Is Skin in the Game a Game Changer? Evidence from Mandatory Changes to D&O Insurance Policies ☆

Chen Lin
University of Hong Kong

Micah Officer
Loyola Marymount University, USA

Thomas Schmid
University of Hong Kong

Hong Zou
University of Hong Kong

Abstract

There is a longstanding debate over the costs and benefits of directors' and officers' liability insurance (D&O insurance). We contribute to this debate by examining a hitherto unstudied question - whether including a personal deductible in D&O insurance contracts benefits shareholders. Exploiting an innovative German law change in 2009 that introduces a mandatory personal deductible for D&O insurance, we find that affected firms experience positive announcement returns around the first announcement of a mandatory deductible. There is also strong evidence of an increase in long-run firm valuation, a decrease in the cost of capital and risk-taking, and some evidence of improved cash flows for affected firms after the law change. Therefore, including a personal deductible appears to represent a key step towards a better design of D&O insurance contracts.

Keywords: Investor protection, directors' and officers' (D&O) liability insurance, legal liability, deductibles, firm value, cost of capital

JEL: G32, G34

---

1. Introduction

Legal protection of investors, particularly minority shareholders, is a fundamental corporate governance mechanism (Shleifer and Vishny, 1997). Directors and officers (D&Os) owe fiduciary duties to shareholders in managing a company and overseeing business decisions. They may be held legally liable for breach of fiduciary duties and for violation of the securities law (La Porta, Lopez-de-Silanes, Shleifer and Vishny, 2000). In this vein, directors' and officers' liability insurance (D&O insurance) emerged as an important and efficient risk transfer tool to cover the legal defense costs and potential damage awards when D&Os are sued for "wrongdoing" in discharging their duties. The efficiency of risk transfer emanates from insurance companies' comparative advantage in bearing the liability risk and valuable real services in litigation (Mayers and Smith, 1982; 1990). D&O insurance may directly cover D&Os' legal costs and damage awards (via the so-called Side-A coverage) or reimburse a company for the amount it has indemnified D&Os for legal costs (via Side-B coverage).

D&O insurance is usually purchased and paid for by companies in order to protect D&Os from bearing legal liability. Almost every publicly listed company in the US routinely purchases D&O insurance, attesting the importance of D&O insurance in protecting company D&Os.[1] Furthermore, the prevailing practice is that D&O insurance does not contain a *personal* deductible for D&Os (i.e., an amount of risk retained by insured individuals) in Side-A coverage, although there is often a deductible that needs to be borne by the company in Side-B coverage. This feature means D&Os' legal liability risk is effectively extinguished by D&O insurance that carries a sufficient level of coverage.

Debate over the merit of D&O insurance to shareholders continues to this day. Proponents (D&Os, practitioners, and some academics) argue that sufficient D&O insurance coverage is indispensable for attracting quality candidates to be D&Os and to induce them to take on risky, but positive-NPV, projects. Opponents contend that D&O

---

[1] An appropriately crafted D&O insurance policy represents a means of protection that is more certain and flexible than other means of protection such as company indemnification (see Lin et al. (2013) for a detailed discussion).

insurance shields D&Os from the deterrence and discipline of litigation, lowers their vigilance and accountability, and has the potential to engender unintended moral hazard on the part of D&Os (Baker and Griffith, 2010). Since there appears to be both pros and cons of D&O insurance, an important research question that has not received attention in the literature is whether D&O insurance contracts can be made more effective for shareholders by including a personal deductible for covered executives. In this study, we answer this question by examining the effects of a novel and recent law change in Germany that mandates personal deductibles in D&O insurance.

As a response to the growing public pressure to strengthen D&Os' accountability for their decisions in the aftermath of the 2008 financial crisis[2], and in order to promote sustainability in company management, the Act on the Appropriateness of Management Board's Remuneration (VorstAG) was passed by the German Parliament on June 18, 2009. It came into effect on August 5, 2009. The Act affects new D&O insurance contracts of German firms immediately and existing D&O insurance contracts after June 30, 2010 or after their expiration (i.e., August 5, 2009 to June 30, 2010 is a transition period for implementation of the law).

A novel aspect of this Act is the imposition of a mandatory personal deductible (the amount of loss that is to be borne by the insured before the insurer's coverage kicks in) on the members of the management board in the Side-A coverage of a D&O insurance policy. If a company takes out D&O insurance, a mandatory deductible amount for the members of the management board must be included in the contract, and this deductible must be at least 10% of the relevant loss (with an annual cap that is at least one and half times the officer's annual fixed pre-tax remuneration). Considering that the post-tax net income of executives in Germany is typically around 50% of their gross income, this law implies that the mandatory personal deductible is at least approximately three times an executive's annual after-tax fixed compensation. This is an economically significant penalty, and

---

[2] Specifically, we define "D&O" as members of the management board in Germany.

potentially has a large incentive effect on D&Os. This mandatory risk retention is imposed because even though a deductible in D&O insurance has been a recommended practice by the German Corporate Governance Code (GCGC) since 2002, it has been largely ignored by German companies (Menzies and Kammerer-Galahn, 2009). German companies often argue that a deductible is uncommon internationally, would not improve the consciousness of responsibility of their D&Os, or induces D&Os to avoid taking risks.[3]

The mandatory risk retention in the Act is intended to induce D&Os to behave in a fashion that is more responsible to their shareholders (i.e., reduce agency costs). This approach to corporate governance and risk management failures in the 2008 financial crisis (in general) and D&O legal liability (in particular) is unique because the prevailing international practice in D&O insurance is that there is no deductible in the personal coverage portion of D&O insurance. Therefore, whether the policy initiative is effective or not has important implications for other countries that may seek to strengthen the accountability of D&Os and to improve corporate governance and risk management (as was the ultimate goal of the Sarbanes-Oxley Act, 2002, in the U.S., for example).

Ex-ante it is not clear whether, and how, the German mandatory deductible requirement in D&O insurance will change D&Os' behavior and, thereby, have any measurable impact on corporate outcomes. On the one hand, the mandatory deductible requirement forces D&Os to have "skin in the game," strengthens their legal liability, and increases their accountability and (presumably) vigilance in corporate decision-making, which should ultimately lead to better outcomes for shareholders. If so, market reactions to the announcement of the law change are likely positive and subsequent long-run corporate outcomes are likely improved for the firms affected by the law (which we call treated firms).

On the other hand, unlike D&Os who are typically risk averse, shareholders are risk

---

[3] We also frequently observe these arguments in our process of manually collecting D&O insurance information.

neutral and maximizing value for shareholders involves *optimal* risk-taking (Smith and Stulz, 1985). To the extent that the legal change imposes significant personal legal liabilities on D&Os, they may become overly conservative in corporate decisions and shareholders may ultimately suffer. A third possibility is that the effect of the law change may be negligible if D&Os can transfer the mandatory loss retained in a D&O insurance policy by taking out another D&O insurance policy at their own cost (the law is silent on whether this is allowed) (Schultz, 2010). We, however, note that this possibility is unlikely to render the new law ineffective in altering D&Os' behaviors because D&Os still suffer for any mismanagement in the form of future higher D&O insurance premium and/or more restricted coverage. It is therefore interesting to see which of these competing arguments are supported by the data.

Using hand-collected D&O insurance data for a broad sample of German non-financial firms over the period 2005-2013, we test the effects of the exogenous legal change in D&O legal liability with a difference-in-differences (DiD) research design. In our analysis, the treatment group consists of firms that carry D&O insurance right before the law change because they will be subsequently required to include a, or increase the, personal deductible for D&Os in their D&O insurance policy following the law change.[4] In order to conduct robust tests of our hypotheses, we use several alternative control groups that consist of matched or unmatched German firms that do not have D&O insurance coverage before the law change and firms from Austria and European countries neighboring Germany.[5]

We report several key findings. First, following the very first announcement of the possible introduction of a mandatory personal deductible, stock market reactions for treated

---

[4] While we find that some German firms voluntarily introduce deductibles on members of the management board before the law change, the amount of the deductible is often very low and appears symbolic.

[5] Austria and Germany share the same language and currency, a similar culture and business environment, as well as similar industry structures, but there is no similar legal change in Austria regarding D&Os' retained legal liability. As a result, Austrian firms are natural candidates for control firms for German treated firms. Most of these same arguments apply to other countries immediately neighboring Germany.

firms (measured by cumulative raw or abnormal returns) are significantly positive (while insignificant for size-matched control firms). The differences in cumulative abnormal returns between the treatment and control groups are statistically different from zero, and these results are robust to the choice of different control groups. Therefore, investors seem to interpret the possible imposition of a personal deductible in D&O insurance positively, probably because having "skin in the game" leads D&Os to act more responsibly.

After establishing the positive short-term wealth effect of the law change, we procced to examine whether the positive effect of a mandatory personal deductible has a lasting effect by examining changes in long-run firm valuation proxied by Tobin's Q. Using a panel data set, we find that treated firms exhibit increased valuation (about 13% higher) compared with that of the control firms in the period following the law change; while before the law change, there is little difference in valuations between the two groups of firms.

