# Do Reduced Managerial Risk-Taking Incentives Cause Managers to 'Play-it-Safe'? Evidence from FAS 123R

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# Abstract

In this study, we investigate the effect on firm risk and managerial risk-taking behaviour caused by a reduction in managerial risk-taking incentives after the imposition of FAS 123R. We exploit FAS 123R to establish causation since this financial accounting standard required firms to expense options at fair value in compensation packages and led to a significant reduction in a form of compensation typically associated with increased managerial risk-taking incentives. We find that a reduction in managerial risk-taking incentives leads to reduced firm risk. However, while our findings reveal that a reduction in managerial risk-taking incentives does not affect the volume of investment in mergers and acquisitions and research and development, it does cause managers to more actively open and close business segments and to change the focus of their principal business segment. Overall, our findings suggest that managers 'play-it-safe' after FAS 123R by shifting the firm's businesses to lower risk activities. We also find that a reduction in managerial risk-taking incentives leads to diminished firm value in the long run.

Keywords: Risk-taking, FAS 123R, Compensation, Agency issue

EFMA classification: 110 150 190

# 1. Introduction

A certain amount of risk-taking is an essential component of corporate activities and vital for shareholder wealth creation (see Fisher and Hall, 1969; Merton, 1974). However, owing to career concerns and risk aversion, managers might be tempted to take on less than an ideal level of risk (see Low, 2009; Gormley and Matsa, 2016). Divergences in attitude toward risk-taking between executives and shareholders can lead to value-destroying activities (see Jensen and Meckling, 1976; Amihud and Lev, 1981; Smith and Stulz, 1985; Hirshleifer and Thakor, 1992; John *et al.*, 2008). In an attempt to mitigate this risk-related agency issue, boards of directors can, among other things, provide CEOs with option-based pay (see Murphy, 1999; Frydman and Jenter, 2010). Yet, among the various types of compensation used to induce CEOs to act in the best interest of shareholders, option rewards have received considerable negative attention from company stakeholders.[1] The effectiveness of option rewards has also been fiercely debated in the academic literature.[2] A regulatory change that makes it more costly to grant options to executives is Financial Accounting Standards (FAS) 123R. This study relies on FAS 123R to directly examine whether making it more costly to grant options to executives causes a reduced level managerial risk-taking.

Prior to FAS 123R, firms had the discretion to record stock options at either fair value or intrinsic value – intrinsic value being the difference between the stock's market price and the option exercise price. Given that most option grants were issued at-the-money, prior to FAS 123R and opting for the intrinsic value method, firms did not need to report any option expenses on their financial statements at the time of granting the stock options (see Hall and Murphy, 2003). In addition, using the intrinsic value method to record at-the-money options aided firms in maintaining earnings patterns and

[1] Walt Disney heiress, Ms Abigail Disney, recently heavily criticised the CEO's $65.7 million pay packet, among which $26.3 million consisted of option-based rewards from Disney's $71 billion mega acquisition of 21st Century Fox's entertainment businesses. Detailed information is available at: https://www.ft.com/content/b1c68f4c-651a-11e9-9adc-98bf1d35a056

[2] Lambert *et al.* (1991), Geczy *et al.* (1997), Carpenter (2000), Haushalter (2000), Hall and Murphy (2002), Ross (2004), Lewellen (2006), Cao *et al.* (2008), Pástor and Veronesi (2009), Minnick *et al.* (2011), and Armstrong and Vashishtha (2012) cast doubt on the effectiveness of option-based rewards in creating convexity in CEO pay and so better aligning executive and shareholder interests. In contrast, Haugen and Senbet (1981), Smith and Stulz (1985), Tufano (1996), Guay (1999), Coles *et al.* (2006), Sanders and Hambrick (2007), Chava and Purnanandam (2010), Liu and Mauer (2011), Gormley *et al.* (2013), and Croci and Petmezas (2015) find support for a positive association between option convexity (vega) and managerial risk-taking.

meeting analysts' forecasts (see Carter *et al.*, 2007). Unsurprisingly therefore, prior to FAS 123R, only a handful of firms applied the fair value method in accounting for employee option grants (see Aboody *et al.*, 2004). It took the corporate accounting scandals of Enron and WorldCom to finally alert the market to the fact that the intrinsic value method does not reflect the true economic costs of options. This led to the regulatory change addressing how options should be expensed in firms' financial statements. Under FAS 123R, firms are required to record CEO option grants at fair value, e.g. the Black-Scholes value (see Hayes et al, 2012). A direct consequence of FAS 123R is the additional compensation expense recorded in the income statement at the time of granting options, and hence an increased cost of using options as compensation (see Murphy, 2013). As a result, boards of directors have reduced option grants to their CEOs, and substituted them with restricted stock and long-term incentive awards (see Carter *et al.*, 2007; Chi and Johnson, 2008; Brown and Lee, 2011; Hayes *et al.*, 2012).

We begin our examination by reaffirming the effect of FAS 123R on CEO compensation structure, as previously documented in Brown and Lee (2011), Hayes *et al.* (2012), Mao and Zhang (2018), and Hong (2019). Although all firms in the US have been required to adopt the fair valuation method of expensing options since FAS 123R, the actual effect on each firm is different. Consistent with this prior literature, we find that the value of CEO option vega decreased after the adoption of FAS 123R. More importantly, the change in executive compensation is more pronounced for CEOs employed at firms that are more affected by FAS 123R, i.e. that prior to FAS 123R had more options in their CEOs' compensation packages. These results indicate that the reduction in option rewards and option convexity is a consequence of this mandatory regulatory change. Hence, it is plausible to treat FAS 123R as an exogenous shock to CEO compensation (see Carter *et al.*, 2007; Hayes *et al.*, 2012; Bakke *et al.*, 2016; Gormley and Matsa, 2016; Aboody *et al.*, 2018).

In our main empirical analysis, we go on to establish that FAS 123R has a causal effect on managerial risk-taking behaviour by documenting a significant decrease in managerial risk-taking, both in terms of systematic risk and idiosyncratic risk, after the adoption of FAS 123R. Our findings in this regard have two main implications. First, the findings provide direct support for the premise that

executive option convexity serves as a mechanism to induce managerial risk-taking. Second, although the original intention for adopting FAS 123R is to improve accounting transparency (see Lyke and Shorter, 2003), an unintended effect of FAS 123R is a decline in the risk appetite of CEOs and hence an aggravation of the risk-related agency issue.

Risk averse managers can avoid risk-taking either by exerting less effort to seek a “quiet life” (see Holmstrom, 1979; Grossman and Hart, 1983; Bertrand and Mullainathan, 2003; Bertrand and Schoar, 2003) or by undertaking less risky activities to “play it safe” (see Gormley and Matsa, 2016). Evidence from related studies that rely on FAS 123R is unable to clearly differentiate between “quiet life” and “play it safe” managerial behaviours after the adoption of FAS 123R. Bakke *et al.* (2016) find increased hedging behaviour after FAS 123R. Mao and Zhang (2018) investigate R&D and find that, although the R&D expense is not affected by the adoption of FAS 123R, the R&D patents are less explorative and less related to firms’ core businesses. These findings are consistent with the “play it safe” behaviour. However, a decline in firm investment after the adoption of FAS 123R documented in Welker (2019) is instead more in line with the “quiet life” hypothesis. To further explore the effect of FAS 123R on managerial risk-taking behaviour and to more clearly distinguish between the "quite life" and "play it safe" hypotheses, we investigate the effect of FAS 123R on major investment activities, such as mergers and acquisitions (M&A), research and development (R&D), capital expenditure (CAPX) and the changes in firm business segments.

Croci and Petmezas (2015) argue that acquisitions are risky because firm risk, on average, increases after acquisitions. Acquisition volume would be expected to decrease if the adoption of FAS 123R encourages managers to seek a "quiet life". However, as M&A distorts firm operations and serves as a direct method to adjust firm risk, it can either be risk-increasing or risk-reducing (see Amihud and Lev, 1981; May, 1995; Datta *et al.*, 2001; Acharya *et al.*, 2011; Gormley and Matsa, 2016; Li *et al.*, 2017). If the adoption of FAS 123R does not have a significant impact on the volume of acquisition investment, but managerial risk-taking is nevertheless reduced, it might instead be the case that managers want to "play it safe" by undertaking less risky deals. R&D and CAPX can also serve to distinguish between these two managerial behaviours. Coles *et al.* (2006) argue R&D is generally riskier than CAPX. Hence, managers who "play it safe" would be expected to shift investment more away from

risky R&D, but not necessarily reduce the overall volume of R&D, and more toward relatively safer CAPX. On the other hand, managers who instead seek a "quiet life" would be expected to exert less effort by doing less of both types of investment.

Our results are consistent with Hayes *et al.* (2012) in so far as the adoption of FAS 123R does not affect the overall volume of M&A and R&D, and only results in a slight increase in CAPX. However, since we find that M&A and R&D investment is not significantly affected by the adoption of FAS 123R, the reduced level of managerial risk-taking that we uniquely observe is therefore likely to come from managers who are increasingly investing in activities that are relatively safer after FAS 123R. By also examining firms' business segments, we find that managers from firms that are more affected by the adoption of FAS 123R are more likely to change the focus of their firm's principal business segment and to open up new business segments. Given the reduction in managerial risk-taking after FAS 123R, these business segment changes suggest that CEOs shift their firms' principal focus away from more risky activities and enter into new activities to diversify the firm's portfolio. This provides further evidence to suggest that managers increasingly choose to "play it safe" after FAS 123R.

In order to understand the firm value impact of the reduced option rewards, we examine firm value over a three-year window. We find that firm value, as measured by Tobin Q, decreases in the period after the adoption of FAS 123R, and the reduction in firm value is greater for firms that are more affected by FAS 123R. This evidence suggests that the accounting regulatory change is detrimental to firm value and shareholders wealth. We conclude that risk-taking incentives afforded by the granting of option rewards are important for inducing managerial risk-taking and firm value creation.

This study makes a number of important contributions to the literature. First, we contribute to the growing body of literature that studies the effect of FAS 123R on the risk-related agency issue. Prior studies agree that managerial risk-taking behaviour has declined after FAS 123R. However, manager's intention behind these behaviours has been inconclusively documented with Hayes et al. (2012), Bakke *et al.* (2016) and Mao and Zhang (2018) who find evidence in line with the "play it safe" intentions,

while and Welker (2019) support the "quiet life" motivation.[3] More importantly, other than investigating managerial risk-taking indirectly through firm policies, we examine risks directly. By finding that FAS 123R had the effect of reducing managerial risk-taking, but without generally affecting the volume of investment activities, we provide more direct evidence suggesting that reduced risk-taking incentives cause managers to "play it safe".

Second, our study contributes to the debate on whether executive compensation convexity provides CEOs with risk-taking incentive. Coles *et al.* (2006) and Low (2009) argue that the endogeneity between managerial risk-taking and executive compensation structure prevents researchers from uncovering the true relationship between the two. In addition, manager-firm matching in the labour market is endogenously determined as risk-averse managers might choose to work for firms that award fewer options, and risk-averse boards may select CEOs who prefer less compensation vega (see Bakke *et al.*, 2016). We utilise FAS 123R as an exogenous shock in executive compensation convexity to address these endogeneity issues. In so far as FAS 123R reduces both managerial risk-taking incentives and firm risk, our findings suggest a positive causal relationship between option convexity and managerial risk-taking.

The remainder of the paper proceeds as follows. Section 2 describes the data and variable construction, and presents the univariate results. Section 3 discusses our main empirical results. Section 4 discusses various robustness tests. Lastly, Section 5 concludes.

[3] Chava and Purnanandam (2010) show that higher delta in CEO compensation packages leads to safer investment policies, such as lower leverage and higher cash balances. Hayes *et al.* (2012) do not find empirical evidence to support the argument that FAS 123R changes firm policy. Bakke *et al.* (2016) find a negative relationship between option vega and corporate hedging intensity, suggesting that the risk-taking incentive is provided by compensation convexity. Mao and Zhang (2018) study the effect of FAS 123R on firm innovation and find that innovation outcomes, especially those related to the firm's core business, have significantly declined in the post-FAS 123R period, owing to a reduction in CEO compensation vega. Welker (2019) adopts FAS 123R as an exogenous shock to CEO pay duration and finds that reduced CEO pay duration after FAS 123R leads to decreased investment and a more conservative balance sheet,

# 2. Data, Variable Construction, and Univariate Results

## 2.1 Data Sources

Our analysis is mainly based on ExecuComp data for the period 1999-2011. The year 2005 is excluded from the sample because it is the year that FAS 123R came into effect.[4] We exclude CEOs from financial firms and regulated utilities, and collect firm fundamental data from COMPUSTAT. Our imputed managerial risk-taking and firm value proxies are constructed using data from the COMPUSTAT Business Segment Database. We obtain financial market data from the Center for Research in Security Prices (CRSP) database. These restrictions produce a sample of 6,545 CEO-firm-year observations, with all computable variables.

For the firms in our sample, we also collect data on their mergers and acquisitions from the Securities Data Corporation (SDC) database. In order for their deals as acquirers to be counted the deals need to be announced and completed during the period 1999-2011 (excluding 2005). Moreover, the transaction value of each deal needs to exceed $1 million and be greater than 1% of the firm's pre-merger book value of total assets. A firm also needs to acquire more than 50% of the target's shares in a single transaction. Lastly, we eliminate deals coded by SDC as leveraged buyouts, spin-offs, recapitalisations, self-tender offers, exchange offers, repurchases, minority stake purchases, and privatisations.

## 2.2 Variable Construction

### 2.2.1 Managerial Risk-taking and Firm Value

Some of the main dependent variables in our study are proxies for managerial risk-taking. A widely used measure of firm total risk is the firm's observed stock return volatility. However, studies, including Armstrong and Vashishtha (2012), argue that the observed stock return volatility does not reflect the real level of managerial risk-taking, since managers have a tendency to conceal unfavourable information and to only reveal positive information. This biased disclosure from CEOs might lead to positive performance in the early stages, but stock price crashes later on (Andreou *et al.*, 2017).

[4] The effective date for FAS 123R is officially 15 June 2005. However, we follow Mao and Zhang (2018) by excluding the year 2005 for a more clean-cut analysis.

