The Corporate Compliance Function - Effects on Equity and Credit Risk

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Abstract

Does corporate compliance help to reduce firm risk? We explore this question by examining the reported compliance activities of 150 publicly listed German firms over the years 2014 to 2018. We build a summary score that accounts for 24 clearly identifiable compliance elements and find that stronger reported compliance - measured via a higher score - reduces downside equity risk but increases short-term credit risk. This indicates that the tradeoff between lower extreme losses but higher day-to-day expenses from stronger compliance systems benefits equity investors at the expense of short-term debt investors. Based on a factor analysis, we furthermore observe that the equity-risk reducing effect is mainly driven by internally-oriented compliance components, whereas the credit-risk increasing effect appears to be driven by externally-oriented compliance elements. The equity-risk reducing effect of compliance is moreover shown to strengthen over time, reaching a plateau in 2017, the year in which non-financial reporting became compulsory for German corporations. Both firms and capital market participants hence seem to have become increasingly sensitive to corporate compliance reporting in the run-up to the respective legislation.

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1 Introduction

Over the last two decades, the role of corporate compliance has gained tremendous importance in business management. Defined as the set of "processes by which an organization seeks to ensure that employees and other constituents conform to applicable norms" (Miller, 2017), corporate compliance needs to quickly adapt to changing legal and regulatory requirements, but also to shifting societal expectations (Griffith, 2016). As a consequence, compliance management systems have developed most dynamically in firms operating in highly-regulated sectors such as finance or pharmaceuticals and in sectors undergoing disruptive change in consumer acceptance such as energy or automotives (Braun, 2019). The strong increase in corporate resources allocated towards compliance activities underscores this development: A Finextra-blogpost in late 2019 estimates that 10 – 15% of the total workforce in financial firms are dedicated purely to regulatory compliance functions (Somananth, 2019). Nevertheless, the highest fines for non-compliance with laws and regulations in the last decade have also mainly been reported in the financial industry. They range from a fine of $1.8 billion for SAC Capital Advisors for insider trading, a total of $2.5 billion paid by five international banks in the LIBOR scandal to $9 billion borne by BNP Paribas for financing terrorism (Planetofcompliance, 2019), surpassed only by Volkswagen's payment of EUR30 billion damage claims in the wake of the emissions scandal (Deutschlandfunk, 2020).

While the increasing attention and resources that compliance activities have attracted in recent years indicate that firms value the benefits of compliance more highly than its costs, only a surprisingly small number of academic papers have actually examined the effectiveness of compliance management systems so far. The few existing studies mainly rely on qualitative case studies or survey data to assess compliance performance (Hartmann, Marton, and Söderström, 2018; Hutter, 2001; Parker and Nielsen, 2008). Other analyses focus solely on specific areas such as conformance with environmental or health and safety regulations (Coglianese and Lazer, 2003; McKendall, DeMarr, and Jones-Rikkers, 2002; Potoski and Prakash, 2005). And yet others only consider specific elements of compliance management systems such as whistleblowing facilities (Bowen, Call, and Rajgopal, 2010; Erkmen, Özsözgün Çalışkan, and Esen, 2014; Read and Rama, 2003). We try to enhance this earlier literature by taking a more comprehensive perspective: Based on a large set of German corporations over a five-year period (2014-2018), we evaluate the economic effects of compliance management systems. More precisely, we examine the association between the strength of a compliance system and the corresponding compliance-related firm risk. In this respect, we see compliance as an input factor in companies' business processes and study its relation with the intended output, i.e. the avoidance of adverse events following from non-compliance such as lawsuits, regulatory ordinances or societal pushbacks.

We estimate the strength of a firm's compliance management system from the compliance efforts described in the firm's annual report. Given the strong emphasis on non-financial reporting in Europe, culminating in a corresponding EU directive in 2014 (Directive 2014/95/EU), we are confident that we can capture a significant proportion of a firm's total compliance engagement from this highly-regulated piece of corporate communication. Relying on self-reported corporate compliance in this way, our approach comes close to the literature on the effects of internal control weakness reporting for U.S. companies (see Chalmers, Hay, and Khlif, 2019, for a recent review). In contrast to this literature, however, our focus is less on internal control over financial accounting than on any procedural activity aimed at self-regulation with respect to applicable norms (Parker, 2009).