We consider several alternative explanations of our finding. In addition to imposing a mandatory deductible in D&O insurance, the Act also increases a minimum of 4-year vesting period for stock options from the previous 2-year period (see Section 193 of the GSCA) in order to provide D&Os with more long-term incentives. One concern is that our finding of improved firm valuations post the 2009 law change may be due to the lengthened option vesting period. We rule out this interpretation by showing that our results are robust to limiting the analysis to firms that do not use stock or option based compensation. Another alternative explanation is that following the 2009 law change that increases D&Os' personal liability, companies may need to pay D&Os more to compensate for the higher risk facing D&Os, and this higher compensation, in turn, leads to improved morale and firm valuation. Inconsistent with this argument, using German firms without D&O insurance as a control group, we find no significant increase in D&Os' compensation.

Third, to uncover the channels through which D&Os' "skin in the game" helps improve firm valuation, we examine changes in firms' cost of equity capital around the law

change. To the extent that imposing greater personal liability on D&Os for their actions helps align the interests of D&Os and shareholders, shareholders may *perceive* that investing in the company becomes less risky because potential agency problems of D&Os are mitigated. In turn, investors may lower their required rate of return. Note that the reduction in the cost of equity could be instant as long as investors change their perception of the risk associated with their investment in the company. Following Hail and Leuz (2009), we use the average of four measures of implied cost of equity and find that treated firms experience an about 13% reduction (in relative terms) in the cost of equity after the 2009 law change compared to control firms.

If D&Os act more responsibly and vigilantly after putting "skin in the game", they may be able to make better business decisions that eventually result in improved cash flows of the firm. We examine whether this is borne out in our data. After controlling for firm fixed effects and other firm characteristics, we find some weak evidence that treated firms experience an increase in cash flows relative to control firms after the law change, and the economic magnitude is also small (about 3% increase).

Finally, we also examine changes in firms' risk-taking and find that treated firms exhibit significantly lower stock-return volatility relative to control firms after the mandatory introduction of personal deductibles in D&O insurance, which broadly corroborates the decline in the cost of equity that we observe. These results suggest that D&Os also become more cautious in risk-taking.

Taken together, our findings indicate that increased legal liability as a result of a mandatory personal deductible in D&O insurance induces D&Os to act more responsibly and appears to have significant economic consequences that benefit shareholders. Therefore, including a personal deductible in D&O insurance represents an important step towards a better design of D&O insurance contracts. While risk-neutral shareholders want firms to take an optimal amount of risk, our results show that the reduced risk-taking in our sample firms does not appear to be detrimental to shareholders. It may be that treated firms

whose D&Os are well protected by the coverage of D&O insurance before the law change took an excessive amount of risk, and the law change helps restore the level of risk-taking to the optimum.

Our study makes several important contributions to the literature. First, we examine an unstudied question in the D&O insurance literature in particular, and the literature on D&O legal liability in general – i.e., whether including a personal deductible in D&O insurance helps mitigate the unintended effects of D&O insurance and thereby benefit shareholders (see Baker and Griffith (2010) for a discussion of the unintended effects). While some prior studies have examined why firms purchase D&O insurance (e.g., Core 1997; Chalmers et al., 2002) and the potential (unintended) adverse incentive effect of excessive D&O insurance (e.g., Lin et al., 2011; 2013; Chen et al., 2016),[6] none of these studies have focused on how D&O insurance contracts can be better designed to mitigate the potential moral hazard (e.g., lowered vigilance of D&Os and excessive risk-taking in corporate decision-making).

Our study is also germane to the longstanding debate on whether it is beneficial to impose personal legal liability on D&Os. Zero or too little personal legal liability for D&Os may mute shareholder discipline via litigation and induce excessive risk-taking, but too much personal legal liability may cause D&Os to become overly conservative. Prior studies (e.g., Bhagat et al., 1987; Brook and Rao, 1994) relying on event studies of firms' purchase of D&O insurance or adoption of liability limitation provisions in corporate bylaws have been inconclusive. Our results show that having skin in the game by imposing a personal deductible in D&O insurance is a game changer and benefits shareholders.

Second, our research is especially relevant and timely because regulators in many countries are striving to increase managerial accountablity and strengthen corproate governance and risk management in the aftermath of the 2008 financial crisis. Our results

---

[6] Lin et al. (2013) find some evidence that D&O insurance coverage appears to improve the value of large increases in capital expenditure for firms with better internal and external governance. See Chen et al. (2016) for a review of the recent D&O insurance literature.

show that Germany's novel approach to this issue appears to be a policy initiative with some merits for shareholders. This is likely to have important policy implications for regulators, as well as for investors, in other countries. Finally, our paper also for the first time provides evidence on D&O insurance in Europe, whereas most prior studies on D&O insurance have used data from North America.

The remainder of this paper is organized as follows. Section 2 describes the institutional background, including the legal bases of D&O liability and D&O insurance in Germany. Section 3 describes the sample and research design. Section 4 provides summary statistics and regression results, and Section 5 concludes.

2. Institutional background

2.1. Legal basis of D&O liability in Germany

German companies are governed by a two-tier board system that consists of the management board (MB) and the supervisory board (SB). Legal liability of members of the MB is essentially derived from regulations in the German Stock Corporation Act (GSCA). For example, §93 states: "Members of the management board who violate their duties shall be jointly and severally liable to the company for any resulting damage. They shall bear the burden of proof in the event of a dispute as to whether or not they have employed the care of a diligent and conscientious manager." §117 also extends the liability for compensation to the losses caused to shareholders. In general, duty of care and responsibility of the members of the MB apply analogously to members of the SB (§117).

The German Corporate Governance Code (GCGC) that was first issued in February 2002 mostly adopts a "comply-or-explain" principle. Recommendations of the GCGC are non-binding; companies can deviate from them, but are then obliged to disclose and explain such deviations and make these explanations available to shareholders.[7] In particular, the GCGC recommends (in clause 3.8) that if a company takes out a D&O

---

[7] GCGC also contains some "suggestions" that can be deviated from without disclosure.

insurance policy, a suitable *personal* deductible shall be included. However, in practice, very few companies follow this recommendation, and when a company does follow it the amount of the personal deductible is often trivial and symbolic.

As introduced earlier, the Act on the Appropriateness of Management Board's Remuneration (VorstAG) was passed by the German Parliament in 2009 as a response to the growing public pressure to strengthen D&Os' accountability for their decisions in the aftermath of the 2008 financial crisis, and in order to promote sustainability in company management. Following the passage of VorstAG, the GCGC and the GSCA were revised to reflect the mandatory personal deductible requirement in D&O insurances. In particular, although the mandatory personal deductible only applies to members of the MB under the VorstAG, the update to the GCGC in 2009 recommends the same deductible for SB members when D&O insurance is purchased for the SB.

2.2. D&O lawsuits and corporate purchase of D&O insurance in Germany

In Germany, as a result of the two-tier board system, a large portion of D&O claims concern internal liability – i.e., a company asserting a claim against its board members. One estimate shows that about two-thirds of suits against D&Os of public companies in Germany are brought by their own companies.[8] To the extent that any potential recovery goes to the company, this kind of lawsuit bears some similarities to shareholder derivative suits in the U.S. legal system.

Recent high-profile D&O claims include Siemens (whose directors failed to prevent or detect bribery), Volkswagen (whose directors failed to prevent or detect embezzlement), and Deutsche Bank (whose CEO was alleged to have issued a statement and damaged the creditworthiness of a client). Lufthansa, Infomatec, EM.TV, Metabox, Comroad, and Deutsche Telekom are also reported to be involved in D&O claims. German firms are also facing increasing D&O liability risk from the U.S. For example, Siemens recently resolved

---

[8] State of the European D&O market 2013, Zurich, March 2013.

bribery allegations with the U.S. Department of Justice and Securities and Exchange Commission for US$800 million, with D&O insurers paying more than €100 million of that amount. Volkswagen also recently became the target of legal investigations in the US and several other countries.

In view of the legal liability risk, the purchase of D&O insurance is common among German companies. Our statistics show that as of 2008, about 77% of German listed companies in 2008 carry D&O insurance. Allianz, a major insurance provider in Germany, estimates that nearly 50% of small- and medium-sized German companies also carry D&O insurance. Although information on the purchase of D&O insurance is often deemed sensitive in other jurisdictions, the GCGC requires German firms to discuss and declare in annual reports and governance compliance statements whether they have followed the GCGC recommendation regarding D&O insurance personal deductibles, and, if not, the reason for non-compliance. This enables us to collect information on firms' purchase of D&O insurance.

2.3. Potential confounding changes in the 2009 VorstAG

While the 2009 Act strengthens D&O accountability via the introduction of the mandatory personal deductible requirement in D&O insurance for the MB members, a major concurrent item in the Act is that the Act also imposes a minimum of 4-year vesting period for stock options and this is increased from the previous at least 2-year period (stipulated in Section 193 of the GSCA) in order to provide D&Os better long-term incentives. This new provision, however, does not affect existing stock option schemes. To the extent that lengthened vesting period in option-based compensation improves long-term incentives of D&Os and affect firm value, it may confound our examination of the value implications of increased personal liabilities arising from a mandatory deductible in D&O insurance.

3. Data and sample selection

3.1. Data sources

We collect annual reports for all non-financial and non-foreign companies listed on the Frankfurt stock exchange for the period 2005-2013. The sample includes all the stocks which were included in the Composite DAX (CDAX) during our sample period. We prioritize using the English version of filings; for some firm-years where the English version is ambiguous in description, or the English version is not available, we refer to the German version. For firm-years that do not have an annual report, we download from company website the firm's annual declaration of GCGC compliance. As mentioned above, the GCGC requires firms to disclose whether they have followed the GCGC recommendations, and, if not, the areas of (and reasons for) non-compliance. These data sources enable us to find and code information on each firm's purchase of D&O insurance and personal deductibles for D&Os.