Moreover, higher observed stock return volatility, by design, results in a higher compensation vega. Therefore, this mechanical relationship between vega and observed stock return volatility might distort the findings from an examination of the relationship between managerial risk-taking incentives (in our case as impacted by FAS 123R) and firm total risk.

In order to overcome these potential limitations of observed stock return volatility, we follow Pryshchepa (2019) to construct proxies for firm risk using business segment data from COMPUSTAT. Thus, we view each firm as a portfolio and each business segment as an asset in the portfolio.[5] We calculate the pure-play industry portfolio return by weighting the stock returns of pure-play firms in each segment, then construct the imputed stock return of the firm as the value-weighted return for each business segment the firm has in equation (1).

$$r_{i,t} = \sum_{S=1}^{S} \frac{A_i^S}{A_i} r_t^S \tag{1}$$

where $r_t^S$ is the imputed weekly return at time *t* of pure-play industry portfolio *s*. $A_i^S$ is the book value of segment *s* of firm *i*, and $A_i$ denote the total book value in firm *i*. $r_{i,t}$ is our proxy of total risk for firm *i* at week *t*. Firm systematic risk and idiosyncratic risk are decomposed by regressing the excess weekly return on Fama and French (1993) three factors as in equation (2). The square roots of explained and unexplained variation are used as the systematic risk proxy and idiosyncratic risk proxy, respectively.

$$r_{j,t} = \beta_0 + \beta_1 r_{MKTRF,t} + \beta_2 r_{SMB,t} + \beta_3 r_{HML,t} + \varepsilon_{j,t} \tag{2}$$

Since the imputed risk proxy is derived from each business segment and the risks from pure-play firms in each segment, this measure reflects managers' risk-taking more accurately irrespective of

[5] The rationale behind the risk measure from Pryshchepa (2019) is similar to the risk proxy in Armstrong and Vashishtha (2012). However, we follow Pryshchepa (2019) because Pryshchepa (2019) uses four-digit SIC codes to define industries, which is more precise than the two-digit code used in Armstrong and Vashishtha (2012). Moreover, the calculation differs from Armstrong and Vashishtha (2012) in the sense that Pryshchepa (2019) captures the most recent risk of the firm by using weekly stock return and calculated volatility over the current year, which reveals the most recent risk of the firm. Hence, this risk proxy in Pryshchepa (2019) should capture the underlying risk of the firm more precisely and not be subject to the information released by the CEO.

CEO disclosure and is not subject to the mechanical relationship between vega and traditional stock return volatility.

We use Tobin's Q to proxy for firm value in our analysis. Again, we follow Pryshchepa (2019) to construct the *Imputed Q* the same way as our imputed risk proxy as the weighted average Tobin's Q of all pure-play firms in each business segment.

### 2.2.2 Post-FAS 123R Indicator and Accounting Impact

To explore the effect of the adoption of FAS 123R, we construct a *POST* dummy variable that equals one for all years after the regulatory change, and zero for all years before. The post-FAS 123R period is therefore defined as being 2006-2011, and the pre-FAS 123R period is defined as being 1999-2004.[6]

Although all US firms are required to comply with FAS 123R, some firms are expected to be affected by the accounting standard more than others. We follow Hayes *et al.* (2012) to measure the accounting impact of FAS 123R as the average value of the pro-forma option expense, deflated by fully diluted shares used to calculate earnings per share, that a given firm reports in the pre-FAS 123R period. The rationale underpinning this variable is that it captures the extent to which Earnings Per Share (EPS) would be expected to be reduced once the firm is compelled to recognise its option grants at fair value. Thus, for firms using more option grants before FAS 123R, EPS would be expected to decline more after the fair valuation required by FAS 123R, were the firm not to reduce its use of option grants. Consequently, CEOs of such firms might be expected to be in receipt of fewer option rewards after FAS 123R because the board of directors now has a valid reason to grant fewer options in order to avoid the associated costs. Based on this accounting impact variable, CEOs from firms with a higher than median accounting impact are assigned to the treatment group, while CEOs from firms with a below or equal

[6] For robustness, in Section 4.3, we use a narrower sample period from 2002 to 2008 to maintain consistency with many previous studies. However, for our main analysis, we opt for a slightly wider sample period because FAS 123R was well-anticipated by firms. In fact, the Financial Accounting Standards Board (FASB) announced on March 2003 that a new requirement regarding employee stock options was likely to come into effect in 2004. The International Accounting Standards Board (IASB) even required the expensing of stock options as early as February 2004. As a result, firms started to expense CEO option grants at fair value or reduce the number of option grants to CEOs several years before FAS 123R actually came into effect in 2005. In Section 4.2, we also examine the effect of changing the 'timing' of the regulatory change.

to median accounting impact are assigned to the control group. The variable *Treated* is equal to one for the treated group and zero for the control group.

### 2.2.3 CEO Compensation, Investment Activities, and Business Segments

We follow the procedure in Hayes *et al.* (2012) to retrospectively adjust ExecuComp data to reflect changes owing to the adoption of FAS 123R and provide consistent measures regarding CEO compensation throughout the sample period. The calculations of vega and delta follow those in Pryshchepa (2019).[7] Vega is defined as the change in the dollar value of the CEO's (current and total) option holding for a 1 unit (percentage point) change in the firm's annualised observed stock return volatility. Delta is defined as the change in the dollar value of the CEO's (current and total) wealth for a 1 unit (percentage point) change in the firm's underlying stock price. Both vega and delta are otherwise calculated using the Merton (1974) model, adjusted for dividends by following Core and Guay (2002).

We investigate three major investment activities, namely mergers and acquisitions (*M&A investment*), research and development (*R&D*), and capital expenditure (*CAPX*). *M&A investment* is calculated as the sum of acquisition deal values paid by a firm in a given year divided by book value of total assets of the firm in previous year. *R&D* is constructed as R&D expenses scaled by book value of total assets, as in Coles *et al.* (2006). We also follow Coles *et al.* (2006) to measure *CAPX* as the net of capital expenditure and sale of property, plant, and equipment (PPE) scaled by book value of total assets.

We follow Aretz *et al.* (2019) in constructing variables for the firm's business segments and potentially reflecting managerial risk-taking behaviour in so far as these variables treat the firm as a portfolio of business segments. *Focus* is a dummy variable equal to one if the firm's largest segment by sales, defined by its two-digit SIC code, changes in a given year, and zero otherwise. *New Segment* is defined as a dummy variable equal to one if the firm creates any new segment, and zero otherwise. *No. New Segment* is the number of new segments created in a given year. *Close Segment* is a dummy

[7] We follow Pryshchepa (2019) by only computing the manager's option vega, instead of the entire equity-based compensation vega because Guay (1999), Rajgopal and Shevlin (2002) and Coles et al. (2006) all suggest stock vega contributes only an insignificant amount to total vega. In addition, measuring option vega alone should provide us with a cleaner understanding of the effect of FAS 123R on executive option convexity.

variable equal to one if the firm closes any existing segment in a given year, and zero otherwise. *No. Closed Segment* represents the number of closed, existing segments in a given year. The difference between the newly created segments and the closed, existing segments is *No. Net Change in Segment*. *No. Segment* is the total number of business segments the firm has in a given year.

### 2.2.4 Control Variables

In our regression analysis, we control for a set of firm and CEO characteristics that have been shown to affect managerial risk-taking. Previous studies document a negative relationship between firm size and risk (see Coles *et al.*, 2006; Low, 2009). We follow Hayes *et al.* (2012) to define firm size as the natural logarithm of book value of total assets (*Ln(Asset)*). Guay (1999) argue that firms with more investment opportunities and growth options to take on riskier projects. Therefore, I use *Market-to-Book* and *Tangibility* to proxy firm' investment and growth opportunities (see Armstrong and Vashishtha, 2012). *Market-to-Book* is the ratio of market value to book value of total assets, and *Tangibility* is the value of Property, Plant, and Equipment to book value of total assets. Hence, *Market-to-Book* and *Tangibility* are expected to be positively related to firm risk. Firm profitability is measured as the ratio of net income divided by book value of total assets (*ROA*) as in Armstrong and Vashishtha (2012). Firm age (*Ln(Firm Age)*) is constructed as the natural logarithm of the number of years the firm is tracked in COMPUSTAT, plus one. We expect *Firm Age* to be negatively related to firm risk, as more mature firms tend to have a lower level of risk (see Serfling, 2014). We follow Hayes *et al.* (2012) and define *Cash Holding* as the value of cash and short-term investments to book value of total assets. Conventional wisdom may suggest that higher *Cash Holding* is associated with lower firm risk because cash-rich firms have a lower probability of default (Acharya et al., 2012). However, were a higher *Cash Holding* to be the result of a debt covenant requirement to protect creditors' interests from excessive risk-taking then we would expect to observe a positive relationship between *Cash Holding* and managerial risk-taking (see Liu and Mauer, 2011). *Leverage* is the ratio of book value of debt to book value of total assets (as in Leland, 1998; Lewellen, 2006). Previous studies, including Friend and Lang (1988), Leland (1998), and Lewellen (2006) find conflicting evidence for the relationship between

leverage and firm risk.[8] We also include the natural logarithms of CEO age (*Ln(CEO Age)*) and CEO tenure, plus one, (*Ln(CEO Tenure)*) as additional controls that have been shown to affect managerial risk-taking (see Prendergast and Stole, 1996; Berger *et al.*, 1997; Guay, 1999; Serfling, 2014). Definition of all variables can be found in Appendix A1.

## 2.3 Summary Statistics and Univariate Difference-in-Differences

Table 1 presents basic summary statistics for our entire sample period of 1999-2011, excluding the year 2005 in which FAS 123R came into effect. The fraction of options in CEO total compensation averages 33.717%, while stock and long-term incentive plans account, on average, for 13.938% and 6.020% of the entire compensation package, respectively. These values are similar to those reported by Hayes *et al.* (2012) and Mao and Zhang (2018). The average value of CEO current vega and delta are $23,126 and $40,575, respectively.[9] The means for firm total risk, systematic risk, and idiosyncratic risk are 34.702%, 14.044% and 31.648%, respectively, while *Imputed Q* averages 2.378. In terms of investment activities, investment in M&A averages 5.623% of firm total assets, and investment in R&D and CAPX amounts, on average, to 3.720%, and 4.994% of firm total value, respectively. Firms in our sample has average 1.460 business segments.

*[Inset Table 1 about here]*

Table 2 presents a comparison of the structure of CEO compensation, firm risk and *Imputed Q*, and investment activities for the pre- and post-FAS 123R periods. FAS 123R appears to affect the structure of CEO compensation packages. The average percentage of option grants drops from 40.251% in the pre-FAS 123R period (1999-2004) to 23.994% in the post-FAS 123R period (2006-2011). However, the average fraction of stock-based compensation increases from 5.197% before FAS 123R to 24.059% after FAS 123R. Long-term incentive plans also account for a greater fraction of total compensation after FAS 123R. In terms of CEO compensation convexity (vega), both CEO current period vega and total vega decreases after FAS 123R. The same is true for CEO current period and total

[8] Higher leverage might induce managers to transfer wealth from creditors to shareholders. Consistent with this overinvestment theory, Leland (1998) finds a positive relationship between leverage and firm risk. In contrast, Friend and Lang (1988) and Lewellen (2006) argue that riskier firms are more likely to be financially distressed and would therefore be expected to have lower leverage.

[9] These values are comparable yet lower than the $29,264 and $53,398 documented in Hayes et al. (2012).

pay-for-performance sensitivity (delta). These changes in the structure of CEO compensation from before to after FAS 123R are generally consistent with those documented in Hayes *et al.* (2012) and Mao and Zhang (2018).

*[Inset Table 2 about here]*

The average values of our proxies for managerial risk-taking and firm value also change from before to after the implementation of FAS 123R. Firm total risk decreases from 37.778% in the pre-FAS 123R period to 31.141% in the post-FAS 123R period. The imputed Tobin's Q declines from 2.640 prior to FAS 123R to 2.075 after its implantation. Investment activities also appear to be affected by FAS 123R. Annual M&A investment averages 7.095% of firms' previous year sales in the period before FAS 123R, but drops to 3.919% in the period after FAS 123R came into effect. Similarly, R&D investment declines slightly from 3.878% to 3.538%, while CAPX investment reduces from 5.417% to 4.504%.

However, the effect of FAS 123R on a given firm is likely to depend on the extent of its accounting impact on the firm's EPS (Hayes *et al.*, 2012). Therefore, in Table 3, we present statistics for the difference-in-differences (DiD) between the treated (high impact) and control (low impact) firms around FAS 123R. Prior to FAS 123R, CEOs from the treated firms evidence significantly higher compensation vega and delta compared to their counterparts in the control group. This continues to be the case after FAS 123R, even though CEOs from both the treated and control groups evidence lower vegas and deltas in the post-FAS 123R period. Crucially, however, the difference in these differences, before and after FAS 123R, for the executives' current vega (an $8,060 pre-FAS 123R difference versus an $4,226 post-FAS123R difference) is significantly different from zero (at the 1% level). The difference in differences for the executives' current delta (a $17,680 pre-FAS 123R difference versus a $5,138 post-FAS123R difference) is also negative and statistically significant. This indicates that the effect of FAS 123R is stronger on CEOs from the treated firms.

*[Inset Table 3 about here]*

For our proxies for managerial risk-taking and firm value, the difference-in-differences are also significantly negative. The difference-in-differences for managerial total risk-taking is -2.591%, while the difference-in-differences for systematic risk and idiosyncratic risk are -2.642% and -1.719%, respectively. For imputed Tobin's Q, the difference-in-differences is -0.371. In contrast, the difference-in-differences for firms' investment activities are all statistically insignificant. However, despite the differences in investments activities (M&A, R&D, and CAPX) between the treated and control firms around the adoption of FAS 123R, we do not observe any significant difference-in-differences. Regarding the changes in business segments, we find some significant changes for the two groups and the DiD statistics are significant for the *Focus*, *New Segment*, *No, New Segment*, *Close Segment*, and *No. Closed Segment*, suggesting different changes in business segments for the treated and control group.

These univariate difference-in-differences appear to provide support for our main hypothesis that, owing to its negative effect on managerial risk-taking incentives, FAS 123R caused a reduction in managerial risk-taking. This is in spite of the observation that FAS 123R does not appear to have also caused a reduction in the volume of various types of investment activity, while the change in business segments may related to the reduced risk-taking.