We approximate firm risk via capital-market based measures that reflect investors' claims on the firm's expected free cash-flows. These are cash-flows from operations after all, i.e. also compliance-related, expenses are borne and after all losses from extreme events such as, e.g., lawsuits, product recalls or consumer strikes due to non-compliant corporate behavior are covered. We believe that the corresponding equity- and credit-based risk measures are better able to capture the complex, tradeoff-like nature of compliance-related risk than the observed criminal and regulatory fines which not necessarily reflect the true amount of non-compliant activity nor present it at an equivalent point of time.[1] Our approach is, thus, again similar to the literature on internal control weaknesses that have been shown to be related to higher information risk for investors and, therefore, to increase the reporting firm's cost of equity (Ashbaugh-Skaife, Collins, Jr., and Lafond, 2009; Maria Ogneva and Raghunandan, 2007) and cost of debt (Duffie and Lando, 2001; Lambert, Leuz, and Verrecchia, 2007). We consider standard measures for credit risk such as credit default swap spreads and probabilities of default over both short and long time periods in our analyses, but examine only downside-risks from equity[2] and focus particularly on proxies for tail-risks. The latter have been shown to be particularly suitable for capturing risks from environmental and reputational infringements (Ilhan, Sautner, and Vilkov, 2018; Hoepner, Oikonomou, Sautner, Starks,

[1] As a prime example in this respect, Volkswagen was ordered to pay a criminal fine of EUR 30 billion in 2017 for violating emissions regulations in the late 1990s and 2000s. The strength of Volkswagen's compliance system was certainly much higher in 2017 than over the time period where the regulatory violation was conducted. Examination of the simultaneous relation between the fine, as a manifestation of non-compliance risk, and the compliance strength would therefore have led to a biased result. Consideration of a time lag, on the other hand, would require to estimate the length of this lag for each compliance-breach observed, which is hardly feasible. Employing capital-market based risk measures, instead, appears to be both a more comprehensive and manageable approach for the task at hand.

[2] It should be noted that an equity claim has both an upside and a downside: Depending on the firm's performance, equity holders may receive either more or less than expected (Modigliani and Miller, 1958). Clearly, for our question at hand, we are only interested in the loss potential, so that we focus only on downside-risks from equity.

and Zhou, 2016).

Based on this methodological approach, our contribution to the literature is four-fold. To the best of our knowledge, we are the first to compile a comprehensive compliance score that measures the strength of a firm's compliance management system. To do so, we identify 24 clearly distinguishable compliance elements from the auditing standard IDW PS 980 enacted by the Institute of Public Auditors in Germany and the German Corporate Governance Code. We define a firm's total compliance score as the sum of the individual compliance elements depicted in the firm's annual report and calculate this score for each of the five years of our sampling period. We show that the average compliance score increases throughout this period, but find strong differences between firms' size groups and industries. Furthermore, as there might be a natural correlation structure between the different compliance elements in the score, we also run a factor analysis on the full list of 24 items. This allows us to decompose the total compliance score into five compliance factors that we use as alternative explanatory variables in further analyses.

As our second and main contribution, we provide evidence on the relation between the strength of a firm's compliance management system and firm risk. Studying this relation empirically is not trivial due to endogeneity problems that might be caused by measurement errors, omitted variables, or reverse causality in the compliance-risk relation. It may, for instance, be conceivable that an observed correlation between the compliance score and firm risk is not due to a causal relation but rather masked by a third factor that affects both a firm's compliance activity and its capital-market based risk. If this factor is not accounted for in the analyses, this may lead simple regression analyses to deliver inconsistent results. We address potential endogeneity problems not only by employing a large number of control factors in our regressions, but also by resorting to an elaborate empirical design: We run both dynamic panel regressions following Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998) and fixed-effects panel analyses with lagged dependent variables á la Angrist and Pischke (2009) to assess the effects of interest in a robust way.

We conjecture that a company's credit risk might be affected by both elements in the trade-off between regular but comparably low compliance expenses and irregular but large losses from non-compliance, as both may impact the firm's solvency. We therefore do not pose a directional hypothesis regarding the relation between the strength of a firm's compliance system and its credit risk. Equity investors - as the residual claimants on the firm's cash-flows - in contrast, should be more strongly exposed to the extreme losses following from non-compliant behavior than to regular compliance expenses. We therefore hypothesize that a stronger compliance management system helps to reduce the downside-risks of equity investors. Indeed, our results confirm this hypothesis:

All of our equity-based risk proxies decrease with increasing compliance score. Interestingly, however, we find divergent results for debt investors with a short-term perspective compared to those with a long-term perspective. More precisely, we observe that the compliance score raises short-term credit risk but has no association with long-term credit risk. For short-term debt investors, the cost-increasing effect of stronger compliance activity hence seems to outweigh the decreased likelihood of extreme adverse events occurring. Equity investors, in contrast, predominantly benefit from the reduction in extreme losses. For long-term debt investors, who stand in-between these two positions with regard to the seniority of their cash-flow claims, the two effects appear to outweigh each other so that there is no association between compliance strength and long-term credit risk.