Although we have attempted to record all information relevant to D&O insurance from the sources noted above, only a binary variable about carrying D&O insurance or not has sufficient observations for a meaningful statistical analysis. This binary variable suffices for our purpose of conducting a DiD analysis that compares treated firms (those that have D&O insurance and need to follow the legal requirement to introduce or increase personal deductibles) with control firms (that do not carry D&O insurance immediately before the law change, and so are not subject to the new legal requirement on mandatory personal deductibles). Our long-term analysis of corporate outcomes uses a panel dataset (four years before and four years after the law change) of these companies. Financial statement data is taken from Worldscope and stock return data is obtained from DataStream. Analyst earnings forecast data is from I/B/E/S. Please refer to the Appendix for detailed definitions of the important variables used in our analyses.

3.2. Control firms

As mentioned above, our treated firms are those German firms that have D&O insurance in the fiscal year before the law change and thus need to follow the legal requirement to introduce, or increase, personal deductibles for D&Os. Our control sample consists of German firms that do *not* carry D&O insurance right before the law change, and are therefore not subject to the new legal requirement on mandatory personal deductibles. Because this control sample is small (firms without D&O insurance account for less than a quarter of all listed German companies), we supplement this subset of German firms with Austrian firms. We label this pool of German firms without D&O insurance before the law change and Austrian firms as the "unmatched control sample." Austria and Germany share the same language and currency, a similar cultural and business environment, as well as similar industry structures, but there is no similar legal change regarding D&Os' legal liability in Austria. As a result, Austrian firms are a natural control group for German treated firms. We also show that our results are robust to using only German or Austrian firms as the control group.

The number of firms in the treatment group is about three times the number of firms in the unmatched control sample given the popularity of D&O insurance among German listed companies. More importantly, treated firms on average are larger than the group of (unmatched) control firms described above, consistent with the pattern reported in prior studies that large firms are more likely to become a target of litigation, and hence are more likely to carry D&O insurance, than small firms are (e.g., Chalmers et al., 2002; Lin et al., 2013). Large firms and small firms may differ in other unobserved aspects that are not measured by the vector of control variables included in our regression models.

Therefore, to make the treatment and control groups more comparable we match each treated firm with a control firm that is closest in firm size (total assets) using nearest-neighbor propensity score matching (without replacement). This approach, while reducing the size of the treated sample but leaves the control sample unchanged, has the advantage of ensuring greater similarity between treated and control firms and a balanced sample size

in the treatment and control groups. We use this matched control sample in our main analyses, but also use the unmatched control sample in robustness checks.

Importantly, in addition to the unmatched control sample, we also use firms from Austria and other countries neighboring Germany (i.e., Belgium, the Czech Republic, Denmark, France, Luxembourg, the Netherlands, Poland, and Switzerland) as a broader group of control firms (we label these the "neighboring country control sample") in our long-term valuation analysis to examine the robustness of our results. We also alternatively match by firm size and industry and our results are robust.

4. Empirical results

4.1. Market reactions to the first announcement of the mandatory deductible requirement

4.1.1. Univariate analyses

Our first objective is to conduct an event study to examine the short-term market reaction to the announcement of the mandatory personal deductible in D&O insurance. We have carefully searched news reports on the legislative process and established the event history of the legislative process, which confirms "the swift enactment" of the law (Schultz, 2010). Our search reveals that on April 23, 2009, Wolfgang Bosbach and Joachim Poss, who were the leaders of the joint workgroup of the two parties that form the coalition government (CDU and SPD) on executive compensation, announced the results of a discussion on the draft of the law. In the announcement, they mentioned that D&Os should be more liable for decisions with their personal wealth at stake, and the way they want to achieve that is to introduce a mandatory deductible for D&O insurance for members of the MB. It is important to note that this was the first mention of the idea of mandating a personal deductible for D&O insurance covering MB members.[9] Thus, this was the first

---

[9] There are several other potential event dates including, for example, final discussions of the draft in the legislation committee held on May 7, 2009, the final draft of the law published on June 17, 2009, and the

time when the market could have learned of the idea to mandate personal deductibles in D&O insurance. Consequently, we use April 23, 2009 as the event date in our event study. Our news search also suggests that there was little mention of the idea on dates before April 23, 2009, and as a result, the announcement of the idea on this date constitutes a surprise to the market.

Table 1 reports summary statistics of the variables used in our study for the pooled treated and matched control firms over the period 2005-2013. Sample firms on average have a total asset of €2.13 billion, but this is inflated by the presence of some large firms in the sample: the median total asset for firms in our pooled sample is just €212 million. On average, firms in our pooled sample have a total debt ratio of 31%, return on assets (EBITDA scaled by total assets) of 10%, and a cost of equity of 12%.

[Insert Table 1 here]

The results from the event study are reported in Table 2. We first focus on the matched sample (i.e., treated firms and their one-to-one matched control firms) in Panel A and B. Panel A presents the cumulative abnormal announcement returns (CARs) over the five days (i.e., [-2; +2]) surrounding the date of the first announcement of the mandatory personal deductible on April 23, 2009. CARs are five-day cumulative difference between a firm's daily return minus the corresponding daily return for the Austrian market obtained from Datastream. We choose the Austrian market index as the benchmark return rather than the German market index because the German market index might have reflected the

---

passage of the law with a majority of supporting votes in the German parliament on June 18, 2009. However, none of these events were unexpected.

impacts of the law especially through those firms that have D&O insurance and so are contaminated. As a result, using the Austrian market index as the benchmark can help provide a cleaner test of the effect of introducing a mandatory personal deductible in D&O insurance.

The treatment group has a mean (median) CAR of 3.83% (1.59%) compared to the mean (median) of 0.40% (-0.30%) for the control group, suggesting that the market reads the likely introduction of a mandatory personal deductible in D&O insurance for MB members positively. Both differences in the mean and median returns between the treatment group and control group are statistically significant at the 1% level.

Panel B reports the results from benchmarking raw returns against the corresponding Datastream industry return index for Austria as an alternative way of computing CAR. The inference is the same as what we report in Panel A: significantly higher (and positive) returns for treated firms compared to control firms.

In Panel C, we repeat the event study in Panel B using the unmatched control sample instead of size-matched control sample as a robustness check. The sample size in the treatment group is more than doubled once the matching constraint is removed. The mean (median) difference in the market reaction between treated firms and control firms is 2.34% (0.85%), which continues to be statistically significant at the 5% level or better. Therefore, no matter whether matched or unmatched control firms are used, treated firms – German firms affected by the law change – experience a positive and significant market reaction to the first announcement of the idea of imposing a mandatory personal deductible for executives in D&O insurance contracts. This provides the first evidence regarding the merit of this innovative policy initiative. In contrast to the prior evidence on the potential

unintended adverse incentive effects of full D&O insurance protection (e.g., Chen et al., 2016), introducing a personal deductible in D&O insurance appears to help mitigate agency problems and generate positive wealth effects for shareholders.

[Insert Table 2 here]

4.1.2. Multivariate analyses

We also perform a multivariate analysis to examine the robustness of the above univariate results. Specifically, we estimate the following OLS regression:

$$CAR_{it} = f\,(Treated_i,\ Control\ variables_{it\text{-}1},\ Industry\ fixed\text{-}effects) \tag{1}$$

In Eq. (1), CAR is the cumulative abnormal return for firm i over the [-2; +2] window (relative to day 0: April 23, 2009). We focus on size-matched samples, but also examine the robustness of our results to the use of many alternative control samples, alternative ways of calculating CAR, and alternative event windows. We control for firm size, leverage, and profitability in our regression models, and all of these variables are measured in the fiscal year ending immediately prior to the event date. Industry fixed-effects are also included to account for the potential difference in market reactions to the announcement of the possible introduction of a mandatory personal deductible among firms from different industries. The ordinary least square (OLS) results are reported in Table 3.

[Insert Table 3 here]

16

Column 1 of Table 3 reports results from the baseline CAR regression, where the dependent variable is the sum of industry-adjusted returns (using Datastream industry return indexes for Austrian firms as a benchmark) over the five days centered on the date of the first announcement of mandatory personal deductibles (April 23, 2009). Consistent with the results from the univariate comparison in Table 2, the indicator variable for the treatment group has a positive coefficient (4.14%) that is statistically significantly different from zero at the 1% level. The magnitude is economically large (but similar to the mean difference in industry-adjusted CAR reported in Panel B of Table 2), implying that treated firms have a five-day CAR that is 4.14% higher than that of the control firms. None of the coefficients on firm-level control variables are significant. This is not surprising since the balance of control variables reported in Panel B suggests that there is no statistically significant difference in size, leverage, or profitability between treated firms and control firms.[10]

In the next four columns (II, IIIa-IIIc), we examine the sensitivity of event study results to the use of alternative control groups and matching approaches. Only German control firms without D&O insurance are considered in model II. In model IIIa, we use all German firms without D&O insurance before the law change and Austrian firms as control firms (i.e., no matching is imposed) to maximize the sample size. In model IIIb and IIIc, we match by size and industry (using the Fama/French 12 industry classification in model IIIb and the Fama/French 38 industry classification in model IIIc). The coefficient on the *Treated* indicator is always statistically significantly greater than zero, suggesting that our regression results are robust to the choice of different control groups and matching

---

[10] The slightly smaller number of observation for the treated group is caused by the existence of several missing values on firm-level control variables.

procedures. In model IIIa, the coefficient of firm size is positive and statistically significant, consistent with the notion that large firms potentially benefit more than small firms if mandatory personal deductibles help strengthen the accountability of the members of the MB.