# 3. Multivariate Empirical Results

## 3.1 Effect of FAS 123R on CEO Compensation Structure

The fair value accounting treatment of CEO option rewards required by FAS 123R imposes additional costs on a firm's income statement at the time of granting options. The increased accounting costs may force shareholders to re-evaluate the trade-off between providing the CEO with risk-taking incentives and the costs associated with option grants. Hayes *et al.* (2012) and Mao and Zhang (2018) show the changed accounting treatment for employee option rewards leads to decreased options rewards to executives. We first follow Hong (2019) to verify the effect of FAS 123R on the risk-taking incentives in executives' compensation packages by employing the DiD approach. The DiD approach is able to control for the omitted trends and constant unobserved differences inherit in the treated and control groups. Therefore, we adopt equation (3) to test the change in CEO compensation structure.

$$Compensation_{i,t}$$

$$= \beta_0 + \beta_1 POST_t + \beta_2 Treated_i + \beta_3 POST_t \times Treated_i \quad (3)$$

$$+ \theta X_{i,t-1} + Inudstry\ Fixed\ Effects + Year\ Fixed\ Effects + \varepsilon_{i,t}$$

where $Compensation$ represents the fraction of option compensation, or the current value of the executive's vega or delta; $POST$ indicates years after the adoption of FAS 123R; $Treated$ equals 1 for CEOs from the high accounting impact group, and 0 otherwise; and $X_{i,t-1}$ is a set of control variables, including *Ln(Asset), ROA, Market-to-Book ratio, Market leverage, Cash holding, Tangibility, Ln (Firm age), Ln (CEO age),* and *Ln (CEO tenure)*. Hayes *et al.* (2012) argue FAS 123R would have a more significant impact on CEOs from the treated firms as they are "forced" to receive a reduced number of options to avoid heavy compensation expenses appearing on their firms' income statements. Hence, we expect the coefficient on $POST$ and the interaction between $POST$ and $Treated$ to be negative and significant when the dependent variable is the fraction of option compensation or compensation vega.[10]

The results are presented in Table 4. Models (1) and (2) show the percentage of option rewards in CEOs' total compensation significantly reduced in the post-FAS 123R period. Consistent with Hong (2019), the negative and significant coefficient on the interaction between *POST* and *Treated* indicates a further reduction in the fraction of option rewards in the total compensation packages for CEOs from the treated firms. The negative coefficients on *POST* in models (3) and (4) show CEOs' wealth becomes less sensitive to firm stock return volatility following the adoption of FAS 123R in 2005. Moreover, the statistically significant interaction terms ($POST \times Treated$) show that the changes in executives' current annual compensation vegas (*Vega_current*) around the adoption of FAS 123R are different for the two groups. Compared with CEOs from the control firms, CEOs from the treated firms experience a further reduction in compensation vega. In model (4), the coefficients suggest the reduction in *Vega_current* for CEOs in the treated firms is \$11.720 (\$8.382 + \$3.338) thousands. Considering the

[10] We do not form any predictions about the signs of the coefficients when the dependent variable is compensation delta, as Hayes *et al.* (2012) show the current value of CEO compensation delta increases after FAS 123R and the total value of delta decreases slightly in the post-FAS 123R period. Hence, the effect of FAS 123R on delta can be either positive or negative.

pre-FAS 123R average value of CEOs' current vega was $24.223 thousands, the adoption of FAS 123R reduces approximately 48.384% of the vega that CEOs from the treated firm received in a year. Thus, when facing the trade-off introduced by FAS 123R, the board of directors chooses to save additional accounting expenses by reducing the number of options for CEOs.

*[Inset Table 4 about here]*

Models (5) to (6) reveal FAS 123R has a similar effect on the CEO compensation delta: the current period delta (*Delta_current*) is reduced after the adoption of FAS 123R, consistent with Mao and Zhang (2018). It is worth noting that Hayes *et al.* (2012) find an increase in the CEO's current annual delta as shareholders use more stock rewards to substitute the reduced option grants after the adoption of FAS 123R. Hong (2019) does not find any significant reduction in delta after FAS 123R. The conflicting results in the previous literature suggest the overall effect of FAS 123R on delta is somewhat less definitive. What is important is that the focus of our study is on compensation vega and managerial risk-taking behaviour. The results from Table 4 confirm FAS 123R is a valid shock to option vega in CEO compensation and pave the way for our following analysis.

## 3.2 Managerial Risk-taking after FAS 123R

The use of option grants in CEOs' compensation packages is based on the premise that option vega provides CEOs with risk-taking incentives and mitigates the risk-related agency problem (see Haugen and Senbet, 1981; Smith and Stulz, 1985; Guay, 1999; Coles *et al.*, 2006; Chava and Purnanandam, 2010). Hence, the reduction in compensation vega after the adoption of FAS 123R may render CEOs reluctant to take on risks, or to even reduce risk-taking, and therefore aggravate the risk-related agency issue. We continue to employ the DiD approach to explore the impact of FAS 123R on managerial risk-taking directly. In so doing, we are indirectly testing the relationship between option vega and managerial risk-taking. The two-way causality between CEO option convexity and managerial risk-taking presents an obstacle when testing the relationship directly (see Coles *et al.*, 2006). The DiD setting that utilises FAS 123R as an exogenous shock circumnavigates the endogeneity problem and provides evidence to support a positive, causal relationship between compensation vega and managerial

risk-taking. Hence, equation (4) is used to investigate the impact of FAS 123R on managerial risk-taking,

$$Managerial\ risk\ taking_{i,t} = \beta_0 + \beta_1 POST_t + \beta_2 Treated_i + \beta_3 POST_t \times Treated_i + \theta X_{i,t-1} + Industry\ Fixed\ Effects + Year\ Fixed\ Effects + \varepsilon_{i,t} \quad (4)$$

where $Managerial\ risk\ taking$ is a proxy for firm total risk, systematic risk, or idiosyncratic risk, and the other variables are as previously described for equation (3). Since the classification of the treatment and control groups is based on the pro-forma accounting expense of options constructed by Hayes *et al.* (2012), vega is expected to decrease more for the treated group. Therefore, the sign of the coefficients on the interaction terms is expected to be negative as we expect managerial risk-taking to decrease further for CEOs from the treated firms owing to the adoption of FAS 123R.

We present the results in Table 5[11]. Model (1) of Table 5 shows that our proxy for managerial total risk-taking in the post-FAS 123R period is approximately 2.071% lower than in the pre-FAS 123R period, suggesting a negative impact of FAS 123R on managerial risk-taking. More importantly, the coefficient on the interaction term is negative and statistically significant, suggesting a further reduction in risk-taking for managers from the treated firms. The interaction term between *POST* and *Treated* remains statistically significant after controlling for several firm and CEO characteristics in model (2). The DiD estimator is 6.339 in model (2), suggesting an additional 6.339% reduction in managerial risk-taking from the treated group after the adoption of FAS 123R relative to CEOs from the control firms. The economic effect of the reduction is significant. Considering that the pre-FAS 123R period average total risk is 37.778%, a 6.339% decrease represents a further 16.780% reduction in managerial risk-taking for the treated group. Thus, managers who work in firms that are more impacted by the adoption of FAS 123R undertake significantly less risk-taking than those who work in firms that are less affected by the regulation.

[11] The models in Table 5 include both *Industry Fixed Effects* and *Year Fixed Effects*. Table A3 in the Appendix excludes the *POST* and *Treated* individual dummies and controls instead for *Firm Fixed Effects*. The results for the interaction terms are essentially the same as those discussed below.

*[Inset Table 5 about here]*

Models (3) to (6) replace the dependent variable with our proxy for managerial systematic risk-taking and idiosyncratic risk-taking, respectively. Our analysis shows that the coefficients on the interaction terms are negative and statistically different from zero in all models, implying that managers in the treated firms decrease both systematic and idiosyncratic risk considerably further compared with the control group. Therefore, this evidence suggests that FAS 123R undermines managerial risk-taking behaviours because of the contracted level of risk-taking incentives in their compensation packages. The accounting regulation, which aimed to increase accounting transparency (see Lyke and Shorter, 2003), may have inadvertently aggravated the risk-related agency issue.

It is worth noting that our results suggest the decrease in vega owing to FAS 123R reduces both managerial systematic risk-taking and idiosyncratic risk-taking. At first glance, this result appears to be in conflict with Armstrong and Vashishtha (2012) who show that vega only induces CEOs to increase systematic risk but not idiosyncratic risk. Naturally, conventional wisdom would suggest that a reduction in vega would lead only to a reduction in systematic risk. However, neither Armstrong and Vashishtha (2012) nor traditional finance theory support the inverse proposition. The risk-averse assumption under traditional finance theory suggests individuals are unwilling to take on risks. Hence, CEOs with higher amounts of risk-taking incentives will only increase systematic risk because it can be easily hedged by trading the market portfolio. However, without these risk-taking incentives, a risk-averse CEO would avoid all kinds of risks to a larger extent. This is likely why we observe a significant decline in both managerial systematic risk-taking and idiosyncratic risk-taking in the post-FAS 123R period.

The signs of the control variables in Table 5 are generally in line with our expectations. Older firms and more profitable firms operate with a lower level of risk. Managerial risk-taking is higher when the market-to-book ratio is higher, or the firm is more financially levered. However, *Cash Holding* is positively related to risk, suggesting creditors require higher cash reserves in response to greater managerial risk-taking (see Liu and Mauer, 2011). Firms with higher tangibility tend to have lower risk,

but the coefficients are insignificant in our models. It appears that CEO characteristics, such as CEO age and CEO tenure do not have a significant impact on risk-taking as the coefficients on *Ln(CEO Age)* and *Ln(CEO Tenure)* are insignificantly different from zero.

## 3.3 Managerial Investments after FAS 123R

Reduced managerial risk-taking might stem from managers either seeking a "quiet life" (see Grossman and Hart, 1983; Holmström, 1999; Bertrand and Schoar, 2003) or "play it safe" (see Gormley and Matsa, 2016). Although it is difficult to disentangle these two possibilities, we use levels of several major investment activities, namely M&A, R&D and capital expenditure, to proxy for the extent of managers' efforts. With a reduced level of risk-taking incentives in compensation after FAS 123R, managers who prefer a "quiet life" might be tempted to reduce their effort by reducing the volume of all such investments. However, if managers "play it safe", the investment input might not necessarily be significantly affected because managers can choose less risky investment output in the post-FAS 123R period. Specifically, managers who "play it safe" may tend to increase the volume of less risky investment, such as capital expenditure, but shift away from relatively risky investment, such as M&A and R&D (see Coles *et al.*, 2006; Croci and Petmezas, 2015). We examine the effect of FAS 123R on investment activities in equations (5),

$$Investments_{i,t} = \beta_0 + \beta_1 POST_t + \beta_2 Treated_i + \beta_3 POST_t \times Treated_i + \theta X_{i,t-1} + Industry\ Fixed\ Effects + Year\ Fixed\ Effects + \varepsilon_{i,t} \quad (5)$$

where $Investments_{i,t}$ can be M&A investment, R&D investment, or capital expenditure, and the other variables are as previously described for equation (3). We rely on tobit models, rather than OLS models, to examine managers' M&A investment or R&D investment because, unlike for capital expenditure, many managers do not undertake these two kinds investment every year.

The results for managers' investment activities are presented in Table 6. In models (1) and (2), we test the volume of M&A investment. The insignificant coefficients on the interaction terms in both models suggest that the changes in managerial M&A investment are insignificantly different for the treated and control groups. Thus, the adoption of FAS 123R does not impact the volume of managers' M&A activities. Moreover, the statistically insignificant coefficients on the interaction terms between

*POST* and *Treated* in models (3) and (4) reveal that the adoption of FAS 123R also does not affect the volume of R&D investment. This finding is consistent with Mao and Zhang (2018), who also show the adoption of FAS 123R does not affect R&D input, but that R&D output nevertheless becomes less risky. We have found that managerial risk-taking reduces after the adoption of FAS 123R, but because neither M&A nor R&D investment is affected by FAS 123R, our conclusion is that managers are more likely to "play it safe" after FAS 123R by choosing less risky investments in M&A and R&D.

*[Inset Table 6 about here]*

Furthermore, models (5) and (6) show increased investment in capital expenditure for managers from the treated firms relative to managers from the control firms. Coles *et al.* (2006) argue that investing in capital expenditure is more conservative than investing in R&D and that compensation vega induces managers to shift investments away from capital expenditure and to R&D. Therefore, with a decline in compensation convexity after the adoption of FAS 123R, our results suggest managers also "play it safe" after the regulation by investing more in capital expenditure.

Overall, the results in Table 6 are consistent with Hayes *et al.* (2012), who show the adoption of FAS 123R affects executive compensation vega but has no effect on levels of investment, except for a weak effect on capital expenditure. However, our results go further in showing that although managerial risk-taking declines in the post-FAS 123R period this does not reduce managers' investment input. Hence, our results suggest that FAS 123R has rendered managers to "play it safe" rather than to seek a "quiet life".

## 3.4 How Do CEOs Adjust Risk

When the firm is viewed as a portfolio of segments, as we have done to compute the imputed measures of firm risk, the CEO can adjust risk by changing the components of the portfolio altogether or the weight of each segment. Thus, the risk-reduction we observe might result from CEOs closing risky segments and entering or expanding in to lower-risk segments. To explore how CEOs might adjust risk in responding to the adoption of FAS 123R, we examine changes in the segments of their firms in Table 7.

The positive interaction term in model (1) of Table 7 shows that compared with the CEOs in the control firms, CEOs from the treated group are more likely to change the focus of their principal business segment. Moreover, models (2) and (3) show CEOs from the treated firms not only are more likely to enter a new business segment, but also to open up more new segments in absolute terms. Model (4) shows the chance of closing existing segments is insignificantly different for CEOs from the treated and control firms. However, model (5) indicates CEOs from the treated group close more existing segments than their counterparties in the control firms. This opening and closing of segments results in insignificant DiD estimators in models (6) and (7) when the dependent variables are the net change in the number of business segments and the raw number of segments, respectively.