Our third contribution refers to the structural characteristics of the compliance-risk relation. When we substitute the total compliance score in our regression models with the five compliance factors retained from the factor analysis, we can show that not all compliance factors influence investors' risk assessments equally. This corroborates findings by Chen, Chan, Dong, and Zhang (2016) who demonstrate that the individual components of internal control systems may have different impact on firms' crash risk. More precisely, we find that the equity-risk reducing effect of a strong compliance management system is mainly caused by a clear "institutionalization" of compliance within the firm. This institutionalization is based on the following compliance elements: existence of a chief compliance officer, implementation of a code of conduct combined with a compliance risk assessment and internal compliance controls, regular compliance trainings and the set-up of an anonymized, internal whistleblower facility. There is also some indication that the compliance "organization", i.e. having a compliance committee at board level and employing job rotation, is beneficial for reducing equity risks. Thus, equity investors appear to value clearly defined, internal compliance elements that anchor compliance-related responsibilities within the firm and directly affect employees' behavior.

Interestingly, these internally-oriented compliance elements play hardly any role when it comes to credit risks. Rather, the increase in short-term credit risk is mainly caused by "externally-oriented" compliance elements such as subscription to the UN Code of Conduct (Global Compact; set of principles that encourages firms to align their operations and strategies with committed values), membership in the Committee of Sponsoring Organizations (COSO; one of the largest international standard-setting bodies with regard to compliance systems) and implementation of an external whistleblower facility whose findings are externally disclosed. Surprisingly, there is also some indication that a firm-specific audit of the compliance management system based on the auditing standard IDW PS 980 tends to reduce credit risk. It hence seems to be the case that debt

investors perceive a lower risk from a compliance management system that is audited according to a national standard based on firm-specific characteristics. Orienting the compliance system on global and less specific standards, in contrast, is seen as risk-increasing from the debt holders' perspective.

We also analyze whether the risk-effects of compliance change over time. Even though our dataset covers an admittedly rather short time dimension, the period studied nevertheless captures an interesting development as the European Commission started to discuss the relevance of non-financial reporting from 2011 on with the so-called EU Corporate Social Responsibility (CSR) strategy (European Commission, 2019). The corresponding CSR directive was eventually passed in 2014 and became effective in Germany from business year 2017 onwards. As such, we should expect the firms in our sample to have turned increasingly attentive to compliance issues and the importance to discuss them in their annual report. Analyzing the time-dependency shows that the risk-reducing effect of compliance on equity markets has indeed been increasing throughout our sampling period and reaches a plateau from 2017 on, i.e. the year in which non-financial reporting became compulsory. With regard to credit risks, we find that the risk-increasing effect of compliance is lowest in 2014 and particularly pronounced in 2015 and 2017 while stabilizing in 2018.

We finally test the robustness of our core findings by studying a subgroup of firms that we know to be most strongly exposed to regulatory compliance issues: financial firms. As this subsample comprises only 27 firms, we repeat solely our main analyses but do not examine the more intricate characteristics of the compliance-risk relation that would have required a further disaggregation of the data along the factor or time dimension. We can show indeed that the equity-risk reducing effect of compliance is even stronger for financial firms than for the total sample. Surprisingly, however, there is no effect of compliance on credit risk for financial institutions. Thus, for the highly regulated financial firms both short- and long-term debt investors seem neutral with regard to the risk effects of compliance.

Overall, we take our findings as an indication that stronger compliance management systems change investors' expectations about firms' cash-flow distributions in two ways: First, the left tail appears to lose probability mass due to compliance breaches (and the ensuing large losses) becoming less likely. This benefits particularly equity investors as the residual claimants on firms' cash-flows. Second, the distribution also seems to shift to the left as the higher regular compliance expenses reduce the expected free cash-flow. This moves more probability mass into the area where cash-flows are low enough so that they might trigger a default, with potentially detrimental effects particularly for short-term debt investors. Corporate compliance hence appears to be a double-

edged sword: Stronger compliance management systems indeed help to reduce the occurrence of extreme losses from non-compliant behavior, but this comes at the cost of more near-term risks due to a higher level of compliance-based expenses. While the combined effect seems to benefit equity investors, it may hurt debt investors.

