)	0.00132	(0.31)	Table 4, Model (1)	410	0.5341	Yes
Δ (Market) Leverage	0.00471	(0.43)	Table 5, Model (1)	410	0.3601	Yes
Δ (Book) Leverage	0.00942	(0.60)	Table 5, Model (3)	410	0.2824	Yes
Δ Equally weighted correlation between acquirer and target industry	-0.08212	(-0.95)	Table 6, Panel A, Model (1)	214	0.2422	Yes
Δ Value weighted correlation between acquirer and target industry	-0.08394	(-0.99)	Table 6, Panel A, Model (3)	214	0.2358	Yes
Δ Equally weighted imputed risk of acquiring firms	0.00034	(0.22)	Table 6, Panel B, Model (1)	170	0.2274	Yes
Δ Value weighted imputed risk of acquiring firms	0.00030	(0.19)	Table 6, Panel B, Model (3)	170	0.2327	Yes
Δ ROA volatility	-0.00407	(-1.06)	Table 7, Model (1)	410	0.5087	Yes
Δ Total compensation	0.08927	(0.84)	Table 8, Model (1)	410	0.2914	Yes
Δ Cash compensation	0.11159	(1.50)	Table 8, Model (3)	410	0.2986	Yes
Δ Equity compensation	0.24212	(0.47)	Table 8, Model (5)	410	0.1927	Yes

Table 10: Alternative proxies for binding SOR

This table summarizes the test results when we repeat the analyses from Table 3 to Table 8 using four alternative proxies for binding SORs. In Panel A, we classify an SOR to be ‘binding’ if: $Number\ of\ shares\ held \leq Number\ of\ shares\ required \times (1 + stock\ return\ volatility)$, where stock return volatility is the standard deviation of monthly stock returns during the three years before the SOR adoption year. In Panel B, ‘binding level’ equals zero if a CEO owns at least the number of shares required in the SOR, and equals the difference between the number of shares required and the number of shares owned by the CEO, scaled by the number of shares required, if the CEO holds fewer than the required shares. In Panel C, ‘binding level’ equals zero if a CEO owns at least the share value required in the SOR, and equals the difference between the share value required and the share value owned by the CEO, scaled by CEO’s total compensation in the year before the adoption, if the CEO holds less than the required share value. In Panel D, ‘binding level’ equals zero if a CEO owns at least the share value required in the SOR, and equals the difference between the share value required and the share value owned by the CEO, scaled by her outside wealth. We use the changes in state capital gains tax rates as instruments for binding requirements and binding levels in all four panels. All variables are defined in Appendix 1. All models control for adoption year and industry fixed effects, with industry defined by the Fama-French 48-industry classification. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Summary of multivariate results – Alternative ‘binding’ definition, accounting for stock return volatility

Dependent variable: Δ from t-1 to t+1	Binding	t-value	Other control variables as in	N	R-sq	Fixed Effects (Year, Industry)
Δ Total risk (imputed)	-0.00591	(-2.53)**	Table 3, Model (1)	412	0.7557	Yes
Δ Systematic risk (imputed)	-0.00326	(1.43)	Table 3, Model (3)	412	0.8910	Yes
Δ Idiosyncratic risk (imputed)	-0.00650	(-2.32)**	Table 3, Model (5)	412	0.6095	Yes
Δ Imputed portfolio risk	-0.00575	(-1.90)*	Table 4, Model (1)	412	0.6507	Yes
Δ (Market) Leverage	-0.02907	(-2.95)***	Table 5, Model (1)	412	0.4164	Yes
Δ (Book) Leverage	-0.03373	(-2.70)***	Table 5, Model (3)	412	0.3106	Yes
Δ Equally weighted correlation between acquirer and target industry	-0.13029	(-1.83)*	Table 6, Model (1)	216	0.4360	Yes
Δ Value weighted correlation between acquirer and target industry	-0.14052	(-1.98)**	Table 6, Model (3)	216	0.4653	Yes
Δ Equally weighted merger- induced risk	-0.00099	(-1.66)*	Table 6, Panel B, Model (1)	178	0.4759	Yes
Δ Value weighted merger- induced risk	-0.00096	(-1.66)*	Table 6, Panel B, Model (3)	178	0.4873	Yes
Δ ROA volatility	-0.00885	(-1.79)*	Table 7, Model (1)	412	0.5807	Yes
Δ Total compensation	0.11867	(1.50)	Table 8, Model (1)	412	0.5649	Yes
Δ Cash compensation	0.17519	(1.47)	Table 8, Model (3)	412	0.3444	Yes
Δ Equity compensation	1.08423	(2.15)**	Table 8, Model (5)	412	0.5998	Yes

Panel B: Summary of multivariate results - Alternative ‘binding’ definition, accounting for shortfall relative to total requirement