*[Inset Table 7 about here]*

Collectively, the results in Table 7 suggest that CEOs actively adjust the business segments in their firms in response to the reduced risk-taking incentive in compensation after the adoption of FAS 123R. Although the overall number of the business segments is not significantly different for the treated and the control firms, CEOs from the treated firms are more likely to change the focus of their principal segment, as well as open new segments and close existing segments. Since we have previously documented reduced risk-taking after FAS 123R, the evidence from Table 7 suggests that CEOs change the focus of their principal segment from riskier to lower risk. In addition, CEOs likely close riskier segments and enter in to less risky segments. This evidence further supports our previous "play it safe" conclusion.

## 3.5 Long-Term Firm Value after FAS 123R

Up to this point, our analysis yields evidence of reduced managerial risk-taking owing to a decline in option vega after FAS 123R. If risk-taking stimulates firm value and growth opportunities (see Fisher and Hall, 1969; Merton, 1974) then we would expect to observe a decrease in firm value after the adoption of FAS 123R. However, if reduced compensation convexity is able to ameliorate the over-investment problem, as suggested by Glover and Levine (2017), then we would expect long-term firm value to be positively affected by FAS 123R. We examine the effect of FAS 123R on firm value over a three-year window by estimating equation (6),

$$Imputed\ Q_{i,t} = \beta_0 + \beta_1 POST_t + \beta_2 Treated_i + \beta_3 POST_t \times Treated_i + \theta X_{i,t-1} + Industry\ Fixed\ Effects + Year\ Fixed\ Effects + \varepsilon_{i,t} \quad (6)$$

where $Imputed\ Q$ is construed by following Pryshchepa (2019) and in a similar manner to our imputed managerial risk-taking proxy, and the other variables are as previously described for equation (3). We do not form a prediction about the sign of the coefficient on the interaction term as no consensus exists on the relationship between compensation vega and firm value. Hence, the adoption of FAS 123R could cause firm value to go either way.

Table 8 presents the results for the effect of FAS 123R on firm value. First, the coefficients on the *POST* variable are negative and highly significant across all models, suggesting a decrease in firm value in the post-FAS 123R period for all firms. Second, and more importantly, the negative coefficients on the interaction terms between *POST* and *Treated* across all models indicate the treated group experiences greater long-term value reduction relative to the control firms. The extra reduction in *Imputed Q* for the treated firms is economically meaningful. Based on model (2), *Imputed Q* for the treated firms decreases by an extra 0.254 points in the first year after the adoption of FAS 123R, which represents approximately 9.621% of the pre-FAS 123R level of *Imputed Q*. The extra negative effect of FAS 123R on the treated firms lasts right up to the third year of the three-year window for *Imputed Q*. These results provide evidence suggesting that the decline in CEO risk-taking incentives caused by the adoption of FAS 123R leads to a decrease in firm value. Our empirical evidence in its totality suggests that FAS 123R has inadvertently aggravated a risk-related agency issue caused by managers being more inclined to "play it safe" when their risk-taking incentives are reduced.

*[Inset Table 8 about here]*

# 4. Robustness Tests

## 4.1 Parallel Trends Test

The parallel trends assumption is a fundamental assumption underlying DiD analyses. This requires making the assumption that the treated and control groups would have been expected to have otherwise similar trends in managerial risk-taking and in other key outcome variables in the absence of

FAS 123R. Although there is no direct method to test the parallel trends assumption, we follow Gormley and Matsa (2016) and Pryshchepa (2019) to examine the changes in the key outcome variables over several windows prior to the regulatory change.

Table 9 compares the means for the treated and control groups of the changes in managerial risk-taking, M&A investment, R&D investment, capital expenditure, firm value, the number of newly opened segments, the number of closed existing segments, the net changes in the number of segments, and the total number of segments over a two-, four-, and six-year window prior to the regulatory shock. The results suggest there are no significant differences between the treated and control groups when it comes to changes in these key outcome variables across all three pre-FAS 123 windows. Therefore, we argue the parallel trends assumption is likely to be applicable for our study. That is, it is reasonable to believe that the two groups of firms would have continued to have behaved in a similar manner to one another had the regulatory change not occurred.

*[Inset Table 9 about here]*

## 4.2 Placebo Tests

We conduct two sets of placebo tests to verify our main findings by randomly assigning firms to the treated and control groups in one test and by employing a false regulatory shock at an arbitrary point in time in another test. Table 10 presents the results from these placebo tests for which the outcome variables are our proxies for managerial risk-taking. The first placebo test in models (1) to (6) keeps 2005 as the year of the regulatory shock, but randomly assigns firms to the treated and control groups. Unlike the earlier corresponding models, these models show no significant differences in managerial risk-taking between the treated and control groups after FAS 123R. Therefore, we conclude that the previously documented results in this study are robust in this particular regard.

*[Inset Table 10 about here]*

Although the effective year of FAS 123R is 2005, speculation regarding this accounting change occurred some years before the effective date. It might be the case that firms pre-emptively reduced option grants, rendering our previous results a mere coincidence. Hence, in the second placebo test, we follow Mao and Zhang (2018) in assuming a false treatment occurred in the earlier year of 2000 and

choosing 1997-1999 as the 'pre-event' period and 2001-2003 as the 'post-event' period. We examine whether the false shock in 2000 impacts managerial risk-taking in models (7) to (12) of Table 10. The insignificant coefficients on the interaction terms suggest no significant differences in the changes of managerial risk-taking between the treated and control firms. Hence, the false event in 2000 cannot replicate the actual effect of FAS 123R in 2005 on managerial risk-taking.

Overall, these placebo tests reinforce our main findings that it is the passage of FAS 123R in 2005, and its different accounting impact on treated and control firms' earnings, that leads to a decline in managerial risk-taking.

## 4.3 Alternative Pre- and Post-FAS 123R Periods

To further examine the robustness of our main findings, we repeat our analysis of the effect on managerial risk-taking using a shorter window around the adoption of FAS 123R. We follow Hayes *et al.* (2012) and Mao and Zhang (2018) in here defining the pre-FAS 123R period as being 2002-2004 and the post-FAS 123R period as being 2006-2008. We present the results for the shorter window in Table 11. These results are consistent overall with our earlier results for managerial risk-taking. That is, the negative and significant coefficients on the interaction terms between *POST* and *Treated* across all models reinforce that treated firms experience a significantly greater decrease in managerial risk-taking after FAS 123R relative to control firms.

*[Inset Table 11 about here]*

## 4.4 Alternative Definition of Treatment

Lastly, as in Bakke *et al.* (2016), we use an alternative definition of treatment to further examine the robustness of our main finding that managerial risk-taking declines after the adoption of FAS 123R. The fair valuation method of employee option rewards under FAS 123R increases the accounting expense for firms that use options to compensate their CEOs. As such, the accounting regulatory change would be expected to have no direct impact on firms that at no time prior to FAS 123R relied on any options to reward their CEOs. Hence, we follow Bakke *et al.* (2016) in here differentiating between firms with and without any option rewards in the pre-FAS 123R period.

We examine the changes in our proxies for managerial risk-taking between the alternative treated and control groups after the adoption of FAS 123R and present the results in Table 12. The results are generally consistent with our previous findings in that once again managerial risk-taking is reduced more for the treated group in the post-FAS 123R period.

*[Inset Table 12 about here]*

# 5. Conclusion

This paper investigates the impact of FAS 123R on managerial risk-taking behaviours. Due to the reduction in CEO compensation convexity, FAS 123R significantly reduces managerial risk-taking behaviours. CEOs from the firms that are profoundly affected by FAS 123R experience a more substantial decline in risk-taking. However, the adoption of FAS 123R does not significantly affect manager's M&A and R&D investment inputs. Moreover, there is evidence show that CEOs actively change the focused segment and open up new segments after FAS 123R, suggesting extra efforts CEOs made to adjust their risk-taking. As a result, firm long-term value is negatively affected by the reduce managerial risk-taking after the adoption of FAS 123R. These findings are robust after several further tests.

Collectively, our results show that option vega is an essential component in executive compensation to induce managerial risk-taking and value creation. The adoption of FAS 123R, which reduces managerial compensation convexity, aggravates the risk-related agency issue as managers tend to "play it safe" in respond to a reduced risk-taking incentive. We conclude that appropriate risk-taking incentive in managerial compensation package help to mitigate the risk-related agency issue and benefit shareholder value in the long-term, regulators need to bear managerial risk-taking in mind when making regulatory changes.

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# Table

**Table 1: Whole Sample Summary Statistics**

This table presents the univariate results for the sample from 1999 to 2011, excluding year 2005. Statistics include the number of observations (Obs), the mean (Mean), the standard deviation (Std. Dev), the 25th (p25), 50th (Median), and 75th (p75) percentiles. Variable definitions can be found in Table A1. All variables are winsorised at 1% level of both tails, except compensation vega and delta are winsorised at the 99% only.

| | Obs. | Mean | Std. Dev. | p25 | Median | p75 |
|---|---|---|---|---|---|---|
| Compensation | | | | | | |
| Pct_salary (%) | 6,545 | 29.425 | 23.337 | 13.161 | 22.153 | 38.557 |
| Pct_bonus (%) | 6,545 | 11.673 | 15.763 | 0.000 | 4.830 | 19.841 |
| Pct_option (%) | 6,545 | 32.717 | 40.006 | 0.000 | 27.792 | 54.089 |
| Pct_stock (%) | 6,545 | 13.938 | 21.076 | 0.000 | 0.000 | 23.832 |
| Pct_LTIAs (%) | 6,545 | 6.020 | 0.186 | 0.000 | 0.000 | 0.000 |
| Vega_current ($000) | 6,545 | 23.126 | 35.310 | 0.000 | 8.193 | 29.516 |
| Vega_total ($000) | 6,545 | 117.665 | 146.55 | 18.58 | 55.49 | 148.09 |
| Delta _current ($000) | 6,545 | 40.575 | 57.314 | 3.733 | 18.799 | 49.875 |
| Delta_total ($000) | 6,545 | 502.355 | 731.730 | 84.883 | 221.692 | 558.167 |
| | | | | | | |
| Risk and Tobin Q | | | | | | |
| Total Risk (%) | 6,545 | 34.702 | 15.350 | 23.583 | 31.231 | 42.353 |
| Systematic Risk (%) | 6,545 | 14.044 | 8.484 | 7.738 | 12.221 | 18.157 |
| Idiosyncratic Risk (%) | 6,545 | 31.648 | 15.326 | 21.344 | 28.305 | 38.167 |
| Imputed Q | 6,545 | 2.378 | 1.194 | 1.535 | 2.151 | 2.893 |
| | | | | | | |
| Investments | | | | | | |
| M&A (%) | 6,545 | 5.623 | 19.441 | 0.000 | 0.000 | 0.000 |
| R&D (%) | 6,545 | 3.720 | 5.844 | 0.000 | 0.000 | 5.582 |
| CAPX (%) | 6,545 | 4.994 | 5.084 | 1.688 | 3.314 | 6.239 |
| | | | | | | |
| Business Segments | | | | | | |
| Focus | 6,107 | 0.032 | 0.175 | 0 | 0 | 0 |
| New Segment | 6,107 | 0.058 | 0.233 | 0 | 0 | 0 |
| No. New Segment | 6,107 | 0.067 | 0.294 | 0 | 0 | 0 |
| Close Segment | 6,107 | 0.063 | 0.243 | 0 | 0 | 0 |
| No. Closed Segment | 6,107 | 0.074 | 0.312 | 0 | 0 | 0 |
| No. Net Change in Segment | 6,107 | -0.007 | 0.348 | 0 | 0 | 0 |
| No. Segment | 6,107 | 1.460 | 0.819 | 1 | 1 | 2 |
| | | | | | | |
| Control Variables | | | | | | |
| Ln (Asset) | 6,545 | 7.023 | 1.548 | 5.926 | 6.842 | 7.952 |
| Firm Age | 6,545 | 23.352 | 15.612 | 11.000 | 18.000 | 35.000 |
| ROA | 6,545 | 0.034 | 0.113 | 0.012 | 0.050 | 0.091 |
| Market-to-Book | 6,545 | 2.144 | 1.632 | 1.177 | 1.621 | 2.479 |
| Leverage | 6,545 | 0.267 | 0.185 | 0.113 | 0.232 | 0.385 |
| Cash Holding | 6,545 | 0.175 | 0.189 | 0.026 | 0.099 | 0.271 |
| Tangibility | 6,545 | 0.274 | 0.234 | 0.090 | 0.192 | 0.413 |
| CEO Age | 6,545 | 55.171 | 7.348 | 50.000 | 55.000 | 60.000 |
| CEO Tenure | 6,545 | 7.230 | 7.138 | 2.000 | 5.000 | 10.000 |
| M&A Liquidity | 6,545 | 0.038 | 0.045 | 0.008 | 0.026 | 0.051 |

**Table 2: Pre- and POST-FAS 123R Comparison**

This table presents summary statistics of the main variables of interest for the pre- and post-FAS 123R subsample. Statistics include the number of observations (Obs), the mean (Mean), the standard deviation (Std. Dev), the 25th (p25), 50th (Median), and 75th (p75) percentiles. Pre-FAS 123R period is defined from 1999 to 2004, while post-FAS 123R period is from 2006 to 2011. Variable definitions can be found in Table A1. All variables are winsorised at 1% level of both tails, except compensation vega and delta are winsorised at the 99% only.