The remainder of the paper proceeds as follows. Section 2 presents a brief history of corporate compliance and derives the hypotheses that we set out to test. We then delineate the construction of the compliance score and describe its cross-sectional and temporal characteristics before a factor analysis considers the relation between the individual compliance elements in the score. Section 3 describes the dataset and Section 4 portrays the econometric methodology used to derive the effect of compliance strength on firm risk. Section 5 presents the main results from examining the total compliance score but considers also further details from the compliance-risk relation such as the role of individual compliance factors and the development of the risk effects over time. Section 6 examines financial firms in isolation as a robustness check of our main results. Section 7 concludes the paper with a discussion of our results and an outlook on future research.

2 Corporate Compliance

2.1 Background and Hypotheses

Corporate compliance has become a buzzword in modern management parlance. Referring to the actions that a company undertakes to ensure that externally given or internally developed standards and norms are obeyed, it aims at insulating the firm against fines, civil law penalties, payment of damages, voiding of contracts or reputational losses from non-conformant behavior. A compliance management system is therefore part of a firm's internal control system and contributes to an effective risk management. At the same time, the compliance management system also feeds into a firm's corporate governance, even though corporate governance – as the overall set of mechanisms by which corporations are directed and controlled – has a much broader focus (Griffith, 2016).

In the United States, the origins of corporate compliance lie in the 1970s. In 1977, the Foreign Corrupt Practices Act (FCPA) obliged U.S. firms to establish internal controls to prevent corporate wrongdoing (Josephson, 2014). Despite this new legislation, several scandals among defense contractors occurred in the late 1970s and early 1980s. The ensuing extreme public scrutiny of the topic led the CEOs of the largest companies within the industry to voluntarily implement a standard of ethical conduct in business (Gupta and Lad, 1983; Kurland, 1993). In parallel, the so-called Treadway Commmission recommended to its private-sector sponsors the development of

guidelines for internal controls (Grundfest and Berueffy, 1989). The Committee of Sponsoring Organizations (COSO) that was born out of this initiative published the "Internal Control-Integrated Framework" in 1992, which has become the de facto standard for auditing and monitoring internal control systems in the United States. The Federal Sentencing Guidelines for Organizations (FSGO), enacted in 1991, gave further incentives to firms for establishing a compliance function as they described the necessary compliance elements that make a firm eligible for a reduced sentence if convicted. Despite all this, a wave of corporate scandals and accounting frauds in the early 2000s (Enron, WorldCom, Tyco, etc.) led the U.S. Congress to pass the Sarbanes-Oxley (SOX) Act in 2002 that imposed very rigorous internal control requirements on U.S. corporations. The financial crisis in 2007 and 2008 led to a further tightening of regulations in the financial industry via the Dodd-Frank Act of 2010.

In Europe, legislators broadly followed these initiatives and implemented rules for compliance management systems especially for listed firms (Christiansen and Koldertsova, 2009). In Germany, Section 91 (2) of the German Stock Corporation Act (AktG) together with section 130 of the Administrative Offences Act (OWiG) holds the top management personally responsible for implementing an effective risk management system that has to include compliance risks. A commission set up by the Federal Ministry of Justice in 2001 provides further recommendations for good corporate governance as summarized in the German Corporate Governance Code (GCGC). Principles 4, 5, 14 and 15 of this code prescribe the implementation of a compliance management system to ensure conformance with external rules and regulations as well as with internal guidelines.

In addition to these national legislations, global securities exchanges have also strengthened the importance of compliance management systems for firms active on capital markets (Christiansen and Koldertsova, 2009). In line with this development, European legislators have put an early emphasis on the role of non-financial reporting for publicly-listed firms, thereby effectively granting a sanctioning mechanism to capital market participants. This not only contributes to a high level of transparency regarding non-financial firm risks in Europe but also supports the more strongly stakeholder-oriented governance of firms acting under civil law systems (Shleifer and Vishny, 1997). In this respect, the EU corporate social responsibility (CSR) strategy of 2011 covers social, environmental, ethical, customer and human rights and has led to the enactment of the European directive on non-financial reporting in 2014 (2014/95/EU) and its national counterparts via the CSR Directive Implementation Act in 2017 (2017/C 215/01). According to this regulation, firms need to disclose in particular actions taken to prevent corruption and bribery as highly-material non-compliant behavior (§ 289b Abs. 2 Nr. 5 HGB).