In columns IVa - IVc, we examine the sensitivity of our results to different choices of benchmark stock returns in calculating CAR. Specifically, model IVa uses the cumulative five-day raw (instead of abnormal) return as the dependent variable. In model IVb, the dependent variable is industry-adjusted return with US firms in the same industry as benchmarks; in model IVc, the dependent variable is industry-adjusted return with firms from countries neighboring Germany (i.e., Austria, Belgium, the Czech Republic, Denmark, France, Luxembourg, the Netherlands, Poland, and Switzerland) in the same industry as benchmarks. These alternative dependent variables make little difference to the coefficient estimate and statistical significance of the *Treated* indicator variable.

The final four columns in Table 3 report robustness checks with alternative event windows. The event windows is [-1; +1] and [-1; +2] in model Va and Vb, respectively. The *Treated* indicator variable continues to load positively albeit being smaller in the window [-1; +1]. We also conduct two placebo tests in models VIa and VIb. The event windows for those event studies are [-5; -3] and [+3; +5]: in other words, three-day windows shortly before and after our key announcement date but not spanning day 0. As expected, there is no significant difference in CAR between the treatment group and control group in these placebo tests.

Taken together, we find robust evidence that increasing D&Os' legal liability by introducing a mandatory personal deductible in D&O insurance is positively perceived by the market, consistent with the notion that the presence of personal deductibles enables D&Os to have skin in the game and increases firm value, potentially by incentivizing D&Os to act more responsibly in corporate decision making.

4.2. The effect of mandatory personal deductibles on long-term firm value

Thus far, the results from the short-term event study provide evidence supporting the merits of imposing a mandatory personal deductible in D&O insurance. However, it is unclear whether the benefit is short-lived or not. We therefore examine the effect of mandatory personal deductibles on long-term firm value in this section. We measure firm value by Tobin's Q. The analysis spans the period from 2005 to 2013 (i.e., from fours year before the 2009 law change to four years after the law change), but excluding 2009 (in which the law regarding mandatory personal deductibles was passed).

4.2.1. Graphical analyses

Before we conduct regression analyses, we perform a visual inspection of the changes in Tobin's Q. Figure 1 plots average Tobin's Q for the treated firms and size-matched control firms separately. As can be seen, in 2008 (the year before the event year), the average Tobin's Q of the treatment and control groups are very similar; in 2009 (the event year), average Q of the treatment group starts to rise and exceed that of the control group, and the difference further widens over the next three years. These patterns suggest that mandating personal deductibles in D&O insurance seems to have increased the Tobin's Q of the treated firms relative to control firms.

4.2.2. Baseline regression analyses

19

We estimate the following baseline DiD regression model:

$Ln(Tobin's\ Q_{it}) = f\ (Treated_i \times Post_t,\ Control\ variables_{it-1},\ Firm\ fixed\text{-}effects,\ Year\ fixed\text{-}effects)$ *(2)*

In Eq. (2), the dependent variable is the natural logarithm of Tobin's Q for firm *i* in year *t*. The key independent variable of interest is *Treated × Post*. If changing the law to mandate personal deductibles in D&O insurance leads D&Os to act more responsibly and thereby improve the firm value of the treated firms relative to control firms, we predict that the interaction term will have a positive and statistically significant coefficient.[11] Control variables include lagged firm size (natural logarithm of total assets), lagged firm leverage, and lagged profitability (EBIT/assets). Please refer to the Appendix for detailed definitions of these variables. Robust standard errors are clustered at the firm level to account for within-firm autocorrelations. The regression results are reported in Table 4. The regressions are performed on the treated firms and their one-to-one size-matched control firms. As can be seen from the reported balance check in Panel B of Table 4, treated firms and control firms are similar in firm size, leverage and profitability, suggesting that treated firms and control firms are comparable before the passage of the law.

.

[Insert Table 4 here]

In model I of Panel A of Table 4, we present results without firm-level control variables. The coefficient on the *Treated × Post* interaction term is 0.14 and statistically significant at the 5% level, suggesting that treated firms experience an improvement in Tobin's Q by 14% relative to control firms after the passage of the 2009 law regarding mandatory personal deductibles. Adding firm-level control variables on the stepwise basis

---

[11] Note that the *Treated* indicator variable itself is absorbed by the firm fixed-effects in the model. The same is true for the *Post* indicator variable itself: it is absorbed by the year fixed-effects in the model.

in models II and III does not materially affect the magnitude and significance of the interaction term *Treated × Post*. In addition, smaller firms appear to have higher Tobin's Q than their larger counterparts. In model IV, we further include the interactions between *Post* and each of the firm control variables to see whether our result is robust to controlling for the potential changes in the effects of firm-level control variables on Tobin's Q following the law change. The magnitude (0.13) and significance of *Treated × Post* remain similar.

Overall, we find that the value of treated firms improves by about 13% (as shown in model IV) relative to that of control firms after the law change, suggesting that improved D&O personal liability and accountability appears to have a lasting positive effect on shareholder wealth.

4.2.3. Robustness of the results on long-term valuation
4.2.3.1. Alternative years of analysis and dynamic DiD analysis

Exclusion of the 2008 financial crisis period We previously examine the change in firm value over the four years before the law change and four years after the law change (i.e., 2005-2013, excluding the law passage year 2009), and this period of analysis includes some years affected by the 2008 financial crisis. One may argue that firms have a lower valuation in the crisis period and a higher valuation after the crisis period, and our observed improvement in firm value may reflect this crisis effect. We note that our DiD estimation should have largely captured any such trend in valuation, thereby protecting us from the inference issue. Nevertheless, as a robustness check we directly exclude 2008 and 2010 from the analysis (2009 is already excluded, since that is the year in which the law is passed) and the results are reported in model I of Table 5. Here, we find an even larger effect of 16% improvement in the valuation of treated firms relative to that of control firms, suggesting that our prior result is not an artifact of the effect of the financial crisis.

[Insert Table 5 here]

Alternative windows around the law change   As discussed, our previous analysis uses four years around the law change. In this section, we use an alternative two-year window and three-year window around the law change as a robustness check. As the results reported in models IIa and IIb of Table 5 show, the inference on *Treated x Post* is qualitatively similar.

Dynamic DiD analysis   Thus far, we find that treated firms exhibit an improvement in Tobin's Q relative to control firms after the law passage. The validity of a DiD estimation, however, relies on the lack of a similar trend before the law change event. Our graphical analyses in Figure 1 suggest that this assumption appears to be satisfied: treated and control firms have very similar Tobin's Q's prior to the law change in 2009. To formally verify the lack of a similar pre-event trend, we conduct a dynamic DiD analysis. To be specific, we replace the *Post* indicator variable in the model with five indicator variables: *Before*$^{-2}$ equals one for 2007, *Before*$^{-1}$ equals one for 2008, *After*^{1} equals one for 2010, *After*^{2} equals one for year 2011, and *After*$^{3+}$ equals one for years after 2011, and zero for otherwise (as before, the event year of 2009 and is excluded from the analysis). The omitted group corresponds to years before 2007. The coefficients on *Treated* $\times$ *Before*$^{-1}$ and *Treated* $\times$ *Before*$^{-2}$ allow us to verify the existence of a pre-event trend. The result from the dynamic analysis is reported in model III of Table 5. As the table shows, neither the coefficient of *Treated* $\times$ *Before*$^{-2}$ nor that of *Treated* $\times$ *Before*$^{-1}$ is statistically significant, suggesting that there is no similar trend in the difference in the average Tobin's Q between the treated and control firms before the event, which corroborates our graphical analysis. In fact, the significant improvement in Tobin's Q of treated firms vis-à-vis control firms only starts to show up in year 2 (or later) after the passage of the new law, confirming that the change in firm value of treated firms is causal.

4.2.3.2. Robustness to alternative samples of control firms and alternative matching

Our analyses so far are based on a control group of size-matched German firms without D&O insurance in the year before the passage of the law and Austrian firms. In this subsection, we examine the sensitivity of our results on long-term firm valuation to the use of alternative samples of control firms and alternative matching approaches. The results are reported in Table 6.

We only use size-matched German firms without D&O insurance in the year before the law change in model Ia in Table 6, and only use size-matched Austrian firms as the sample of control firms in model Ib. The results reported in models Ia and Ib show that the coefficient on *Treated × Post* remains statistically significant with a similar point estimate to that in Table 4. In model Ic, only German firms that are located in Lower Bavaria, Swabia, or Upper Bavaria (i.e., those regions that have a common border with Austria) are considered as treated firms. The sample is smaller, and the coefficient on *Treated × Post* remains statistically significant.

As discussed, treatment firms outnumber control firms in most of our analyses. To see whether this data limitation impacts our inference, in model II we use size-matched firms located in the neighboring countries of Denmark, Poland, Czech Republic, Switzerland, Luxembourg, France, Belgium, and the Netherlands as control firms. While the sample becomes more than four times larger, the coefficient on *Treated × Post* remains statistically significant and the point estimate trends larger.