| | Pre-FAS 123R (1999 - 2004) | | | | | | Post -FAS 123R (2006-2011) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Obs. | Mean | Std. Dev. | p25 | Median | p75 | Obs. | Mean | Std. Dev. | p25 | Median | p75 |
| Compensation | | | | | | | | | | | | |
| Pct_salary (%) | 3,512 | 31.126 | 24.805 | 13.180 | 23.580 | 41.760 | 3,033 | 27.455 | 21.150 | 13.147 | 20.811 | 34.237 |
| Pct_bonus (%) | 3,512 | 16.732 | 16.165 | 2.404 | 13.367 | 25.587 | 3,033 | 5.815 | 12.864 | 0.000 | 0.000 | 4.097 |
| Pct_option (%) | 3,512 | 40.251 | 31.039 | 6.460 | 41.030 | 66.633 | 3,033 | 23.994 | 47.922 | 0.000 | 17.631 | 33.983 |
| Pct_stock (%) | 3,512 | 5.197 | 13.295 | 0.000 | 0.000 | 0.000 | 3,033 | 24.059 | 24.425 | 0.000 | 20.062 | 42.617 |
| Pct_LTIAs (%) | 3,512 | 3.218 | 7.041 | 0.000 | 0.000 | 0.000 | 3,033 | 9.264 | 8.900 | 0.000 | 0.000 | 0.000 |
| Vega_current ($000) | 3,512 | 24.223 | 35.748 | 0.000 | 9.244 | 30.565 | 3,033 | 21.856 | 34.695 | 0.000 | 6.524 | 28.252 |
| Vega_total ($000) | 3,512 | 126.824 | 156.487 | 19.183 | 62.301 | 165.234 | 3,033 | 107.060 | 137.776 | 18.317 | 50.977 | 136.659 |
| Delta _current ($000) | 3,512 | 41.973 | 61.688 | 2.661 | 17.231 | 50.842 | 3,033 | 38.956 | 51.069 | 5.593 | 20.566 | 49.115 |
| Delta_total ($000) | 3,512 | 522.344 | 755.522 | 85.564 | 227.942 | 574.374 | 3,033 | 479.209 | 699.158 | 84.674 | 217.412 | 543.441 |
| Risk and Tobin Q | | | | | | | | | | | | |
| Total Risk (%) | 3,512 | 37.778 | 15.952 | 25.882 | 33.990 | 45.923 | 3,033 | 31.141 | 14.001 | 21.008 | 27.445 | 38.077 |
| Systematic Risk (%) | 3,512 | 14.700 | 7.858 | 9.066 | 13.024 | 18.792 | 3,033 | 13.285 | 9.650 | 6.296 | 10.156 | 18.207 |
| Idiosyncratic Risk (%) | 3,512 | 34.786 | 15.939 | 23.469 | 30.659 | 41.924 | 3,033 | 28.015 | 13.348 | 19.188 | 24.592 | 33.068 |
| Imputed Q | 3,512 | 2.640 | 1.418 | 1.567 | 2.317 | 3.230 | 3,033 | 2.075 | 0.772 | 1.527 | 1.932 | 2.538 |
| Investment | | | | | | | | | | | | |
| M&A (%) | 3,512 | 7.095 | 21.810 | 0.000 | 0.000 | 1.474 | 3,033 | 3.919 | 15.295 | 0.000 | 0.000 | 0.000 |
| R&D (%) | 3,512 | 3.878 | 5.938 | 0.000 | 0.150 | 6.169 | 3,033 | 3.538 | 5.711 | 0.000 | 0.000 | 5.081 |
| CAPX (%) | 3,512 | 5.417 | 5.406 | 1.863 | 3.625 | 6.865 | 3,033 | 4.504 | 4.800 | 1.489 | 2.959 | 5.685 |
| Business Segment | | | | | | | | | | | | |
| Focus | 3,473 | 0.035 | 0.183 | 0.000 | 0.000 | 0.000 | 2,634 | 0.027 | 0.163 | 0.000 | 0.000 | 0.000 |
| New Segment | 3,473 | 0.075 | 0.263 | 0.000 | 0.000 | 0.000 | 2,634 | 0.035 | 0.185 | 0.000 | 0.000 | 0.000 |
| No. New Segment | 3,473 | 0.088 | 0.333 | 0.000 | 0.000 | 0.000 | 2,634 | 0.040 | 0.228 | 0.000 | 0.000 | 0.000 |
| Close Segment | 3,473 | 0.070 | 0.256 | 0.000 | 0.000 | 0.000 | 2,634 | 0.053 | 0.224 | 0.000 | 0.000 | 0.000 |
| No. Closed Segment | 3,473 | 0.081 | 0.317 | 0.000 | 0.000 | 0.000 | 2,634 | 0.065 | 0.304 | 0.000 | 0.000 | 0.000 |
| No. Net Change in Segment | 3,473 | 0.007 | 0.388 | 0.000 | 0.000 | 0.000 | 2,634 | -0.025 | 0.287 | 0.000 | 0.000 | 0.000 |
| No. Segment | 3,473 | 1.482 | 0.852 | 1.000 | 1.000 | 2.000 | 2,634 | 1.431 | 0.771 | 1.000 | 1.000 | 2.000 |

| Control Variables | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ln (Asset) | 3,512 | 6.704 | 1.486 | 5.670 | 6.562 | 7.583 | 3,033 | 7.393 | 1.541 | 6.369 | 7.313 | 8.328 |
| Firm Age | 3,512 | 20.089 | 14.785 | 8.000 | 14.000 | 30.000 | 3,033 | 27.130 | 15.760 | 14.000 | 21.000 | 39.000 |
| ROA | 3,512 | 0.031 | 0.117 | 0.008 | 0.048 | 0.090 | 3,033 | 0.038 | 0.107 | 0.017 | 0.052 | 0.091 |
| Market-to-Book | 3,512 | 2.375 | 1.909 | 1.185 | 1.683 | 2.777 | 3,033 | 1.877 | 1.119 | 1.164 | 1.545 | 2.207 |
| Leverage | 3,512 | 0.265 | 0.194 | 0.102 | 0.228 | 0.393 | 3,033 | 0.269 | 0.172 | 0.131 | 0.238 | 0.378 |
| Cash Holding | 3,512 | 0.177 | 0.199 | 0.021 | 0.087 | 0.287 | 3,033 | 0.173 | 0.176 | 0.036 | 0.110 | 0.256 |
| Tangibility | 3,512 | 0.286 | 0.233 | 0.101 | 0.209 | 0.426 | 3,033 | 0.261 | 0.234 | 0.078 | 0.170 | 0.393 |
| CEO Age | 3,512 | 54.530 | 7.600 | 49.000 | 55.000 | 60.000 | 3,033 | 55.914 | 6.932 | 51.000 | 56.000 | 61.000 |
| CEO Tenure | 3,512 | 7.237 | 7.161 | 2.000 | 5.000 | 10.000 | 3,033 | 7.222 | 7.110 | 2.000 | 5.000 | 9.000 |
| M&A Liquidity | 3,512 | 0.048 | 0.051 | 0.012 | 0.031 | 0.073 | 3,033 | 0.026 | 0.030 | 0.006 | 0.018 | 0.036 |

**Table 3: Difference-in-Difference in Means of the Dependent Variables**

This table presents the univariate results for the Difference-in-Differences (DID) analysis. Mean value for each variable in the pre- and post-FAS 123R period of the treated and control group are reported. Firms with the higher than median Accounting Impact measure are classified as Treated, and control groups are firms with below median Accounting Impact measure. Variable definitions can be found in Table A1. Difference in mean are tested by t-test. ***, **, and * stand for statistically significant at the 1%, 5%, and 10% respectively.

| | Pre-FAS 123R (1999 - 2004) | | | Post -FAS 123R (2006-2011) | | | DID |
|---|---|---|---|---|---|---|---|
| | High Impact (Treated) | Low Impact (Control) | Diff | High Impact (Treated) | Low Impact (Control) | Diff | |
| Vega_current ($000) | 28.161 | 21.101 | 8.060*** | 23.402 | 19.176 | 4.226*** | -3.834*** |
| Vega_total ($000) | 145.944 | 105.124 | 40.820*** | 120.856 | 89.378 | 31.478*** | -9.342*** |
| Delta _current ($000) | 49.722 | 32.041 | 17.680*** | 41.363 | 36.225 | 5.138*** | -12.542*** |
| Delta_total ($000) | 590.840 | 434.555 | 156.286*** | 527.100 | 424.858 | 102.242*** | 54.044*** |
| Total Risk (%) | 39.851 | 35.284 | 4.567*** | 32.120 | 30.143 | 1.976** | -2.591*** |
| Systematic Risk (%) | 16.084 | 12.792 | 3.285*** | 13.367 | 12.724 | 0.644 | -2.642*** |
| Idiosyncratic Risk (%) | 36.165 | 32.549 | 3.616*** | 28.831 | 26.934 | 1.897** | -1.719*** |
| Tobin Q | 2.905 | 2.259 | 0.647*** | 2.200 | 1.923 | 0.276*** | -0.371*** |
| M&A (%) | 9.092 | 4.732 | 4.360*** | 4.451 | 3.316 | 1.134* | -4.86 |
| R&D (%) | 5.746 | 1.311 | 4.444*** | 5.122 | 1.443 | 3.680*** | -0.764 |
| CAPX (%) | 5.157 | 5.649 | -0.492** | 4.012 | 4.948 | -0.936*** | 0.444 |
| Focus | 0.029 | 0.042 | -0.013** | 0.030 | 0.024 | 0.006 | 0.019* |
| New Segment | 0.056 | 0.099 | -0.043*** | 0.034 | 0.037 | 0.003 | 0.046** |
| No. New Segment | 0.068 | 0.115 | -0.047*** | 0.042 | 0.038 | 0.004 | 0.051*** |
| Close Segment | 0.056 | 0.089 | -0.032*** | 0.051 | 0.055 | 0.004 | 0.036* |
| No. Closed Segment | 0.065 | 0.103 | -0.038*** | 0.065 | 0.065 | 0.001 | 0.039** |
| No. Net Change in Segment | 0.003 | 0.013 | -0.010 | -0.023 | -0.028 | 0.005 | 0.015 |
| No. Segment | 1.371 | 1.631 | -0.260*** | 1.350 | 1.530 | 0.180*** | 0.440 |

**Table 4: Change in Executive Compensation Structure around the Adoption of FAS 123R**

This table shows CEO compensation structure change around the adoption of FAS 123R for the treated and control groups. The sample period is between 2005 and 2011, excluding 2005 when FAS 123R took place on June 15, 2005. POST is a dummy variable indicates the period after FAS 123R (2006-2011). Treated is a dummy variable set to one if the firm is classified in the treatment group. Firms with the higher than median Accounting Impact measure are classified as Treated, and control groups are firms with below median Accounting Impact measure. The dependent variable in model (1) - (2) is the fraction of option pay in CEO total compensation. The dependent variable of model (3) - (4) is the vega in current year. The dependent variable of model (5) – (6) is delta in current year. Variable definition can be found in Table A1. Industry fixed-effect is based the two-digit SIC code. Standard errors are corrected for heteroscedasticity and clustering at the firm level. Robust standard errors in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Pct_option | | Vega_current | | Delta _current | |
| POST | -0.122*** | -0.139*** | 6.585*** | -8.382*** | 8.575** | -14.808*** |
| | (0.026) | (0.027) | (2.371) | (2.063) | (3.842) | (3.355) |
| Treated | 0.174*** | 0.127*** | 11.666*** | 7.838*** | 22.109*** | 15.242*** |
| | (0.014) | (0.014) | (1.231) | (1.085) | (1.994) | (1.764) |
| POST x Treated | -0.094*** | -0.063*** | -6.158*** | -3.338** | -13.369*** | -8.363*** |
| | (0.019) | (0.019) | (1.729) | (1.476) | (2.802) | (2.400) |
| Lag ln (Asset) | | 0.030*** | | 13.374*** | | 22.345*** |
| | | (0.004) | | (0.311) | | (0.506) |
| Lag ln (Firm Age) | | -0.029*** | | 2.109*** | | 0.962 |
| | | (0.009) | | (0.680) | | (1.105) |
| Lag ROA | | -0.208*** | | -1.015 | | -11.447* |
| | | (0.049) | | (3.750) | | (6.099) |
| Lag Market-to-Book | | 0.018*** | | 3.602*** | | 6.257*** |
| | | (0.004) | | (0.294) | | (0.479) |
| Lag Leverage | | -0.199*** | | -22.193*** | | -18.682*** |
| | | (0.038) | | (2.901) | | (4.718) |
| Lag Cash Holding | | 0.113*** | | 5.140* | | 18.214*** |
| | | (0.036) | | (2.777) | | (4.516) |
| Lag Tangibility | | -0.050 | | -7.333** | | -9.128* |
| | | (0.038) | | (2.895) | | (4.708) |
| Lag ln(CEO Age) | | -0.091** | | -11.443*** | | -23.514*** |
| | | (0.041) | | (3.107) | | (5.053) |
| Lag ln(CEO Tenure) | | -0.023*** | | 0.033 | | 0.511 |
| | | (0.006) | | (0.454) | | (0.739) |
| Industry Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | 0.286*** | 0.650*** | 18.369*** | -32.128** | 44.956*** | -22.886 |
| | (0.026) | (0.166) | (2.348) | (12.644) | (3.805) | (20.563) |
| Observations | 6,347 | 6,347 | 6,422 | 6,422 | 6,422 | 6,422 |
| Adjusted R-squared | 0.100 | 0.128 | 0.077 | 0.340 | 0.080 | 0.338 |