Given the objective of corporate compliance to set up processes that help to avoid non-conformance with applicable norms and the corresponding adverse outcomes, we conjecture that an effective compliance management system should contribute to an overall reduction in firm risk. When assessing the relation between the strength of a compliance system and compliance-based risks, we have to consider, however, that the publicly observed fines and penalties for compliance breaches - as a realization of this risk - represent only a fraction of the total losses from non-compliance. Event studies that examine investors' market reaction to the announcement of compliance issues typically conclude that the market-based losses are much larger than these fines (Ewelt-Knauer, Knauer, and Lachmann, 2015; Miller, 2006; Tanimura and Okamoto, 2013; Young and Peng, 2013), thus indicating additional reputational losses. Furthermore, not all compliance breaches are prosecuted or come to the general public's attention at all. Event studies on observed cases hence capture only part of the total non-compliant firm behavior. At the same time, however, we have to bear in mind that the implementation of a compliance management system is also costly on a day-to-day basis (wages for compliance personnel, internal control processes etc.), with corresponding effects on firm risk. Crain and Crain (2010), for instance, estimate the expenses of U.S. firms for complying with the Sarbanes-Oxley Act to be as much as $8,086 annually per employee. In Germany, firms with more than 10.000 employees have been found to spend on average EUR7.4 million per year for compliance, following an ascending trend (PWC, 2018).

Any analysis of the association between corporate compliance and firm risk therefore has to consider the tradeoff between infrequent but potentially large losses from non-compliant firm behavior and regular but much lower expenses for upholding a compliance management system. In order to capture both parts most comprehensively, we decide to approximate firm risk via capital-market based measures that reflect investors' claims on firms' expected free cash-flows. Deriving firm risk from financial securities traded on capital markets clearly requires a reasonably high information efficiency on these markets (Fama, 1970; Malkiel and Fama, 1970). Given the breadth and depth of German capital markets (Chan, Gup, and Pan, 1997; Worthington and Higgs, 2004) and the strong transparency standards regarding non-financial risk reporting in Europe, we believe this assumption to be satisfied, so that relevant information regarding firms' compliance engagement should be sufficiently reflected in the corresponding security prices.

When measuring compliance-based firm risk from security prices, we finally need to differentiate between two types of security holders and their corresponding risk profiles: equity holders and debt holders. Equity investors, as the owners of the firm, are the residual claimants on the firm's free cash-flows. I.e., they lay claim on any free cash-flow that is left after debt investors, who hold a senior position, have received their due. As free cash-flows will be reduced by the

regular compliance expenses, both debt and equity holders will be negatively affected by a stronger compliance engagement. Compliance expenses may in this respect be interpreted as leading to a leftward shift in the distribution of a firm's free cash-flows. The losses from non-compliant behavior, in contrast, will be represented by the left tail of this cash-flow distribution: They materialize rarely but tend to be extremely large if they do (Jagannathan, Ravikumar, and Sammon, 2017). By virtue of being the residual claimants, equity holders fully absorb the detrimental effect of these extreme cash-flow shortfalls. As a shift in the mean is only a second-order effect relative to a change in the mass under the tail of the distribution for equity investors (Vassalou and Xing, 2004), the regular compliance expenses should therefore be less important for downside equity risk than the losses from a compliance breach. As a consequence, if stronger compliance engagement reduces the likelihood of theses losses occurring or the size of the loss in the event, this should lead to a reduction in downside equity risk. Based on these arguments, we posit the following hypothesis with respect to equity investors:

Hypothesis 1: A stronger compliance management system decreases downside equity risk.

Compared to equity investors, debt holders have a more senior claim on the firm's free cash-flows. As a consequence, as long as a compliance breach does not trigger insolvency, debt investors are not affected by the losses from non-compliant behavior. What is more, even if these large penalties or damage claims lead to a default, the loss that occurs to the debt investors cannot exceed the agreed-upon interest and face value. I.e., debt holders do not stand to lose more even if the loss from non-compliant firm behavior is larger than this pre-agreed amount. Tail risks in the distribution of free cash-flows are hence less relevant to debt investors than they are for equity investors. At the same time, however, the leftward shift in the distribution due to regular compliance expenses may easily impair the firm's creditworthiness. Depending on whether the beneficial effect from a reduction in extreme losses outweighs the detrimental effect of the expenses from stronger compliance engagement, credit risks may therefore increase or decrease with a stronger compliance management system. This leads us to posit the following hypothesis:

Hypothesis 2: A stronger compliance management system may increase or decrease credit risk.