In Panel B of Table 6, we check the robustness of our results to different matching methods. Model III reports the results of the regression using all German firms without D&O insurance before the law change and Austrian firms as control firms (i.e., no matching is imposed) to maximize the sample size. We match each treated firm with a control firm drawn from German firms without D&O insurance and Austrian firms by size and Fama/French 12 industry in model IVa, and by size and Fama/French 30 industry in model IVb. In model V, only firms that have data in each year in the four-year window

around the law passage are used in matching. These alternative choices have little effect on the sign and significance of the coefficient of *Treated × Post*.

Taken together, our analysis of the change in long-term firm value suggests that mandating a personal deductible in D&O insurance appears to have improved the Tobin's Q of the treated firms in comparison with control firms. The result is consistent with the notion that increasing D&Os' personal legal liability may lead them to act more responsibly and stay more vigilant in decision-making because they may need to share in part of the loss personally if things later go wrong.

[Insert Table 6 here]

4.2.3.3. Confounding events

As we discuss in detail in Section 2, the VorstAG passed in 2009 also lengthens the minimum vesting period of option-like compensation from 2 years to 4 years. To the extent that lengthened vesting period of option-like compensation provides D&O more incentives to pursue long-term value and our treatment firms (firms with D&O insurance before the law change) are more likely to adopt option-based incentive compensation, we may also observe improved firm value in the treatment firms relative control firms following the law change. We rule out this alternative interpretation by excluding firms that use stock or option based compensation from the size-matched sample and repeating the analysis of changes in Tobin's Q. We hand collect such information from firms' annual reports. The results are reported in Table 7. The sample size drops by about one third relative to that in Table 4. The first two columns drop firm-years that reward D&Os with stock options and the last two columns drop firm-years that reward D&Os with any compensation with option-like features. Clearly, the magnitude and significance of *Treated × Post* are comparable to those in Table 4. Therefore, it is unlikely that the extended vesting period of stock options drives our finding of improved firm valuation following the 2009 law change.

[Insert Table 7 here]

4.2.3.4. Is improved firm valuation a result of higher executive compensation?

One may argue that facing higher personal legal liability following the 2009 law change, D&Os may demand their firms to pay them a higher compensation and this higher compensation may help boost the morale of D&Os and lead to higher firm valuation in treated firms. To see whether this is borne out in our data, we run DiD analyses to examine the change in compensation around the law change. The results are presented in Table 8. Model Ia and IIb use the board's total compensation (logged) as the dependent variable, and Model IIa and IIb use average total compensation per board member (logged) as the dependent variable. The sample is limited to size-matched German firms. We observe no significant change in executive compensation in the treated firms relative to size-matched control firms around the law change. The evidence therefore is not consistent with the argument that higher compensation in response to higher liability explains our results.

4.3. Channel analyses

4.3.1. Change in the cost of capital

Finally, we explore the possible channels through which higher personal legal liability of D&Os arising from the mandatory personal deductible in D&O insurance improves firm value. On the one hand, a higher firm value may be a result of a lower cost of capital. Specifically, forcing D&Os to have "skin in the game" helps align the interests of D&Os and shareholders and mitigate various agency problems. Shareholders may therefore *perceive* that investing in the company becomes less risky, and are willing to lower the required rate of return on their investment after the law change. Note that this reasoning only requires a change in shareholders' ex-ante perception of the risk. To

ascertain whether this is the case, we examine the change in firms' cost of capital. We estimate the following regression model:

Cost of equity$_{it}$ = f (Treated$_i$ × Post$_t$, Control variables$_{it-1}$, Firm fixed-effects, Year fixed-effects)   *(3)*

In Eq. (3), the dependent variable is the implied cost of equity for firm *i* in year *t*. We take the natural logarithm of the cost of equity so that we can interpret the regression coefficients to be percentage changes. Since there is no single universally accepted measure of expected cost of equity, we follow the recent literature (e.g., Hail and Leuz, 2009; Chen et al., 2016; Kaserer, Fischer and Bielstein, 2016) and use the average of four measures of the implied cost of equity in order to have a robust test of the effects of the introduction of mandatory personal deductibles on firms' cost of equity.[12] In principle, these four cost of equity measures are solved from a stock valuation model using residual income (or its variants) in which the firm's stock price is on the left hand side and forecasted residual income (or its variants) based on analysts' earnings forecasts and long-term growth rates are discounted at the implied cost of equity on the right hand side. Please refer to Hail and Leuz (2009) for estimation details. Because estimation of the implied cost of capital requires the availability of analyst earnings forecast data, we end up with a smaller sample of treated firms and their size-matched control firms for the analysis. The period of analysis is from 2005 to 2013 as previous.

The key independent variable of interest is *Treated × Post*. If mandating personal deductibles in D&O insurance by the law leads D&Os to act more responsibly, the coefficient on this interaction term should be negative and statistically significant. We also control for lagged firm size, leverage, and profitability in the model. Robust standard errors

---

[12] Realized returns may not be a good proxy for the cost of equity because they are affected by shocks in expected cash flows and discount rates (Elton, 1999).

are clustered at the firm level to account for within-firm autocorrelations in the regressions. The regression results are reported in Panel A of Table 9.

[Insert Table 9 here]

We only include the *Treated × Post* interaction term in model Ia, and add firm-level control variables in models IIa-IIIa on the stepwise basis. The regression coefficient on *Treated × Post* is always negative and statistically significant at the 5% level or better. Using the point estimate reported in model IIIa, treated firms appear to have experienced a decrease in the cost of equity by 12% relative to control firms after the passage of the 2009 law. Therefore, the decrease in the cost of equity capital is not only statistically significant but also economically sizable. This magnitude also suggests that most of the changes in firm valuation seem to come from the change in the discount rate. This result is also consistent with the argument that requiring D&Os to have "skin in the game" results in lower risk for shareholders ex ante, which leads shareholders to accept a lower expected rate of return.

In model IVa, we further include the interaction between *Post* and each of the firm-level control variables to see whether our result is robust to controlling for the potential changes in the effects of firm-level control variables on the cost of equity following the law change. The coefficient on *Treated × Post* remains similar.

The results on control variables are intuitive: firms with low leverage and profitable firms have a lower cost of equity than other firms. Large firms also appear to have a lower cost of equity than small firms, although the coefficient on firm size is not significant.

4.3.2. Change in cash flows

We also use following model to examine the change in a firm's cash flows following the 2009 law change:

27

Cash flows$_{it}$ = f (Treated$_i$ × Post$_t$, Control variables$_{it-1}$, Firm fixed-effects, Year fixed-effects)   *(4)*

In Eq. (4), the dependent variable is the cash flows for firm *i* in year *t*, proxied by earnings before interest, tax, depreciation, and amortization (EBITDA) scaled by year-beginning total assets. If D&Os act more responsibly and vigilantly after having "skin in the game", they likely make better business decisions that eventually result in improved cash flows of the firm. The results are reported in Panel B of Table 9.

In Column (1), we include no control variables, and the coefficient of *Treated × Post* is positive but insignificant. As we add in firm-level controls on the stepwise basis, its coefficient becomes larger and statistically significant in model IIIb and IVb. The point estimate in model IIIb suggests cash flows of the treated firms increase by 2.8% relative to control firms after the 2009 law change. The economic magnitude (about 3%), however, is modest. It is plausible that unlike the change in the cost of equity that is based on expectation and can be instant, observing a significant change in ex-post cash flows needs a longer window as it takes time for investment projects to be completed and start to generate a return. In this vein, our four-year window post the law change may have limited power in ascertaining the cash flow effect.

To summarize, in this section we find that following the 2009 law change that mandates a personal deductible in D&O insurance, treated firms experience a significant decrease in the cost of equity and a modest increase in cash flows relative to their size-matched control firms. These results provide further evidence on the merit of German government's innovative policy initiative that introduces a mandatory personal deductible in D&O insurance. It also helps explain the observed increase in short-term and long-term value of treated firms.

4.4. Changes in firms' risk-taking

After showing that mandating personal deductibles in D&O insurance generates positive short-term and long-term wealth effects, and a reduction in the cost of equity for firms directly affected by the law change, we next examine whether mandating a personal deductible in D&O insurance results in changes in firms' risk-taking. If a mandatory personal deductible leads D&Os to act more responsibly after the law change, and firms on average engage in excessive risk-taking before the 2009 law change, we expect to see some reduced risk-taking after the 2009 law change. We estimate the following regression model to detect the change in firms' risk-taking:

Risk-taking variable$_{it}$ = f (Treated$_i$ × Post$_t$, Control variables$_{it-1}$, Firm fixed-effects, Year fixed-effects) *(5)*

In Eq. (5), the dependent variable is a proxy for risk-taking for firm i in year t. The key independent variable of interest is *Treated × Post*. If mandating a personal deductible in D&O insurance leads D&Os to refrain from taking excessive risk, the interaction term should have a negative and statistically significant coefficient. We control for lagged firm size, leverage, and profitability in the model. We focus on treated firms and size-matched control firms for the period 2005-2013. The regression results are reported in Table 10.

[Insert Table 10 here]

Panel A of Table 10 shows the results from measuring risk as *total* stock return volatility based on weekly stock return in a year (see the Appendix for detailed definitions). We include no firm-level control variables in model I, and add in firm-level control variables on a stepwise basis in model II and model III. The regression coefficient on *Treated × Post* is negative and statistically significant at the 5% level in all these models, suggesting that treated firms experience a decrease in total risk relative to control firms

after the passage of the law regarding mandatory personal deductibles. The point estimate (-0.08) in model III represents a reduction in firm risk about 20% of the sample mean risk level. In terms of the control variables, large firms and firms with low leverage tend to have a lower level of total risk than other firms, as expected.