**Table 5: The Impact of FAS 123R on Managerial Risk Taking**

This table presents the Difference-in-Differences (DID) for the impact of FAS 123R on managerial risk-taking. The sample period is between 2005 and 2011, excluding 2005 when FAS 123R took place on June 15, 2005. POST is a dummy variable indicates the period after FAS 123R (2006-2011). Treated is a dummy variable set to one if the firm is classified in the treatment group. Firms with the higher than median Accounting Impact measure are classified as Treated, and control groups are firms with below median Accounting Impact measure. The dependent variables are the imputed risk proxy for managerial total risk-taking (model (1)-(2)), systematic risk-taking (model (3) – (4)), and idiosyncratic risk-taking (model (5) – (6)). The risk proxy is constructed using segment data defined as in Pryshchepa (2019). All independent variables are lagged one period. Variable definitions can be found in Table A1. Industry fixed-effect is based on the two-digit SIC code. Standard errors are corrected for heteroscedasticity and clustering at the firm level. Robust standard errors in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

| | Total Risk | | Systematic Risk | | Idiosyncratic Risk | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| POST | -2.071** | -0.581 | 0.513 | 0.779** | -2.316*** | -0.832 |
| | (0.834) | (0.879) | (0.368) | (0.397) | (0.779) | (0.818) |
| Treated | 3.446*** | 2.479*** | 2.073*** | 1.562*** | 2.925*** | 2.054*** |
| | (0.714) | (0.727) | (0.318) | (0.317) | (0.656) | (0.668) |
| POST x Treated | -6.943*** | -6.339*** | -3.740*** | -3.393*** | -5.902*** | -5.365*** |
| | (0.950) | (0.942) | (0.455) | (0.450) | (0.856) | (0.850) |
| Lag ln (Asset) | | -0.268 | | 0.029 | | -0.289 |
| | | (0.197) | | (0.085) | | (0.182) |
| Lag ln (Firm Age) | | -1.697*** | | -0.381* | | -1.671*** |
| | | (0.465) | | (0.197) | | (0.432) |
| Lag ROA | | -7.141*** | | -4.058*** | | -6.148*** |
| | | (2.124) | | (0.977) | | (1.952) |
| Lag Market-to-Book | | 0.801*** | | 0.359*** | | 0.736*** |
| | | (0.183) | | (0.090) | | (0.166) |
| Lag Leverage | | 6.819*** | | 2.499*** | | 6.224*** |
| | | (1.937) | | (0.861) | | (1.775) |
| Lag Cash Holding | | 4.481*** | | 3.727*** | | 3.450** |
| | | (1.575) | | (0.728) | | (1.446) |
| Lag Tangibility | | -0.712 | | 0.267 | | -0.903 |
| | | (1.893) | | (0.825) | | (1.728) |
| Lag ln (CEO Age) | | -0.823 | | -1.188 | | -0.545 |
| | | (1.833) | | (0.856) | | (1.666) |
| Lag ln (CEO Tenure) | | 0.160 | | 0.193 | | 0.088 |
| | | (0.264) | | (0.118) | | (0.240) |
| Industry Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | 33.740*** | 41.263*** | 13.212*** | 17.246*** | 30.620*** | 37.599*** |
| | (0.994) | (7.305) | (0.371) | (3.363) | (0.934) | (6.688) |
| Observations | 6,545 | 6,545 | 6,545 | 6,545 | 6,545 | 6,545 |
| Adjusted R-squared | 0.450 | 0.469 | 0.460 | 0.475 | 0.439 | 0.458 |

**Table 6: The Impact of FAS 123R on Investments**

This table presents the Difference-in-Differences (DID) for the impact of FAS 123R on acquisitions activities. The sample period is between 2005 and 2011, excluding 2005 when FAS 123R took place on June 15, 2005. POST is a dummy variable indicates the period after FAS 123R (2006-2011). Treated is a dummy variable set to one if the firm is classified in the treatment group. Firms with the higher than median Accounting Impact measure are classified as Treated, and control groups are firms with below median Accounting Impact measure. The dependent variable of model (1) – (2) is the volume of M&A investment in a year scaled by book value of total assets in previous year. The dependent variable of model (3) – (4) is the maximum of zero or R&D expense scaled by book value of total assets. The dependent variable of model (5) – (6) is firm net capital expenditure scaled by book value of total assets. We run pooled tobit model for M&A and R&D investment to provide unbiased coefficient when the dependent variables are relatively small and mostly zero. All independent variables are lagged one period. Variable definitions can be found in Table A1. Industry fixed effect is based on the two-digit SIC code. Standard errors are corrected for heteroscedasticity and clustering at the firm level. Robust standard errors in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

| | M&A | | R&D | | CAPX | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| POST | -0.197*** | -0.139*** | -0.002 | 0.004 | 0.012*** | -0.002 |
| | (0.046) | (0.050) | (0.005) | (0.006) | (0.003) | (0.003) |
| Treated | 0.076*** | -0.005 | 0.046*** | 0.034*** | -0.002 | 0.002 |
| | (0.028) | (0.027) | (0.007) | (0.006) | (0.003) | (0.002) |
| POST × Treated | -0.027 | 0.019 | 0.004 | -0.006 | 0.008*** | 0.006** |
| | (0.037) | (0.036) | (0.005) | (0.005) | (0.003) | (0.002) |
| Lag ln (Asset) | | 0.032*** | | -0.004* | | -0.002** |
| | | (0.008) | | (0.002) | | (0.001) |
| Lag ln (Firm Age) | | -0.080*** | | -0.001 | | -0.005*** |
| | | (0.019) | | (0.004) | | (0.001) |
| Lag ROA | | 0.233** | | -0.014*** | | 0.026*** |
| | | (0.095) | | (0.005) | | (0.006) |
| Lag Market-to-Book | | 0.017** | | 0.003** | | 0.003*** |
| | | (0.008) | | (0.001) | | (0.001) |
| Lag Leverage | | -0.337*** | | -0.014 | | -0.037*** |
| | | (0.072) | | (0.013) | | (0.005) |
| Lag Cash Holding | | -0.059 | | 0.132*** | | -0.008* |
| | | (0.071) | | (0.017) | | (0.004) |
| Lag Tangibility | | -0.292*** | | -0.028 | | 0.145*** |
| | | (0.077) | | (0.018) | | (0.008) |
| Lag ln (CEO Age) | | -0.201** | | -0.005 | | -0.002 |
| | | (0.082) | | (0.016) | | (0.006) |
| Lag ln (CEO Tenure) | | 0.013 | | -0.001 | | 0.002** |
| | | (0.011) | | (0.002) | | (0.001) |
| M&A Liquidity | | 0.997*** | | | | |
| | | (0.261) | | | | |
| Industry Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | -0.210*** | 0.794** | -0.103*** | -0.018 | 0.173*** | 0.108*** |
| | (0.055) | (0.329) | (0.016) | (0.067) | (0.010) | (0.025) |
| Observations | 6,545 | 6,545 | 6,545 | 6,545 | 6,545 | 6,545 |
| Adjusted/Pseudo R-squared | 0.061 | 0.091 | 0.038 | 0.045 | 0.422 | 0.593 |

**Table 7: Change of Segments around FAS 123R**

This table presents the Difference-in-Differences (DID) for the impact of FAS 123R on firm business segments. The sample period is between 2005 and 2011, excluding 2005 when FAS 123R took place on June 15, 2005. POST is a dummy variable indicates the period after FAS 123R (2006-2011). Treated is a dummy variable set to one if the firm is classified in the treatment group. Firms with the higher than median Accounting Impact measure are classified as Treated, and control groups are firms with below median Accounting Impact measure. Focus is a dummy variable equals to one if the firm's largest segment by sales, defined by two-digit SIC code, changes, and zero otherwise. New Segment is a dummy variable equals to one if the firm develops any new segment, and zero otherwise. No. New Segment is the number of new segments being developed in the year. Close Segment is a dummy variable equals to one is the firm close any existing segment in the year, and zero otherwise. No. Closed Segment is the number of closed existing segments in the year. No. Net Change in Segment is the difference between the newly developed segments and closed existing segments. No. Segment is the total number of business segments the firm has in the year. All independent variables are lagged one period. Variable definitions can be found in Table A1. Industry fixed effect is based on the two-digit SIC code. Standard errors are corrected for heteroscedasticity and clustering at the firm level. Robust standard errors in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

| | Focus | New Segment | No. New Segment | Close Segment | No. Closed Segment | No. Net Change in Segment | No. Segment |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| POST | -0.380** | -1.042*** | -0.214*** | -0.440*** | -0.079*** | -0.135*** | -0.360*** |
| | (0.182) | (0.140) | (0.026) | (0.145) | (0.025) | (0.029) | (0.067) |
| Treated | -0.231** | -0.274*** | -0.041*** | -0.185** | -0.028*** | -0.013 | -0.114* |
| | (0.107) | (0.083) | (0.014) | (0.079) | (0.013) | (0.013) | (0.063) |
| POST x Treated | 0.275* | 0.238* | 0.046*** | 0.166 | 0.031* | 0.014 | 0.006 |
| | (0.144) | (0.128) | (0.017) | (0.111) | (0.017) | (0.017) | (0.058) |
| Lag ln (Asset) | -0.002 | 0.078** | 0.012** | 0.065** | 0.013*** | -0.000 | 0.078*** |
| | (0.033) | (0.032) | (0.005) | (0.027) | (0.005) | (0.004) | (0.024) |
| Lag ln (Firm Age) | 0.183** | 0.209*** | 0.036*** | 0.310*** | 0.047*** | -0.011 | 0.281*** |
| | (0.077) | (0.056) | (0.008) | (0.055) | (0.008) | (0.008) | (0.047) |
| Lag ROA | -0.747** | -0.648** | -0.103** | -0.962*** | -0.140*** | 0.037 | -0.160 |
| | (0.341) | (0.311) | (0.048) | (0.265) | (0.047) | (0.040) | (0.134) |
| Lag Market-to-Book | -0.044 | -0.000 | -0.002 | -0.006 | -0.000 | -0.001 | -0.022* |
| | (0.038) | (0.028) | (0.003) | (0.025) | (0.003) | (0.003) | (0.012) |
| Lag Leverage | -0.275 | -0.084 | -0.040 | -0.056 | -0.012 | -0.028 | -0.134 |
| | (0.278) | (0.228) | (0.032) | (0.220) | (0.034) | (0.035) | (0.166) |
| Lag Cash Holding | -0.348 | -0.763*** | -0.077*** | -0.258 | -0.025 | -0.052** | -0.578*** |
| | (0.300) | (0.245) | (0.029) | (0.223) | (0.032) | (0.025) | (0.120) |
| Lag Tangibility | -0.705** | -0.915*** | -0.141*** | -0.409* | -0.069* | -0.072* | -0.479*** |
| | (0.318) | (0.248) | (0.041) | (0.231) | (0.036) | (0.039) | (0.185) |
| Lag ln (CEO Age) | -0.150 | -0.339 | -0.021 | -0.103 | 0.016 | -0.037 | 0.161 |
| | (0.314) | (0.259) | (0.034) | (0.260) | (0.036) | (0.033) | (0.162) |
| Lag ln (CEO Tenure) | -0.076* | 0.013 | -0.002 | -0.024 | -0.007 | 0.005 | -0.017 |
| | (0.044) | (0.038) | (0.005) | (0.035) | (0.005) | (0.005) | (0.021) |
| Industry Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | -1.202 | -0.108 | 0.243* | -2.256** | -0.145 | 0.388*** | 0.062 |
| | (1.289) | (1.008) | (0.143) | (1.025) | (0.150) | (0.146) | (0.683) |
| Observations | 6,107 | 6,107 | 6,107 | 6,107 | 6,107 | 6,107 | 6,545 |
| Adjusted/Pseudo R-squared | 0.078 | 0.131 | 0.056 | 0.077 | 0.041 | 0.014 | 0.191 |

**Table 8: Long-term Firm Value Measured by Tobin Q**

This table presents the impact of FAS 123R on firm value in one year (t+1), two year (t+2) and three year (t+3) after the adoption of FAS 123R. The sample period is between 2005 and 2011, excluding 2005 when FAS 123R took place on June 15, 2005. POST is a dummy variable indicates the period after FAS 123R (2006-2011). Treated is a dummy variable set to one if the firm is classified in the treatment group. Firms with the higher than median Accounting Impact measure are classified as Treated, and control groups are firms with below median Accounting Impact measure. The dependent variables are imputed Tobin Q construed from business segment data. All independent variables are lagged one period. Variable definitions can be found in Table A1. Industry fixed effect is based on the 2-digit SIC code. Standard errors are corrected for heteroscedasticity and clustering at the firm level. Robust standard errors in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

| | Imputed Q | | | | | |
|---|---|---|---|---|---|---|
| | t+1 | | t+2 | | t+3 | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| POST | -1.334*** | -1.483*** | -1.130*** | -1.189*** | -0.864*** | -0.920*** |
| | (0.216) | (0.234) | (0.228) | (0.243) | (0.229) | (0.274) |
| Treated | 0.303*** | 0.150** | 0.191*** | 0.085 | 0.151** | 0.082 |
| | (0.065) | (0.066) | (0.064) | (0.061) | (0.061) | (0.057) |
| POST × Treated | -0.352*** | -0.254*** | -0.233*** | -0.173*** | -0.191*** | -0.161*** |
| | (0.061) | (0.064) | (0.057) | (0.058) | (0.052) | (0.054) |
| Lag ln (Asset) | | 0.011 | | 0.008 | | -0.006 |
| | | (0.014) | | (0.013) | | (0.012) |
| Lag ln (Firm Age) | | -0.057 | | -0.037 | | -0.023 |
| | | (0.040) | | (0.039) | | (0.038) |
| Lag ROA | | 0.042 | | -0.239 | | -0.068 |
| | | (0.206) | | (0.184) | | (0.166) |
| Lag Leverage | | -1.041*** | | -0.925*** | | -0.736*** |
| | | (0.117) | | (0.108) | | (0.104) |
| Lag Cash Holding | | 0.616*** | | 0.480*** | | 0.403*** |
| | | (0.136) | | (0.126) | | (0.125) |
| Lag PPE | | -0.267* | | -0.298** | | -0.313** |
| | | (0.149) | | (0.140) | | (0.134) |
| Lag ln (CEO Age) | | -0.157 | | -0.073 | | -0.029 |
| | | (0.152) | | (0.149) | | (0.143) |
| Lag ln (CEO Tenure) | | 0.039* | | 0.027 | | 0.016 |
| | | (0.020) | | (0.019) | | (0.019) |
| Industry Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | 3.175*** | 3.949*** | 2.772*** | 3.238*** | 2.552*** | 2.867*** |
| | (0.040) | (0.610) | (0.041) | (0.597) | (0.029) | (0.571) |
| Observations | 6,545 | 6,545 | 6,545 | 6,545 | 6,545 | 6,545 |
| Adjusted R-squared | 0.365 | 0.409 | 0.357 | 0.401 | 0.380 | 0.422 |

**Table 9: Parallel Trends Test**

This table compares the means for the treated and control groups of the changes in the dependent variables used in this study: managerial risk-taking, M&A investment, R&D investment, capital expenditure, firm value, Number of new segments, Number of closed segments, Net change in the number of segments, and change in the total number of segments over a two-, four-, and six-year window prior to the regulatory shock. Firms with the higher than median Accounting Impact measure are classified as Treated, and control groups are firms with below median Accounting Impact measure. Variable definitions can be found in Table A1. Difference in mean are tested by t-test.