2.2 Measuring the Strength of a Compliance Management System - The Compliance Score

2.2.1 Elements of the Compliance Score

Even though the definition of corporate compliance in general seems to be unequivocal, there is no agreement on a conclusive list of necessary elements for an effective compliance management

system. Emphasis and level of detail often vary with industry and regulatory context (Griffith, 2016). In order to consider a preferrably comprehensive list of compliance elements, we therefore resort to two broad standards: the IDW PS 980, an auditing standard for compliance management systems enacted by the Institute of Public Auditors in Germany in 2011, and the German Corporate Governance Code enacted in 2002 and regularly updated that contains statutory regulations for the management and supervision of German listed companies. In total, we consider 24 different compliance items to measure the strength of a compliance management system. We validate these items with the list of compliance elements used by the Association of Certified Fraud Examiners (ACFE) for their annual Report to the Nations (ACFE, 2018). We compile the total compliance score by checking our sampling firms' annual reports for mentioning the different items as explained below.

According to IDW PS 980 Note 10 and Principles 4 and 14 of the GCGC, an effective compliance management system is based on clear functions and responsibilities. We therefore consider whether a *Chief Compliance Officer* (CCO, compliance item #1) or a *compliance committee* (#2), i.e. a committee at board level responsible for compliance issues (see also GCGC Note D3), are in place. We furthermore look out for whether the company mentions a clear *compliance organization* (#3) that stretches over all hierarchical levels, and whether the firm applies the *COSO framework* (#4) which provides clear guidance on how to implement an effective risk management system through all organizational levels.

As prior research has emphasized the importance of enacting personal norms and values in everyday actions and decisions for an effective compliance management system (Krawiec, 2003; Parker and Nielsen, 2008; Rosen, 2003), we also look out for mentioning of a *compliance culture* (#5) in the annual report.[3] IDW PS 980 Note 23 furthermore stresses that the compliance culture needs to be supported by the management's "*tone at the top*" (#6).[4] Membership in the *UN Global Compact* (#7), the largest global initiative for responsible corporate leadership, should furthermore help top management to credibly underpin its compliance commitment.

To guide compliant employee behavior, a *code of conduct* (#8) is often implemented to set forth clear guidelines particularly with regard to critical business decisions (IDW PS 980 Note A36). A code of conduct is frequently also employed for *business partners* (#9) to encourage compliant behavior along the entire supply chain. In addition, firms organize *compliance trainings* (#10) to increase employees' awareness and acceptance of these rules and regulations. Firms may

[3]Kaptein (2011) and Treviño and Weaver (2001) provide further evidence on the importance of an ethical culture.

[4]An interview-based study by Clinard (1983) identifies top management's behavior as the primary reason for employees' non-compliance. Joseph (2003) furthermore emphasizes that top management's strict support of rules and regulations is the most effective tool for reducing non-compliance within the firm.

furthermore install *monetary incentives* for compliant behavior (#11) by integrating compliance standards into remuneration target agreements. Indeed, prior research has shown these organizational reward systems to significantly increase compliant employee behavior (Allen and Davis, 1993; Treviño, Weaver, Gibson, and Toffler, 1999). *Sanctions* of compliance violations (#12) are also conducive in this respect. Finally, IDW PS 980 Note A17 also mentions *job rotation* (#13) as an effective tool to hamper non-compliance in familiar work surroundings that may give rise to occupational fraud.[5]

To ensure effectiveness of the compliance elements in place, the behavior of employees needs to be controlled and non-compliance must be reported. In line with IDW PS 980 Note 10 and Principles 4 and 5 of the GCGC, we therefore note whether a firm has institutionally installed *internal controls* (#14), for instance based on internal audit teams, to detect compliance breaches. *External controls* (#15), e.g. specific compliance audits conducted by independent audit firms, can also contribute to this end. If these external controls are sufficiently comprehensive and systematic, the full compliance management system may be certified based on auditing standard *IDW PS 980* (#16). We also note whether any type of *control* embraces the compliance behavior of *business partners* (#17).

In addition, firms may implement systems that allow individuals, typically employees, to voluntarily report potential misconduct. Individuals can either report to a contact person within the firm (*internal whistleblowing facility*, #18), such as the compliance officer or the compliance committee, or file their complaint with an external body (*external whistleblowing facility*, #19), for instance a law enforcement agency. We also note whether the number of messages received by the whistleblowing facility is *reported* (#20), as this is seen as an encouraging signal to other employees to speak up when they observe potential misconduct.[6] Since the risk of retaliation is extremely high for whistleblowers, we furthermore consider whether the firm has installed an *ombudsperson* (#21), who protects whistleblowers against discrimination at the workplace. Following Note A.2 of the GCGC, we also note whether the firm assures *anonymity* to whistleblowers (#22) and treats their claims confidentially.