Dependent variable: Δ from t-1 to t+1	Binding level	t-value	Other control variables as in	N	R-sq	Fixed Effects (Year, Industry)
Δ Total risk (imputed)	-0.00819	(-2.15)**	Table 3, Model (1)	412	0.7583	Yes
Δ Systematic risk (imputed)	-0.00276	(-1.09)	Table 3, Model (3)	412	0.9193	Yes
Δ Idiosyncratic risk (imputed)	-0.00454	(-2.78)***	Table 3, Model (5)	412	0.6281	Yes
Δ Imputed portfolio risk	-0.01205	(-2.39)**	Table 4, Model (1)	412	0.6317	Yes
Δ (Market) Leverage	-0.07034	(-2.14)**	Table 5, Model (1)	412	0.4088	Yes
Δ (Book) Leverage	-0.07294	(-1.75)*	Table 5, Model (3)	412	0.3013	Yes
Δ Equally weighted correlation between acquirer and target industry	-0.43859	(-2.38)**	Table 6, Model (1)	216	0.4474	Yes
Δ Value weighted correlation between acquirer and target industry	-0.43717	(-2.37)**	Table 6, Model (3)	216	0.4732	Yes
Δ Equally weighted merger- induced risk	-0.00362	(-1.65)*	Table 6, Panel B, Model (1)	178	0.4846	Yes
Δ Value weighted merger- induced risk	-0.00338	(-1.61)	Table 6, Panel B, Model (3)	178	0.4801	Yes
Δ ROA volatility	-0.03070	(-1.06)	Table 7, Model (1)	412	0.5763	Yes
Δ Total compensation	0.63980	(2.85)***	Table 8, Model (1)	412	0.6409	Yes
Δ Cash compensation	0.14505	(1.16)	Table 8, Model (3)	412	0.5702	Yes
Δ Equity compensation	2.19485	(2.69)***	Table 8, Model (5)	412	0.6987	Yes

Panel C: Summary of multivariate results - Alternative 'binding' definition, accounting for shortfall relative to total compensation

Dependent variable: Δ from t-1 to t+1	Binding level	t-value	Other control variables as in	N	R-sq	Fixed Effects (Year, Industry)
Δ Total risk (imputed)	-0.01282	(-0.65)	Table 3, Model (1)	412	0.7502	Yes
Δ Systematic risk (imputed)	-0.01091	(-1.32)	Table 3, Model (3)	412	0.9173	Yes
Δ Idiosyncratic risk (imputed)	-0.01831	(-1.98)**	Table 3, Model (5)	412	0.6195	Yes
Δ Imputed portfolio risk	-0.01842	(-0.69)	Table 4, Model (1)	412	0.6461	Yes
Δ (Market) Leverage	-0.06874	(-2.06)**	Table 5, Model (1)	412	0.4093	Yes
Δ (Book) Leverage	-0.07698	(-1.81)*	Table 5, Model (3)	412	0.3026	Yes
Δ Equally weighted correlation between acquirer and target industry	-0.57180	(-2.70)***	Table 6, Model (1)	216	0.4551	Yes
Δ Value weighted correlation between acquirer and target industry	-0.55925	(-2.64)***	Table 6, Model (3)	216	0.4793	Yes
Δ Equally weighted merger-induced risk	-0.00474	(-1.88)*	Table 6, Panel B, Model (1)	178	0.4893	Yes
Δ Value weighted merger-induced risk	-0.00450	(-1.86)*	Table 6, Panel B, Model (3)	178	0.4853	Yes
Δ ROA volatility	-0.02047	(-0.30)	Table 7, Model (1)	412	0.5647	Yes
Δ Total compensation	0.29728	(1.09)	Table 8, Model (1)	412	0.5505	Yes
Δ Cash compensation	0.26215	(0.85)	Table 8, Model (3)	412	0.3508	Yes
Δ Equity compensation	2.14934	(1.86)*	Table 8, Model (5)	412	0.5861	Yes

Panel D: Summary of multivariate results - Alternative 'binding' definition, accounting for shortfall relative to total outside wealth