| Change in | Accounting Impact | (-2, -1) | (-4, -1) | (-6, -1) |
|---|---|---|---|---|
| Total Risk | High | 6.082 | 16.221 | 8.949 |
| | Low | 5.439 | 15.557 | 8.876 |
| | P-value (Diff) | 0.487 | 0.354 | 0.398 |
| Systematic Risk | High | 2.016 | 6.128 | 3.857 |
| | Low | 1.360 | 5.834 | 2.553 |
| | P-value (Diff) | 0.879 | 0.593 | 0.228 |
| Idiosyncratic Risk | High | 6.093 | 17.349 | 11.028 |
| | Low | 5.378 | 15.997 | 9.814 |
| | P-value (Diff) | 0.813 | 0.382 | 0.187 |
| M&A Investment | High | -0.047 | 0.015 | 0.052 |
| | Low | -0.003 | -0.011 | 0.047 |
| | P-value (Diff) | 0.160 | 0.554 | 0.935 |
| R&D | High | 0.001 | 0.006 | 0.001 |
| | Low | 0.000 | 0.005 | -0.002 |
| | P-value (Diff) | 0.531 | 0.596 | 0.387 |
| CAPX | High | -0.001 | 0.002 | 0.018 |
| | Low | -0.001 | 0.003 | 0.024 |
| | P-value (Diff) | 0.910 | 0.722 | 0.274 |
| Tobin Q | High | 0.054 | 0.258 | 0.632 |
| | Low | 0.003 | 0.154 | 0.444 |
| | P-value (Diff) | 0.345 | 0.284 | 0.228 |
| No. New Segment | High | -0.006 | 0.010 | 0.160 |
| | Low | -0.035 | 0.015 | 0.217 |
| | P-value (Diff) | 0.362 | 0.893 | 0.344 |
| No. Closed Segment | High | 0.021 | 0.014 | 0.042 |
| | Low | -0.017 | -0.010 | 0.017 |
| | P-value (Diff) | 0.313 | 0.560 | 0.600 |
| No. Net Change in Segment | High | -0.028 | -0.003 | 0.118 |
| | Low | -0.017 | 0.026 | 0.200 |
| | P-value (Diff) | 0.8257 | 0.548 | 0.227 |
| No. Segment | High | 0.006 | 0.073 | 0.078 |
| | Low | 0.030 | 0.056 | 0.151 |
| | P-value (Diff) | 0.417 | 0.748 | 0.273 |

**Table 10: Placebo Test on Managerial Risk Taking**

This table presents the placebo tests for the impact of FAS 123R on acquisitions activities using the imputed managerial risk-taking proxy. The sample period for model (1) - (6) is between 1999 and 2011 (exclude 2005). Pre-FAS 123R period is defined from 1999 to 2004, and the post-FAS 123R period is from 2005 to 2011. POST is a dummy variable indicates the period after FAS 123R (2006-2011). Firms are randomly assigned to the treated and control group. Pseudo Treated is a dummy variable indicates randomly treated firms. The sample period for model (7) to (12) is between 1997 and 2003 (exclude 2000). A false shock in 2000 is used to replace the shock of FAS 123R in 2005. The pre-shock period is from 1997 to 1999, and the post-shock period is 2001 to 2003. Pseudo-POST is a dummy variable set to one to indicate the Pseudo post period. The dependent variables are managerial total risk-taking in model (1), (2), (7) and (8), managerial systematic risk-taking in model (3), (4), (9), and (10), and managerial idiosyncratic risk-taking in model (4), (5), (11) and (12). All independent variables are lagged one period. Variable definitions can be found in Table A1. Industry fixed effect is based on the two-digit SIC code. Standard errors are corrected for heteroscedasticity and clustering at the firm level. Robust standard errors in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

| | Total Risk | | Systematic Risk | | Idiosyncratic Risk | | Total Risk | | Systematic Risk | | Idiosyncratic Risk | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| POST | -5.646*** | -3.713*** | -1.479*** | -0.965*** | -5.339*** | -3.466*** | | | | | | |
| | (0.669) | (0.752) | (0.325) | (0.360) | (0.626) | (0.700) | | | | | | |
| Pseudo Treated | 0.163 | 0.139 | -0.027 | -0.031 | 0.190 | 0.165 | | | | | | |
| | (0.397) | (0.391) | (0.202) | (0.197) | (0.366) | (0.362) | | | | | | |
| POST X Pseudo Treated | -0.213 | -0.245 | 0.009 | 0.003 | -0.210 | -0.240 | | | | | | |
| | (0.544) | (0.544) | (0.290) | (0.287) | (0.499) | (0.500) | | | | | | |
| Pseudo POST | | | | | | | 3.707*** | 3.836*** | 2.843*** | 2.599*** | 2.647*** | 2.882*** |
| | | | | | | | (0.636) | (0.758) | (0.301) | (0.347) | (0.588) | (0.702) |
| Treated | | | | | | | 1.043 | -0.779 | 0.631** | -0.400 | 0.845 | -0.689 |
| | | | | | | | (0.672) | (0.729) | (0.286) | (0.315) | (0.630) | (0.681) |
| Pseudo POST X Treated | | | | | | | 0.919 | 0.561 | 0.223 | 0.228 | 1.016 | 0.618 |
| | | | | | | | (0.801) | (0.864) | (0.366) | (0.390) | (0.743) | (0.802) |
| Lag ln(Asset) | | -0.246 | | 0.049 | | -0.271 | | 0.045 | | 0.077 | | 0.026 |
| | | (0.199) | | (0.085) | | (0.184) | | (0.236) | | (0.105) | | (0.223) |
| Lag ln(Firm Age) | | -1.701*** | | -0.408** | | -1.669*** | | -1.807*** | | -0.492** | | -1.724*** |
| | | (0.463) | | (0.196) | | (0.430) | | (0.493) | | (0.207) | | (0.459) |
| Lag ROA | | -7.851*** | | -4.482*** | | -6.740*** | | -1.157 | | -1.898* | | -0.518 |
| | | (2.165) | | (1.005) | | (1.984) | | (2.325) | | (1.136) | | (2.149) |
| Lag Market-to-Book | | 0.883*** | | 0.405*** | | 0.805*** | | 0.360** | | 0.126 | | 0.358** |
| | | (0.188) | | (0.093) | | (0.170) | | (0.160) | | (0.078) | | (0.149) |
| Lag Leverage | | 6.538*** | | 2.281*** | | 5.999*** | | 3.016 | | 1.055 | | 2.725 |
| | | (1.953) | | (0.869) | | (1.789) | | (1.942) | | (0.938) | | (1.784) |
| Lag Cash Holding | | 4.527*** | | 3.802*** | | 3.480** | | 8.377*** | | 5.320*** | | 6.822*** |
| | | (1.600) | | (0.739) | | (1.468) | | (1.762) | | (0.887) | | (1.617) |
| Lag PPE | | -0.348 | | 0.358 | | -0.576 | | -5.093** | | -3.331*** | | -4.170** |
| | | (1.872) | | (0.828) | | (1.709) | | (2.025) | | (0.884) | | (1.885) |
| Lag ln(CEO Age) | | -1.737 | | -1.729** | | -1.309 | | -2.229 | | -1.440 | | -1.965 |
| | | (1.841) | | (0.862) | | (1.671) | | (2.038) | | (0.941) | | (1.886) |
| Lag ln(CEO Tenure) | | 0.185 | | 0.211* | | 0.109 | | 0.452 | | 0.181 | | 0.427 |
| | | (0.266) | | (0.120) | | (0.242) | | (0.289) | | (0.133) | | (0.266) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Industry Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | 35.292*** | 45.636*** | 14.176*** | 20.023*** | 31.911*** | 41.204*** | 21.180*** | 36.711*** | 7.213*** | 15.821*** | 19.941*** | 33.654*** |
| | (1.013) | (7.260) | (0.396) | (3.365) | (0.947) | (6.642) | (1.228) | (8.271) | (0.424) | (3.734) | (1.170) | (7.693) |
| Observations | 6,545 | 6,545 | 6,545 | 6,545 | 6,545 | 6,545 | 3,520 | 3,520 | 3,520 | 3,520 | 3,520 | 3,520 |
| Adjusted R-squared | 0.438 | 0.459 | 0.446 | 0.464 | 0.428 | 0.449 | 0.433 | 0.467 | 0.459 | 0.479 | 0.415 | 0.450 |

**Table 11: Alternative Pre- and Post-FAS 123R Periods**

This table presents the impact of FAS 123R on managerial risk-taking. The sample period is between 2002 and 2008, excluding 2005 when FAS 123R took place on June 15, 2005. POST is a dummy variable indicates the period after FAS 123R (2006-2008). Treated is a dummy variable set to one if the firm is classified in the treatment group. Firms with the higher than median Accounting Impact measure are classified as Treated, and control groups are firms with below median Accounting Impact measure. Accounting Impact is remeasured in this alternative sample period. The dependent variables are the managerial total-risk (model (1) – (2)), systematic risk-taking (model (3) – (4)), and idiosyncratic risk-taking (model (5) – (6)). The risk proxy is constructed using segment data defined as in Pryshchepa (2019). All independent variables are lagged one period. Variable definitions can be found in Table A1. Industry fixed-effect is based on the two-digit SIC code. Standard errors are corrected for heteroscedasticity and clustering at the firm level. Robust standard errors in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

| | Total Risk | | Systematic Risk | | Idiosyncratic Risk | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| POST | 3.186*** | 4.031*** | 6.508*** | 6.661*** | -0.110 | 0.733 |
| | (0.952) | (0.948) | (0.521) | (0.527) | (0.851) | (0.845) |
| Treated | 1.279* | 1.057 | 1.232*** | 1.067*** | 0.923 | 0.731 |
| | (0.687) | (0.699) | (0.341) | (0.351) | (0.626) | (0.635) |
| POST × Treated | -4.505*** | -4.452*** | -2.739*** | -2.662*** | -3.652*** | -3.611*** |
| | (0.882) | (0.879) | (0.484) | (0.486) | (0.784) | (0.782) |
| Lag ln (Asset) | | -0.224 | | 0.016 | | -0.242 |
| | | (0.206) | | (0.094) | | (0.190) |
| Lag ln (Firm age) | | -1.618*** | | -0.301 | | -1.602*** |
| | | (0.502) | | (0.225) | | (0.465) |
| Lag ROA | | -4.856** | | -2.903*** | | -4.021** |
| | | (2.060) | | (1.023) | | (1.900) |
| Lag Market-to-Book | | -0.073 | | -0.095 | | -0.027 |
| | | (0.203) | | (0.102) | | (0.185) |
| Lag Leverage | | 4.532** | | 1.663 | | 4.152** |
| | | (2.222) | | (1.099) | | (1.994) |
| Lag Cash Holding | | 2.803* | | 2.708*** | | 2.072 |
| | | (1.601) | | (0.776) | | (1.465) |
| Lag Tangibility | | 0.941 | | 0.093 | | 1.036 |
| | | (1.949) | | (0.948) | | (1.776) |
| Lag ln (CEO age) | | 1.973 | | 0.569 | | 1.685 |
| | | (1.851) | | (0.903) | | (1.687) |
| Lag ln (CEO tenure) | | 0.056 | | 0.273** | | -0.050 |
| | | (0.267) | | (0.128) | | (0.242) |
| Industry Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | 42.133*** | 38.975*** | 16.999*** | 14.701*** | 38.226*** | 36.441*** |
| | (0.898) | (7.425) | (0.427) | (3.569) | (0.805) | (6.814) |
| Observations | 3,417 | 3,417 | 3,417 | 3,417 | 3,417 | 3,417 |
| Adjusted R-squared | 0.510 | 0.520 | 0.520 | 0.527 | 0.484 | 0.495 |

**Table 12: Alternative Treatment and Managerial Risk-taking**

This table presents the Difference-in-Differences (DID) for the impact of FAS 123R on managerial risk-taking. The sample period is between 2005 and 2011, excluding 2005 when FAS 123R took place on June 15, 2005. POST is a dummy variable indicates the period after FAS 123R (2006-2011). Alternative Treated is a dummy variable set to one for firms that at no time prior to FAS 123R relied on any options to reward their CEOs. The dependent variables are the managerial total-risk (model (1) – (2)), systematic risk-taking (model (3) – (4)), and idiosyncratic risk-taking (model (5) – (6)). The risk proxy is constructed using segment data defined as in Pryshchepa (2019). All independent variables are lagged one period. Variable definitions can be found in Table A1. Industry fixed-effect is based on the two-digit SIC code. Standard errors are corrected for heteroscedasticity and clustering at the firm level. Robust standard errors in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

| | Total Risk Proxy | | Systematic Risk Proxy | | Idiosyncratic Risk Proxy | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| POST | -1.829 | -0.334 | -0.938 | -0.584 | -1.332 | 0.127 |
| | (2.092) | (2.061) | (0.920) | (0.911) | (1.954) | (1.922) |
| Alternative Treated | 1.122 | 1.041 | 0.504 | 0.434 | 1.055 | 0.995 |
| | (1.600) | (1.583) | (0.693) | (0.683) | (1.507) | (1.487) |
| POST × Alternative Treated | -4.113* | -3.687* | -0.562 | -0.395 | -4.313** | -3.911** |
| | (2.153) | (2.087) | (0.942) | (0.916) | (2.005) | (1.942) |
| Lag ln (Asset) | | -0.243 | | 0.050 | | -0.269 |
| | | (0.198) | | (0.085) | | (0.183) |
| Lag ln (Firm Age) | | -1.673*** | | -0.414** | | -1.636*** |
| | | (0.462) | | (0.197) | | (0.429) |
| Lag ROA | | -7.874*** | | -4.486*** | | -6.765*** |
| | | (2.162) | | (1.004) | | (1.980) |
| Lag Market-to-Book | | 0.886*** | | 0.404*** | | 0.809*** |
| | | (0.187) | | (0.093) | | (0.170) |
| Lag Leverage | | 6.589*** | | 2.252*** | | 6.065*** |
| | | (1.954) | | (0.868) | | (1.790) |
| Lag Cash Holding | | 4.499*** | | 3.793*** | | 3.451** |
| | | (1.590) | | (0.741) | | (1.457) |
| Lag Tangibility | | -0.369 | | 0.352 | | -0.597 |
| | | (1.873) | | (0.828) | | (1.709) |
| Lag ln (CEO Age) | | -1.765 | | -1.699** | | -1.350 |
| | | (1.851) | | (0.864) | | (1.681) |
| Lag ln (CEO Tenure) | | 0.197 | | 0.216* | | 0.120 |
| | | (0.266) | | (0.120) | | (0.241) |
| Industry Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | 34.354*** | 44.750*** | 13.673*** | 19.478*** | 31.058*** | 40.415*** |
| | (1.824) | (7.537) | (0.771) | (3.492) | (1.713) | (6.896) |
| Observations | 6,545 | 6,545 | 6,545 | 6,545 | 6,545 | 6,545 |
| Adjusted R-squared | 0.439 | 0.460 | 0.446 | 0.464 | 0.429 | 0.450 |