Finally, our score considers whether the firm consistently *assesses compliance-based risks* (#23) as required by IDW PS 980 Note 10 and Principle 15 of the GCGC. Furthermore, we account for the fact that structural changes within the firm, for instance due to mergers or acquisitions, may require a regular self-evaluation of a firm's compliance culture. The final compliance item (#24)

[5]The Report to the Nations on Occupational Fraud and Abuse published by the Association of Certified Fraud Examiners identifies job rotation as a major driver of ethical behavior on a team level (ACFE, 2018).

[6]Prior research has underlined the importance of empowering whistleblowers to establish an ethical infrastructure in firms (e.g. Barnett, Cochran, and Taylor, 1993; Ray, 2006; Vandekerckhove and Commers, 2004).

therefore notes whether the company runs regular employee *surveys* that collect information on the firm's compliance culture. The full list of all 24 items that enter our corporate compliance score is given in the Appendix.

To compile the compliance score, each of the firms' annual reports is individually checked for these 24 compliance elements by two different investigators. Each compliance element is treated as an indicator variable. Only if both investigators agree that the text truly describes the element in the above-mentioned sense, a value of 1 will be assigned. Otherwise, the variable keeps a value of zero. It should be noted that even though large parts of the compliance-related information are found in the non-financial (or CSR) section of the annual report, we always consider the full annual report.

2.2.2 Aggregation and Descriptive Statistics

In order to aggregate the information of the individual compliance elements into a comprehensive measure of compliance quality, we summarize the 24 binary indicator variables per company for each year in our sample. The result is an annual time series of total compliance scores for each firm. In this respect, our approach follows Gompers, Ishii, and Metrick (2003) who collect information on binary indicators for different governance aspects from publicly available firm reports and sum them into a collective governance score. Even though some earlier studies have similarly employed textual content analysis to measure the level of risk disclosures (e.g. Linsley and Shrives, 2006; Rajab and Schachler, 2009) or sustainability activities (Caglio, Melloni, and Perego, 2019; Cannon, Ling, Wang, and Watanabe, 2019), to the best of our knowledge we are the first to develop an overall score for the strength of a compliance management system.

Table 1 reports the descriptive statistics regarding the compliance score, where we split the firms also into subgroups regarding the different capital market indices (DAX30, MDAX, SDAX, TecDAX) that they are constituents of. As can be seen, the average total compliance score over all firms and years takes a value of 9.37. Firms hence report on average 9 different compliance elements in their annual reports. The median score takes a value of 10. Disaggregating our sampling firms according to the capital market indices, we see that DAX30-listed firms show much higher average (15.13) and median (15) compliance scores than companies listed in the other indices. SDAX-listed firms for instance show an average compliance score of 6.80 and a median of 6. Given that the DAX30-companies are the largest publicly-listed firms in Germany, this might have been expected. At the same time, however, there is only little variation in the average or median compliance scores per year for this subgroup of firms. In the other subgroups, the mean and median compliance scores increase much more strongly over time and reach their highest levels in the most recent year of

our sampling period.

[Insert Table 1 about here.]

Table 2 shows the development of the average compliance scores per year and industry. While the scores essentially increase over time in all industries, it is nevertheless interesting to note the different levels and growth rates. Utilities, for instance, show the highest average compliance score (15.2) but display the lowest growth rate over time (6.90%). Technology firms, on the other hand, start from the lowest level (4.78) but almost double the score over the five years of our sampling period (growth rate of 83.68%). Telecommunications, financials and consumer cyclicals are further industries that show relatively low average compliance scores in 2014 but display a strong growth in reported compliance activity over the next years.

[Insert Table 2 about here.]

As a simple summary statistic, the compliance score treats each of the individual elements in a firm's compliance management system as equally important. But clearly firms may view specific compliance elements as much more important than others. Also, there may be certain relations between the different compliance elements such that some may be established in groups or, on the contrary, be seen as substitutes. In order to allow for such a structure to arise naturally from our list of compliance items, we run a factor analysis on the 24 binary indicator variables in the compliance score. The general objective of a factor analysis is to identify a small number of unobservable (or latent) characteristic "factors" from a much larger number of observed variables. The factor analysis employs the distance, respectively the relatedness, between the observed variables to derive a weighting scheme (or loadings) that is used to compile different factors. In doing so, it uses a maximum of the common variation in the variables. To generate the factors, we perform an orthogonal varimax rotation of the loading matrix as proposed by Kaiser (1958). These factors are orthogonal in the sense that they are linearly uncorrelated and therefore contain different explanatory content. Factor analysis hence allows us to interpret the (possibly interrelated) effect of individual compliance elements by grouping them into a small number of factors while still containing a maximum informational content of the original data.