Dependent variable: Δ from t-1 to t+1	Binding level	t-value	Other control variables as in	N	R-sq	Fixed Effects (Year, Industry)
Δ Total risk (imputed)	-0.01461	(-1.37)	Table 3, Model (1)	371	0.7519	Yes
Δ Systematic risk (imputed)	-0.00640	(-1.45)	Table 3, Model (3)	371	0.9174	Yes
Δ Idiosyncratic risk (imputed)	-0.00889	(-1.98)**	Table 3, Model (5)	371	0.6156	Yes
Δ Imputed portfolio risk	-0.02281	(-1.66)*	Table 4, Model (1)	371	0.6496	Yes
Δ (Market) Leverage	-0.07518	(-2.26)**	Table 5, Model (1)	371	0.4108	Yes
Δ (Book) Leverage	-0.07939	(-1.87)*	Table 5, Model (3)	371	0.3031	Yes
Δ Equally weighted correlation between acquirer and target industry	-0.56762	(-1.96)**	Table 6, Model (1)	216	0.4385	Yes
Δ Value weighted correlation between acquirer and target industry	-0.54748	(-1.89)*	Table 6, Model (3)	216	0.4636	Yes
Δ Equally weighted merger-induced risk	-0.00462	(-1.29)	Table 6, Panel B, Model (1)	178	0.4782	Yes
Δ Value weighted merger-induced risk	-0.00463	(-1.35)	Table 6, Panel B, Model (3)	178	0.4755	Yes
Δ ROA volatility	-0.00985	(-0.30)	Table 7, Model (1)	371	0.5647	Yes
Δ Total compensation	0.23059	(0.63)	Table 8, Model (1)	371	0.5482	Yes
Δ Cash compensation	0.29444	(0.72)	Table 8, Model (3)	371	0.3503	Yes
Δ Equity compensation	3.41125	(2.24)**	Table 8, Model (5)	371	0.5901	Yes

Appendix 1: Variable definitions

Binding requirement (1/0) equals one if a CEO holds less than the minimum stock holding value required in an SOR at the time of the adoption, and zero otherwise.

Board size is the total number of directors on the board.

Book-to-market (BM) equals the yearend book value of common equity divided by the market value of common equity.

Busy board (1/0) equals one if at least 50% of independent directors hold three or more directorships in public firms.

CEO base salary is the dollar value of the base salary earned by the CEO during a fiscal year.

CEO cash compensation is the sum of a CEO's base salary and bonus earned by the CEO during the year.

CEO chairman/founder (1/0) equals one if a CEO is also the chairman/founder of the firm, and zero otherwise.

CEO equity compensation is the total value of the restricted stock grants and the stock options grants (estimated using a modified Black-Scholes model) received by the CEO in the year.

CEO holding is the dollar value of a CEO's holding in the adopting firm.

CEO tenure is the number of years a CEO has been in this position of the adopting firm.

CEO total compensation is the sum of a CEO's base salary, bonus, value of restricted stock grants and stock options grants, long-term incentives payouts, and all other annual payments.

CEO total outside wealth is the aggregate cash flows she receives from all of her reported S&P1500 executive positions prior to SOR adoption. Annual cash flows are measured as the CEO's bonus plus the net cash from equity sales and purchases during the year. Total outside wealth is the sum of all cash flows, compounded using the average of the annual market return and risk free rate.

CEO salary multiple requirement is the minimum shareholding in the company for a CEO to fulfil an SOR, expressed as a multiple of the CEO's base salary.

Classified board (1/0) equals one if a firm has a classified board and zero otherwise.

Co-opted board (1/0) equals one if at least 50% of independent directors join the firm after the current CEO, and zero otherwise.

Correlation between acquirer and target industry is the correlation between industry returns of acquirer and target firm over the previous 60 months, where industry return is the average monthly imputed returns of all single-segment firms in the Compustat database, weighted by book value of assets, similar to Armstrong and Vashishtha (2012).

Deviation of market (book) leverage from 10-year average is calculated as the market (book) leverage ratio in the year before the adoption minus the 10-year prior rolling average leverage.

Fraction of independent directors equals the number of independent directors divided by the board size.

Idiosyncratic risk (imputed) equals the standard deviation of the residuals from a CAPM regression of the imputed monthly returns measured as in Armstrong and Vashishtha (2012) over the previous 60 months.

Imputed portfolio risk is calculated as the standard deviation of a portfolio of business segments, where the volatility of each industry segment and the correlations between segments are based on monthly return series of the average single segment firms in a particular industry (similar to Armstrong and Vashishtha, 2012) over the previous 60 months, and the segment weights are based on book value of assets.

Leverage (book) equals the book value of total debt divided by the book value of total assets.

Leverage (market) equals the book value of total debt divided by the market value of assets, where the market value of assets equals the book value of assets subtracted by the book value of equity plus the market value of equity.

Poison pill (1/0) equals one if a firm has a poison pill takeover defense, and zero otherwise.

Return on assets (ROA) equals the income before extraordinary items divided by total assets.

ROA volatility is the standard deviation of quarterly ROAs over the previous three years.

State capital gains tax rate is the long term state capital gains tax rate provided by the National Bureau of Economic Research.

Systematic risk (imputed) equals the standard deviation of the predicted values from a CAPM regression of the imputed monthly returns, measured as in Armstrong and Vashishtha (2012) over the previous 60 months.

Total risk (imputed) equals the standard deviation of the imputed monthly returns, estimated as in Armstrong and Vashishtha (2012) over the previous 60 months.