# Appendix

**Appendix A1: Variable Definition**

| Variable | Definition |
|---|---|
| **Compensation** | |
| **Pct_salary** | The dollar value of CEO basic salary (salary) scaled by total compensation (tdc1). |
| **Pct_bonus** | The dollar value of CEO bonus scaled by total compensation (tdc1). The calculation of CEO bonus follows Hayes et al. (2012) and defined consistently for the changed format in ExecuComp.. |
| **Pct_option** | The dollar value of CEO option rewards scaled by total compensation (tdc1). The calculation of CEO option rewards follows Hayes et al. (2012) and defined consistently for the changed format in ExecuComp. |
| **Pct_stock** | The dollar value of CEO restricted stock salary in total compensation. The calculation of CEO restricted stock follows Hayes et al. (2012) and defined consistently for the changed format in ExecuComp. |
| **Pct_LTIAs** | The dollar value of CEO long-term incentive awards scaled by total compensation (tdc1). The calculation of CEO long-term incentive awards follows Hayes et al. (2012) and defined consistently for the changed format in ExecuComp. |
| **Vega_current** | Change in the dollar value of the CEO's current option holding for a 0.01 unit change in annualized stock return volatility of the company stock as in Hayes et al. (2012). |
| **Vega_total** | Change in the dollar value of the CEO's all option holding for a 0.01 unit change in annualized stock return volatility of the company stock. |
| **Delta_current** | The definition of current delta follows Hayes et al. (2012) as (Black-Scholes Delta of all current option grants + number of shares of current restricted stock grants + number of targeted shares granted under LTIA) ×. (fiscal year-end price × 0.01). |
| **Delta_total** | The definition of total delta follows Hayes et al. (2012) as (Black-Scholes Delta of all current option grants + number of shares of current restricted stock grants + number of targeted shares granted under LITA + Black-Scholes Delta of all prior option grants + number of prior shares of restricted stock + number if prior shares granted under LTIA) × (fiscal year-end price × 0,01) |
| **Risk and Tobin Q** | |
| **Total Risk** | Annualised volatility of the weekly imputed risk constructed from business segment data over the previous 52 weeks as in Pryshchepa (2019) |
| **Systematic Risk** | Square root of the unexplained variance from decompose the imputed total risk on the Fama-French (1999) three-factor model. |
| **Idiosyncratic Risk** | Square root of the explained variance from decomposing the imputed total risk on Fama-French (1999) three-factor model. |
| **Imputed Q** | Total assets (at) minus book value of equity (ceq) plus Market Equity minus deferred taxes (txdc) scaled by book value of total assets (at). The imputed Tobin Q is constructed from segment data as in Pryshchepa (2019). |
| **Investments** | |
| **M&A** | Sum of M&A deal transaction value made in a given year by a given firm divided by the book value of total assets (at) in the previous year. |
| **R&D** | The maximum of zero or research and development expenditure (xrd) scaled by book value of total assets (at). |
| **CAPX** | The difference between capital expenditure (capx) and sale of PPE (sppe) scaled by book value of total assets (at). |
| **Business Segments** | |
| **Focus** | A dummy variable equals to one if the firm's largest segment by sales, defined by two-digit SIC code, changes, and zero otherwise. |
| **New Segment** | A dummy variable equals to one if the firm develops any new segment, and zero otherwise. |

| | |
|---|---|
| **No. New Segment** | The number of new segments being developed in the year. |
| **Close Segment** | A dummy variable equals to one is the firm close any existing segment in the year, and zero otherwise. |
| **No. Closed Segment** | The number of closed existing segments in the year. |
| **No. Net Change in Segment** | The difference between the newly developed segments and closed existing segments. |
| **No. Segment** | The total number of business segments the firm has in the year. |
| **Control Variables** | |
| **Accounting impact** | Implied option expense (xintopt) divided by common share used to calculated earnings per share (fully diluted) (cshfd) |
| **Acquisition** | A dummy variable equals to one if the deal value excess 1% of the bidder's book value of total assets (at) in the previous year, and zero otherwise. |
| **Alternative Treated** | Dummy variable equals to one for firms that at no time prior to FAS 123R relied on any options to reward their CEOs, and zero otherwise. |
| **Cash Compensation** | Natural logarithm of the sum of CEO basic salary and bonus. |
| **Cash Holding** | Value of cash and short investments (che) to book value of total assets (at). |
| **CEO Age** | Natural logarithm of Age of CEO documented in Execucomp plus one. |
| **CEO Tenure** | Natural logarithm of the number of years CEO has worked in the company plus one. |
| **Firm age** | Natural logarithm of the number of years the firm has records in COMPUSTAT plus one. |
| **Industry** | Defined by the 2-digit SIC code. |
| **Leverage** | Book value of debt (dltt + lct) over Market Value. |
| **Ln (Asset)** | Natural logarithm of firm book value of total assets (at). |
| **M&A Liquidity** | Sum of M&A deal transaction value made in a given year by all firms in the same industry scaled by the sum of total book value of assets (at) in a given year by all firms in the same industry. |
| **Market Equity** | Common shares outstanding (csho) times close price (prcc_f) |
| **Market Value** | Liabilities (lt) minus Deferred taxes and investment tax credit (txditc) plus Preferred Stock (pstkl/pstkrv/pstk) plus Market Equity. |
| **Market-to-Book** | Ratio of Market Value divided by book value of total assets (at). |
| **POST** | A dummy variable equal to one for the year after 2005, and zero otherwise. |
| **ROA** | Net income (ni) divided by book value of total asset (at). |
| **Tangibility** | Value of net plant, property, and equipment (ppent) to book value of total assets (at). |
| **Treated** | Dummy variable equals to one if the firm has higher than median Accounting Impact measure, and zero otherwise. |

**Appendix A2: The Effect of FAS 123R on Managerial Risk-taking (Firm Fixed Effect Model)**

This table presents the Difference-in-Differences (DID) for the impact of FAS 123R on managerial risk-taking. The sample period is between 2005 and 2011, excluding 2005 when FAS 123R took place on June 15, 2005. The dependent variables are the imputed risk proxy for firm total risks, systematic risk, and idiosyncratic risk. The risk proxy is constructed using segment data defined as in Pryshchepa (2019). All independent variables are lagged one period. Variable definitions can be found in Appendix A1. Standard errors are corrected for heteroscedasticity and clustering at the firm level. Robust standard errors in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

| | Total Risk Proxy | Systematic Risk Proxy | Idiosyncratic Risk Proxy |
|---|---|---|---|
| | (1) | (2) | (3) |
| POST x Treated | -6.269*** | -3.527*** | -5.230*** |
| | (1.142) | (0.549) | (1.025) |
| Lag ln (Asset) | 1.973*** | 1.337*** | 1.595*** |
| | (0.678) | (0.320) | (0.614) |
| Lag ln (Firm Age) | -8.656*** | -2.610** | -8.126*** |
| | (2.134) | (1.015) | (1.935) |
| Lag ROA | -5.828** | -2.410** | -5.270** |
| | (2.260) | (1.097) | (2.114) |
| Lag Market-to-Book | 1.644*** | 0.765*** | 1.476*** |
| | (0.228) | (0.114) | (0.209) |
| Lag Leverage | 4.676 | 0.657 | 4.780* |
| | (2.859) | (1.324) | (2.638) |
| Lag Cash Holding | 1.649 | 0.852 | 1.369 |
| | (2.254) | (1.068) | (2.083) |
| Lag Tangibility | 6.525 | 2.169 | 5.964 |
| | (4.541) | (2.294) | (4.071) |
| Lag ln (CEO Age) | -1.789 | -1.282 | -1.450 |
| | (2.833) | (1.385) | (2.588) |
| Lag ln (CEO Tenure) | 0.180 | 0.061 | 0.167 |
| | (0.346) | (0.173) | (0.314) |
| Firm Fixed Effect | Yes | Yes | Yes |
| Year Fixed Effect | Yes | Yes | Yes |
| Industry Fixed Effect | No | No | No |
| Constant | 45.332*** | 13.730** | 42.781*** |
| | (12.009) | (6.086) | (10.833) |
| Observations | 6,545 | 6,545 | 6,545 |
| Adjusted R-squared | 0.616 | 0.563 | 0.606 |

## Table A3: The Effect of FAS 123R on Tobin Q (Firm Fixed Effect Model)

This table presents the Difference-in-Differences (DID) for the impact of FAS 123R on firm Tobin Q. The sample period is between 2005 and 2011, excluding 2005 when FAS 123R took place on June 15, 2005. The dependent variables are the imputed Tobin Q. The imputed Tobin Q is constructed using segment data defined as in Pryshchepa (2019). All independent variables are lagged one period. Variable definitions can be found in Appendix A1. Standard errors are corrected for heteroscedasticity and clustering at the firm level. Robust standard errors in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

| | Imputed Q | | |
|---|---|---|---|
| | t+1 | t+2 | t+3 |
| | (1) | (2) | (3) |
| POST x Treated | -0.265*** | -0.211*** | -0.190*** |
| | (0.069) | (0.065) | (0.062) |
| Lag ln (Asset) | -0.147*** | -0.148*** | -0.086** |
| | (0.045) | (0.045) | (0.038) |
| Lag ln (Firm Age) | -0.259* | -0.158 | -0.152 |
| | (0.153) | (0.148) | (0.141) |
| Lag ROA | 0.341** | -0.118 | -0.006 |
| | (0.153) | (0.143) | (0.116) |
| Lag Leverage | 0.125 | -0.067 | -0.010 |
| | (0.144) | (0.129) | (0.114) |
| Lag Cash Holding | -0.257 | -0.062 | 0.070 |
| | (0.171) | (0.156) | (0.135) |
| Lag Tangibility | 0.320 | 0.302 | 0.345 |
| | (0.299) | (0.247) | (0.211) |
| Lag ln (CEO Age) | 0.275 | 0.377 | 0.309 |
| | (0.227) | (0.233) | (0.214) |
| Lag ln (CEO Tenure) | -0.003 | -0.014 | -0.021 |
| | (0.024) | (0.024) | (0.022) |
| Firm Fixed Effect | Yes | Yes | Yes |
| Year Fixed Effect | Yes | Yes | Yes |
| Industry Fixed Effect | No | No | No |
| Constant | 3.238*** | 2.598*** | 2.205** |
| | (0.972) | (0.978) | (0.861) |
| Observations | 6,545 | 6,545 | 6,545 |
| Adjusted R-squared | 0.641 | 0.647 | 0.681 |

**Table A4: Correlation Matrix**

This table presents the correlations coefficients for the variables used in this study. Variables definitions can be found in Table A1. Robust standard errors in parenthesis. *, **, and *** denote statistical significance at the 10%, 55 and 1% level, respectively.

| | | A | B | V | D | E | F | G | H | I | J | K | L | M | N | O | P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Risk | A | 1 | | | | | | | | | | | | | | | |
| Systematic Risk | B | 0.793*** | 1 | | | | | | | | | | | | | | |
| Idiosyncratic Risk | V | 0.988*** | 0.696*** | 1 | | | | | | | | | | | | | |
| Imputed Q | D | 0.073*** | 0.058*** | 0.077*** | 1 | | | | | | | | | | | | |
| M&A | E | 0.047*** | 0.041*** | 0.047*** | 0.107*** | 1 | | | | | | | | | | | |
| R&D | F | 0.102*** | 0.187*** | 0.080*** | 0.337*** | 0.076*** | 1 | | | | | | | | | | |
| CAPX | G | 0.041*** | -0.008 | 0.050*** | -0.049*** | -0.011 | -0.158*** | 1 | | | | | | | | | |
| Ln (Asset) | H | -0.168*** | -0.127*** | -0.169*** | -0.272*** | -0.106*** | -0.346*** | 0.046*** | 1 | | | | | | | | |
| Ln (Firm Age) | I | -0.179*** | -0.128*** | -0.184*** | -0.237*** | -0.109*** | -0.217*** | -0.054*** | 0.493*** | 1 | | | | | | | |
| ROA | J | -0.089*** | -0.118*** | -0.077*** | 0.053*** | 0.039*** | -0.252*** | 0.153*** | 0.150*** | 0.055*** | 1 | | | | | | |
| Market-to-Book | K | 0.146*** | 0.119*** | 0.149*** | 0.451*** | 0.197*** | 0.287*** | 0.078*** | -0.233*** | -0.250*** | 0.234*** | 1 | | | | | |
| Leverage | L | 0.002 | -0.040*** | 0.0092 | -0.365*** | -0.131*** | -0.343*** | -0.082*** | 0.288*** | 0.226*** | -0.294*** | -0.565*** | 1 | | | | |
| Cash Holding | M | 0.123*** | 0.184*** | 0.105*** | 0.328*** | 0.107*** | 0.582*** | -0.191*** | -0.411*** | -0.297*** | -0.105*** | 0.384*** | -0.471*** | 1 | | | |
| Tangibility | N | -0.097*** | -0.125*** | -0.085*** | -0.248*** | -0.072*** | -0.355*** | 0.634*** | 0.299*** | 0.223*** | 0.050*** | -0.214*** | 0.235*** | -0.446*** | 1 | | |
| CEO Age | O | -0.072*** | -0.076*** | -0.070*** | -0.099*** | -0.071*** | -0.109*** | -0.022 | 0.140*** | 0.204*** | 0.073*** | -0.117*** | 0.072*** | -0.136*** | 0.067*** | | |
| CEO Tenure | P | 0.013 | 0.017 | 0.011 | 0.050*** | -0.008 | 0.014 | 0.040*** | -0.076*** | -0.071*** | 0.074*** | 0.027** | -0.053*** | 0.039*** | -0.026** | 0.400*** | 1 |