In model IV, we further include the interaction between *Post* and each of the firm-level control variables to see whether our result is robust to controlling for the potential changes in the effects of firm-level control variables on the cost of equity following the 2009 law change. The result on *Treated × Post* remains similar.

In Panel B of Table 10, we report results of regressions where the dependent variable is *idiosyncratic* risk. The models in this panel run parallel to those in Panel A. The regression coefficient on *Treated × Post* is negative and statistically significant in all columns.[13] Merton (1987) theorizes that when there is incomplete information, idiosyncratic risk is priced by investors. Consistent with this view, prior studies (e.g., Chen et al., 2016) find that idiosyncratic risk is positively related to firms' cost of equity. Therefore, our finding of a decline in the total and idiosyncratic risk of treated firms corroborates our previous observed decline in the cost of equity capital for these firms after the 2009 law change. It is worth noting that this reduced risk-taking is also inconsistent with the argument that lengthened vesting period of option-like incentive compensation facilitates risk taking and thereby increase firm value after the 2009 law change. That is, our finding of a higher firm value post the law change is unlikely attributable to the new requirement on the minimum vesting period of option-like incentive compensation.

Taken together, these results suggest that mandatory personal deductibles appear to alter firms' risk-taking: treated firms' risk decreases after the law change, plausibly because D&Os become more cautious and responsible in taking risk once they have "skin in the game." While risk-neutral shareholders would like firms to take an optimal amount of risk, our previous results show that the reduced risk-taking does not appear to be

---

[13] We also tried firms' systematic risk as a risk-taking measure, and found that while treated firms' systematic risk is lower relative to control firms following the law change, the change is not statistically significant.

detrimental to shareholders. Perhaps, treated firms whose D&Os are well protected by the coverage of D&O insurance before the 2009 law change have taken an excessive amount of risk, and the law change helps restore the level of risk-taking to the optimum.

5. Conclusion

Most companies in developed countries routinely purchase D&O insurance to protect their D&Os, and these contracts typically contain no personal deductible. There is a longstanding debate about the costs and benefits of D&O insurance for shareholders. Against this backdrop, we examine an important question not studied in the literature - whether the inclusion of a personal deductible in D&O insurance contract is beneficial for shareholders or not.

Exploiting a 2009 law change in Germany that aims to strengthen D&Os' accountability and responsibility via imposing a mandatory personal deductibles in D&O insurance as a natural experiment, we find that market reactions to firms affected by the law change are positive relative to various control firms around the time when the idea of mandating a personal deductible was first revealed, implying that shareholders consider a mandatory personal deductible a positive development. Extending the analysis beyond short-term market reactions, we find strong evidence that treated firms experience a significant improvement in Tobin's Q and a large decrease in the cost of equity. There is also some weak evidence of an increase in cash flows after the law change. Moreover, we observe that firms affected by the law change appear to reduce risk-taking. Taken together, these results suggest that forcing D&Os to have "skin in the game" via deductibles in D&O insurance is a game changer, and the change appears beneficial to shareholders.

Our study makes an important contribution to the longstanding debate about whether directors and officers should bear personal legal liability, and the debate on the pros and cons of D&O insurance that shields D&Os from bearing personal legal liabilities when they breach their fiduciary duties. In addition, the German approach to addressing the

corporate governance and risk management failures in the aftermath of the 2008 financial crisis by imposing a personal deductible in D&O insurance is novel. Our results suggest that this policy initiative appears beneficial to shareholders. Therefore, the German approach may have important policy implications for regulators in other countries. For example, one normative implication of our results is that including a personal deductible is likely to be a key step towards a better design of the prevalent D&O insurance contracts.

References

Baker, T., Griffith, S.J., 2010. Ensuring corporate misconduct: how liability insurance undermines shareholder litigation. University of Chicago Press.

Bhagat, S., Brickley, J.A., Coles, J.L., 1987. Managerial indemnification and liability insurance: The effect on shareholder wealth. Journal of Risk and Insurance, 721-736.

Brook, Y., Rao, R.K., 1994. Shareholder wealth effects of directors' liability limitation provisions. Journal of Financial and Quantitative Analysis 29, 481-497.

Chalmers, J.M., Dann, L.Y., Harford, J., 2002. Managerial opportunism? Evidence from directors' and officers' insurance purchases. Journal of Finance 57, 609-636.

Chen, Z., Li, O.Z., Zou, H., 2016. Directors′ and officers′ liability insurance and the cost of equity. Journal of Accounting and Economics 61, 100-120.

Core, J.E., 1997. On the corporate demand for directors' and officers' insurance. Journal of Risk and Insurance, 63-87.

Elton, J., 1999. Expected return, realized return, and asset pricing test. Journal of Finance 54, 1199–1220.

Hail, L., Leuz, C., 2009. Cost of capital effects and changes in growth expectations around U.S. cross-listings. Journal of Financial Economics 93, 428-454.

Kaserer, C., Fischer, M., Bielstein, P., 2016. Two sides of the same coin: Disentangling the coinsurance effect and the diversification discount in M&A transactions, Working paper.

LaCroix, K., 2009. New German statutory D&O insurance requirement. The D&O Diary. July 6, 2009.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R., 2000. Investor protection and corporate governance. Journal of financial economics 58, 3-27.

Lin, C., Officer, M.S., Zou, H., 2011. Directors' and officers' liability insurance and acquisition outcomes. Journal of Financial Economics 102, 507-525.

Lin, C., Officer, M.S., Wang, R., Zou, H., 2013. Directors' and officers' liability insurance and loan spreads. Journal of Financial Economics 110, 37-60.

Mayers, D., Smith, C.W., 1982. On the corporate demand for insurance. Journal of Business 55, 281-296.

Mayers, D., Smith, C.W., 1990. On the corporate demand for insurance: Evidence from the reinsurance market. Journal of Business, 19-40.

Menzies, A., Kammerer-Galahn, G., 2009. D&O insurance in Germany – The new legislation arrives. Mondaq News. (http://www.mondaq.com)

Merton, R.C., 1987. A simple model of capital market equilibrium with incomplete information. Journal of Finance 42, 483-510.

Schultz, W., 2010. Directors and officers liability insurance under new German rules - The right way to tackle the problem? January 20, 2010, GCCapitalIdeas.com.

Shleifer, A., Vishny, R.W. 1997. A survey of corporate governance. Journal of Finance 52, 737-783.

Smith, C.W., Stulz, R.M., 1985. The determinants of firms' hedging policies. Journal of financial and quantitative analysis 20, 391-405.
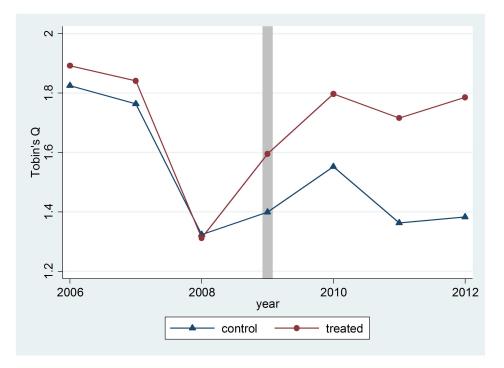
Figure 1: This figure shows the average Tobin's Q around the law change in 2009. Treated firms are German firms with D&O insurance before the law change; control firms are German firms without D&O insurance and Austrian firms. Treated and control firms are matched based on their size. Only firms with at least eight firm-year observations are considered.

'

Table 1: Descriptive statistics

Variable	N	Mean	SD	p25	p50	p75
Treated	1457	0.50	0.50	0.00	1.00	1.00
Tobin's Q	1441	1.65	1.24	1.04	1.28	1.69
Size (mio Euro)	1457	2129	12497	51	212	636
Leverage	1421	0.31	0.24	0.07	0.30	0.48
Profitability	1437	0.06	0.13	0.02	0.07	0.11
ICC	754	0.12	0.04	0.09	0.11	0.14
EBITDA	1426	0.10	0.14	0.06	0.11	0.16
σ_t^{total}	1077	0.39	0.18	0.27	0.36	0.48
$\sigma_t^{idiosyncratic}$	1077	0.36	0.17	0.24	0.32	0.43

This table presents the number of observations (N), mean, standard deviation (SD), 25% percentile, median, and 75% percentile for the major variables used in the analyses. A detailed description of all variables can be found in Appendix A.

Table 2: Short-term valuation: announcement [-2;+2]

Panel A: Cumulative abnormal returns (CAR)

	All	Treated	Controls	Difference
Mean	2.12***	3.83***	0.40	3.43***
	(3.89)	(4.68)	(0.80)	(3.49)
Median	0.57***	1.59***	-0.30	1.89***
	(3.17)	(4.29)	(-0.18)	(3.48)
Observations	238	119	119	

Panel B: Industry-adjusted CAR

	All	Treated	Controls	Difference
Mean	2.56***	4.61***	0.52	4.10***
	(4.79)	(5.44)	(0.86)	(3.94)
Median	1.38***	2.55***	0.29	2.26***
	(4.45)	(5.08)	(0.92)	(3.64)
Observations	238	119	119	

Panel C: Unmatched sample (Industry-adj. CAR)

	All	Treated	Controls	Difference
Mean	2.11***	2.85***	0.52	2.34***
	(5.00)	(5.22)	(0.86)	(2.60)
Median	0.96***	1.14***	0.29	0.85**
	(4.49)	(4.74)	(0.92)	(2.23)
Observations	375	256	119	

Cumulative abnormal returns (CAR) in Panel A are the sum of announcement returns over the five days surrounding the date of the first announcement of the mandatory deductible (April 23, 2009) minus the corresponding Datastream (DS) return index for Austria. Industry-adjusted CARs in Panel B are adjusted for industry effects using the corresponding DS industry return index for Austria. The sample consists of an equal number of size-matched treated and control firms (based on 1-to-1 nearest neighbor matching without replacement). In Panel C, all observations are considered. Signed rank tests are used to test whether the median is different from zero. Differences in medians are based on two-sample Wilcoxon rank-sum (Mann-Whitney) tests. A detailed description of all variables can be found in Appendix A.

Table 3: Short-term valuation: regressions

Panel A: Industry-adjusted CAR

Model	I	II	IIIa	IIIb	IIIc	IVa	IVb	IVc	Va	Vb	VIa	VIb
	main	sample		matching			industry-adjustment			window	placebo	
	ind-adj ret.	only GER	none	12 ind.	30 ind.	raw	U.S.	neighbors	[-1;+1]	[-1;+2]	[-5;-3]	[+3;+5]
Treated	**4.14*****	**2.97****	**2.63****	**2.27***	**2.68****	**3.67*****	**3.48****	**3.71*****	**2.17***	**3.17****	**-1.07**	**0.11**
	(3.02)	**(2.26)**	**(2.49)**	**(1.94)**	**(2.05)**	**(2.73)**	**(2.54)**	**(2.75)**	**(1.90)**	**(2.52)**	**(-1.02)**	**(0.12)**
Size	0.065	0.069	0.48**	0.45	0.43	0.094	-0.25	0.12	0.45*	0.16	0.060	-0.16
	(0.24)	(0.21)	(2.28)	(1.53)	(1.43)	(0.35)	(-0.91)	(0.47)	(1.85)	(0.65)	(0.27)	(-0.70)
Leverage	4.01	5.29	3.04	0.84	4.32	3.99	3.58	4.40*	2.96	3.57	1.01	-1.19
	(1.49)	(1.55)	(1.56)	(0.33)	(1.65)	(1.58)	(1.31)	(1.74)	(1.42)	(1.55)	(0.37)	(-0.57)
Profitability	-2.69	-2.67	-1.08	-3.21	2.81	-1.03	-0.88	-2.05	-5.21	-5.01	-4.51	-1.17
	(-0.64)	(-0.56)	(-0.35)	(-0.72)	(0.55)	(-0.25)	(-0.21)	(-0.49)	(-1.01)	(-1.06)	(-0.97)	(-0.46)
Observations	222	174	350	221	221	222	222	222	222	222	222	222
adj R2	0.12	0.11	0.071	0.033	0.087	0.057	0.090	0.053	0.072	0.12	0.040	0.15
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

Panel B: Balancing of covariates

	obs.	size	leverage	profit.
Treated	108	12.89	0.29	0.06
Controls	114	12.70	0.34	0.04
t-value		0.62	-1.54	1.18

In the base specification of Panel A, the dependent variable is the sum of industry-adjusted returns (%) using Datastream industry return index for Austria as benchmark over the five days surrounding the date of the first announcement of the mandatory deductible on April 23, 2009. The sample consists of an equal number of size-matched treated and control firms (based on 1-to-1 nearest neighbor matching without replacement). Only German firms without D&O insurance are included as controls in Model II. In Model IIIa, all observations are considered (no matching). The matching is based on size and industry (Fama/French 12 or 30 industries classification) in Models IIIb and IIIc. Unadjusted returns are analyzed in model IVa. Industry-adjusted returns are calculated using U.S. firms or countries neighboring Germany (i.e., Austria, Belgium, the Czech Republic, Denmark, France, Luxembourg, the Netherlands, Poland, and Switzerland) in Models IVb and IVc. The estimation windows are [-1;1] and [-1;2] in Models Va and Vb. Placebo testes based on [-5;-3] and [3;5] windows are reported in Models VIa and VIb. Panel B shows the balancing of the covariates between treated and control firms. A detailed description of all variables can be found in Appendix A.

Table 4: Long-term valuation

Panel A: Tobin's Q

Model	I	II	III	IV
Treated x Post	**0.14****	**0.16*****	**0.13*****	**0.13*****
	(2.58)	**(3.09)**	**(3.03)**	**(3.25)**
Size		-0.22***	-0.18***	-0.18***
		(-5.13)	(-4.54)	(-4.50)
Leverage			0.090	0.22**
			(0.94)	(2.10)
Profitability			0.20	0.11
			(1.26)	(0.51)
Observations	1,277	1,271	1,224	1,224
adj R2	0.16	0.24	0.24	0.26
Year FE	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes
Controls x post	no	no	no	yes

Panel B: Balancing of covariates

	obs.	size	leverage	profit.
Treated	639	12.36	0.35	0.05
Controls	638	12.28	0.30	0.04
t-value		0.25	1.14	0.42

The dependent variable is ln(TOBIN'S Q) in Panel A. The year 2009 in which the law was passed is excluded. The estimation window is plus/minus four years (i.e., 2005 to 2008 and 2010 to 2013). Treated equals one for German firms with D&O insurance and zero otherwise. Post equals one after 2009 and zero before. Only firms with at least three pre- and post-event observations are considered. The sample consists of an equal number of size-matched treated and control firms (based on 1-to-1 nearest neighbor matching without replacement). Control variables are lagged by one year. Controls x post means that the control variables are interacted with the post dummy to allow for different effects of the co-variates in the pre- and post-event period. Models are firm fixed effects regressions. T-statistics based on Huber/White robust standard errors clustered by firms are presented in parentheses. ***, ** and * indicate significance on the 1%-, 5%- and 10%-levels, respectively. Panel B shows the balancing of the covariates between treated and control firms for Model IIa in the pre-event year. The t-value refers to the statistical significance of mean values between treated and control observations. A detailed description of all variables can be found in Appendix A.

Table 5: Long-term valuation: time dynamics

Model	I	IIa	IIb	III
	w/o FC	2y window	3y window	dynamics
Treated x Post	**0.16****	**0.095***	**0.12****	
	(2.49)	**(1.91)**	**(2.33)**	
Treated x Before^{-2}				0.025
				(0.55)
Treated x Before^{-1}				0.0063
				(0.12)
Treated x After^{1}				**0.088**
				(1.35)
Treated x After^{2}				**0.14****
				(1.98)
Treated x After^{3+}				**0.19*****
				(2.68)
Observations	950	653	978	1,277
adj R2	0.082	0.23	0.18	0.16
Year FE	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes

The dependent variable is ln(TOBIN'S Q). If not noted otherwise, the model specification equals Model IIa, Table 4. Years which are related to the financial crisis (i.e., 2008, 2009, and 2010) are not considered in model Ia. The estimation windows are two and three years in Models IIa and IIb, respectively. In Model III, Before^{-2} equals one for 2007, Before^{-1} equals one for 2008, After^{1} equals one for 2010, After^{2} equals one for 2011, and After^{3+} equals one for years after 2011. T-statistics based on Huber/White robust standard errors clustered by firms are presented in parentheses. ***, ** and * indicate significance on the 1%-, 5%- and 10%-levels, respectively. A detailed description of all variables can be found in Appendix A.

Table 6: Long-term valuation: sample and matching

Panel A: Alternative control samples				
Model	Ia only GER	Ib only AUT	Ic only border	II 10 countries
Treated x Post	**0.14***	**0.14****	**0.16***	**0.20*****
	(1.85)	**(2.38)**	**(1.77)**	**(6.27)**
Observations	950	966	499	4,231
adj R2	0.13	0.17	0.20	0.20
Year FE	yes	yes	yes	yes
Industry FE	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes
Panel B: Alternative matching approaches				
Model	III full sample	IVa 12 ind.	IVb 30 ind.	V balanced
Treated x Post	**0.098****	**0.14****	**0.13****	**0.13****
	(2.19)	**(2.44)**	**(2.05)**	**(2.25)**
Observations	2,698	1,273	1,279	1,040
adj R2	0.16	0.14	0.13	0.16
Year FE	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes

The dependent variable is ln(TOBIN'S Q). If not noted otherwise, the model specification equals Model I, Table 4. Only German firms without D&O insurance are considered as controls in Model Ia. In Model Ib, only Austrian firms are considered as controls. In Model Ic, German firms are only considered if they are located in Lower Bavaria, Swabia, or Upper Bavaria (i.e., those regions that have a common border with Austria). Firms located in the neighboring countries Denmark, Poland, Czech Republic, Switzerland, Luxembourg, France, Belgium, and the Netherlands are used as possible controls for the size matching in Model II. The full sample without matching is used in Model III. The matching is based on size and industry (Fama/French 12 or 30 industries classification) in Models IVa and IVb, respectively. Only firms for which observations are available for all relevant firm-years are considered for the matching in Model V (balanced sample). T-statistics based on Huber/White robust standard errors clustered by firms are presented in parentheses. ***, ** and * indicate significance on the 1%-, 5%- and 10%-levels, respectively. A detailed description of all variables can be found in Appendix A.

Table 7: Long-term valuation: confounding event

Model	Ia	Ib	IIa	IIb
Exclude firms with:	option-based compensation		any stock-based comp.	
Treated x Post	**0.13****	**0.12****	**0.15****	**0.12****
	(2.00)	**(2.21)**	**(2.15)**	**(2.17)**
Size		-0.13***		-0.15***
		(-2.95)		(-2.97)
Leverage		0.056		0.070
		(0.43)		(0.49)
Profitability		0.41**		0.44**
		(2.07)		(2.05)
Observations	924	881	841	800
adj R2	0.15	0.23	0.14	0.23
Year FE	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes

The dependent variable is ln(TOBIN'S Q). The year 2009 in which the law was passed is excluded. The estimation window is plus/minus four years (i.e., 2005 to 2008 and 2010 to 2013). Treated equals one for German firms with D&O insurance and zero otherwise. Post equals one after 2009 and zero before. Only firms with at least three pre- and post-event observations are considered. The base sample for the tests consists of an equal number of size-matched treated and control firms (based on 1-to-1 nearest neighbor matching without replacement). Control variables are lagged by one year. In Model I, German firms with option-based compensation for executives in 2008 are excluded. We exclude German firms with any type of stock/option based compensation (i.e., any compensation schemes which use the firm's stock price as performance indicator) in Model II. Models are firm fixed effects regressions. T-statistics based on Huber/White robust standard errors clustered by firms are presented in parentheses. ***, ** and * indicate significance on the 1%-, 5%- and 10%-levels, respectively. A detailed description of all variables can be found in Appendix A.

Table 8: Executive compensation and personal liability

Model	Ia	Ib	IIa	IIb
	ln(board compensation)		ln(comp per executive)	
Treated x Post	**0.031**	**-0.028**	**-0.0065**	**-0.044**
	(0.34)	**(-0.34)**	**(-0.070)**	**(-0.49)**
Size		0.34***		0.27***
		(5.40)		(3.63)
Leverage		0.0078		0.096
		(0.062)		(0.71)
Profitability		0.30*		0.29*
		(1.96)		(1.71)
Observations	856	823	756	734
adj R2	0.061	0.15	0.12	0.16
Year FE	yes	yes	yes	yes
Firm FE	yes	yes	yes	yes

The dependent variable is the natural logarithm of the compensation of the whole management board in Model I and the average compensation per executive in Model II. Only German firms are considered for this test. The year 2009 in which the law was passed is excluded. The estimation window is plus/minus four years (i.e., 2005 to 2008 and 2010 to 2013). Treated equals one for German firms with D&O insurance and zero otherwise. Post equals one after 2009 and zero before. Only firms with at least three pre- and post-event observations are considered. The sample consists of an equal number of size-matched treated and control firms (based on 1-to-1 nearest neighbor matching without replacement). Control variables are lagged by one year. Models are firm fixed effects regressions. T-statistics based on Huber/White robust standard errors clustered by firms are presented in parentheses. ***, ** and * indicate significance on the 1%-, 5%- and 10%-levels, respectively. A detailed description of all variables can be found in Appendix A.

Table 9: Channel

Panel A: Implied Cost of Capital

Model	Ia	IIa	IIIa	IVa
Treated x Post	**-0.16*****	**-0.16*****	**-0.12****	**-0.13****
	(-2.82)	**(-2.88)**	**(-2.23)**	**(-2.22)**
Size		0.017	-0.029	-0.010
		(0.37)	(-0.62)	(-0.22)
Leverage			0.23**	0.11
			(2.17)	(1.03)
Profitability			-0.85***	-0.71***
			(-3.25)	(-2.74)
Observations	559	559	555	555
adj R2	0.11	0.10	0.16	0.18
Year/Firm FE	yes	yes	yes	yes
Controls x post	no	no	no	yes

Panel B: Cash flows

Model	Ib	IIb	IIIb	IVb
Treated x Post	**0.012**	**0.018**	**0.028****	**0.027****
	(0.65)	**(1.02)**	**(2.02)**	**(2.01)**
Size		-0.046***	-0.042***	-0.040***
		(-2.74)	(-3.95)	(-3.66)
Leverage			0.018	0.011
			(0.56)	(0.32)
Observations	1,264	1,258	1,228	1,228
adj R2	0.0078	0.038	0.046	0.046
Year/Firm FE	yes	yes	yes	yes
Controls x post	no	no	no	yes

In Panel A, the dependent variable is Ln(ICC), which is the mean of four implied cost of equity capital used in Hail and Leuz (2009) and Chen et al. (2016). Please refer to Hail and Leuz (2009) for the details of the calculation. In Panel B, the dependent variable is EBITDA (scaled by total assets). The year 2009 in which the law was passed is excluded. The estimation window is plus/minus four years (i.e., 2005 to 2008 and 2010 to 2013). Treated equals one for German firms with D&O insurance and zero otherwise. Post equals one after 2009 and zero before. Only firms with at least two pre- and post-event observations are considered. The sample consists of an equal number of size-matched treated and control firms (based on 1-to-1 nearest neighbor matching without replacement). Control variables are lagged by one year. Controls x post means that the control variables are interacted with the post dummy to allow for different effects of the co-variates in the pre- and post-event period. Models are firm fixed effects regressions. T-statistics based on Huber/White robust standard errors clustered by firms are presented in parentheses. ***, ** and * indicate significance on the 1%-, 5%- and 10%-levels, respectively. A detailed description of all variables can be found in Appendix A.

Table 10: Firm risk

Panel A: Total risk

Model	Ia	IIa	IIIa	IVa
Treated x Post	**-0.11****	**-0.11****	**-0.084****	**-0.080***
	(-2.52)	**(-2.56)**	**(-2.00)**	**(-1.93)**
Size		-0.12***	-0.17***	-0.18***
		(-3.69)	(-4.26)	(-4.52)
Leverage			0.29***	0.31**
			(2.78)	(2.55)
Profitability			-0.025	-0.0049
			(-0.25)	(-0.030)
Observations	952	950	924	924
adj R2	0.29	0.32	0.34	0.34
Year/Firm FE	yes	yes	yes	yes
Controls x post	no	no	no	yes

Panel B: Firm-specific risk

Model	Ib	IIb	IIIb	IVb
Treated x Post	**-0.12*****	**-0.12*****	**-0.092****	**-0.091****
	(-2.71)	**(-2.74)**	**(-2.18)**	**(-2.17)**
Size		-0.11***	-0.17***	-0.17***
		(-3.45)	(-4.17)	(-4.17)
Leverage			0.34***	0.34***
			(3.15)	(2.73)
Profitability			-0.047	-0.016
			(-0.48)	(-0.098)
Observations	952	950	924	924
adj R2	0.24	0.27	0.29	0.29
Year/Firm FE	yes	yes	yes	yes
Controls x post	no	no	no	yes

The dependent variable is total risk (σ_t^{total}) in Panel A and idiosyncratic risk (σ_t^{idio}) in Panel B. Both are based on weekly equity returns. The year 2009 in which the law was passed is excluded. The estimation window is plus/minus four years (i.e., 2005 to 2008 and 2010 to 2013). Treated equals one for German firms with a D&O insurance. Post equals one after 2009 and zero before. Only firms with at least three pre- and post-event observations are considered. The sample consists of an equal number of size-matched treated and control firms (based on 1-to-1 nearest neighbor matching without replacement). Control variables are lagged by one year. Controls x post means that the control variables are interacted with the post dummy to allow for different effects of the co-variates in the pre- and post-event period. Models are firm fixed effects regressions. T-statistics based on Huber/White robust standard errors clustered by firms are presented in parentheses. ***, ** and * indicate significance on the 1%-, 5%- and 10%-levels, respectively. A detailed description of all variables can be found in Appendix A.

Appendix

Appendix A: Definition of variables

Variable	Description
Main variables	
Treated	Equals one for German firms with a D&O insurance and zero for German firms without a D&O insurance and Austrian firms. Source: hand-collected.
Post	Equals one after the year 2009 and zero otherwise.
Tobin's Q	Market value of equity plus total liabilities divided by the sum of book value of equity and total liabilities ($\frac{wc08001+wc03351}{wc03501+wc03351}$). Source: WC.
Implied cost of capital	
ICC	Average of the four implied cost of equity measures used in Hail and Leuz (2009) and Chen et al. (2016).
Firm-risk variables	
σ_t^{total}	Annualized standard deviation of weekly equity returns. Set to missing if fewer than 50 weekly returns are available in a year. Returns are adjusted for prices below one Euro and three or more consecutive prices without changes. Source: Own calculations based on DS.
σ_t^{idio}	Annualized standard deviation of the residuals from a market model with CDAX (for German firms) and MSCI Austria Index (for Austrian firms) as market returns. Set to missing if fewer than 50 weekly returns are available in a year. Returns are adjusted for prices below one Euro and three or more consecutive prices without changes. Source: Own calculations based on DS.
Other variables	
Size	Ln of total assets (wc02999). Source: WC.
Leverage	Total debt (wc03255) divided by the sum of total debt and book value of equity (wc03501). Set to missing if the ratio is below zero or above one. Source: WC.
Profitability	EBIT (wc18191) divided by total assets. Set to missing if the ratio is equal to or less than minus one. Source: WC.
Cash flows	EBITDA (wc18198) divided by total assets (wc02999). Source: WC.

DS stands for Datastream, and WC for Worldscope.