From the factor analysis of our dataset, we retain five factors with meaningful eigenvalues larger than 1, i.e. with sufficient explanatory content (Katz and Rohlf, 1975). Table 3 reports the corresponding factor loadings. Since the first factor loads strongly[7] on all those compliance

[7]It should be noted that there is no established threshold for factor loadings to be considered as sufficiently high. In our analysis, we rely on factor loadings above 0.5.

elements that refer to an institutionalization of a compliance system (i.e. existence of a CCO and a code of conduct, of an anonymized internal whistleblower facility, regular compliance trainings, internal compliance controls, ongoing compliance risk assessments and compliance controls of business partners), we refer to this factor as the "institutionalized" compliance factor (*Factor_Inst.*). Essentially, this factor contains all those compliance elements that contribute to a local anchoring of compliance activities and the responsibility for corresponding risks within the firm. The second factor, in contrast, loads strongly on externally-oriented aspects of a compliance management system: membership in the UN Global Compact, subscription to the global COSO standard, external whistleblowing facility and reporting of the whistleblowing activity. We denote this factor as the "externally orientated" compliance factor (*Factor_Ext.*). The third factor comprises only whether the firm's compliance management system is audited by the IDW standard. We therefore dub it the "certification" factor (*Factor_Cert.*). The fourth factor, referred to as "cultural" factor (*Factor_Cult.*), loads strongly on the tone at the top and the compliance culture and the question whether compliance issues are considered for incentivizing employees. Finally, the fifth factor loads heavily on organizational issues such as whether there is a compliance committee at board level and whether the firm uses job rotation. It is referred to as the "organizational" factor (*Factor_Org.*).

[Insert Table 3 about here.]

3 Data

Our dataset comprises all German firms listed in the DAX30, MDAX, SDAX and TecDAX over the time period 2014 to 2018. We include financial firms in our main analyses but also consider them separately as a further robustness check in Section 6. This is because the financial industry is affected by much more extensive regulatory requirements, making financial institutions' compliance activities a prime example for studying the risk-effects of corporate compliance. For our sampling firms, we collect firm level data and daily stock prices via Refinitiv's Datastream. Measures of credit risk, i.e. credit default swap (CDS) spreads,[8] probabilities of default and distance to default (DtD), are downloaded from the Risk Management Institute of the National University of Singapore (NUS). As not all variables are available for all firms over all time periods (e.g., not all firms have CDS traded on the market), our dataset comprises a maximum of 750 firm-year

[8]It should be noted that the collected CDS spreads are "actuarial" spreads that do not contain any upfront fees, which is different from the notation of conventional CDS spreads.

observations from 150 companies, but may show a smaller number of observations depending on the analysis and variables employed.

The dependent variables in our analyses are different proxies of firm risk, based on equity and credit market data. More precisely, we calculate the following four different equity-based proxies of downside risk to capture the nature of compliance-related risks as extreme events (Hoepner, Oikonomou, Sautner, Starks, and Zhou, 2016). First, we employ the value at risk (*VaR*) to measure the predicted maximum loss of a firm over a given horizon within a specific confidence interval (Jorion, 2007). We calculate the VaR as the 0.05-quantile of the empirical daily stock return distribution and translate it into a positive number, so that a risk-reduction will be mirrored by a lower VaR. Second, we use the expected shortfall or conditional value at risk (*CVaR*), which corresponds to the mean value of daily returns that fall below the VaR threshold. Again, the CVaR is translated into a positive number so that lower risk corresponds with a lower CVaR. Finally, we also capture downside risks via lower partial moments (*LPMs*) of the second and third order: *LPM(0,2)* and *LPM(0,3*). We calculate these based on the return distribution below the 0%-return-threshold following Bawa (1975) and Fishburn (1977). To be able to compare our results metrically, we employ the square root of LPM(0,2) and the cube root of LPM(0,3). Equations 1 and 2 illustrate the calculation of LPM(0,2) and LPM(0,3) respectively:

$$LPM(0,2) = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(R_{n,i})^2} \tag{1}$$

$$LPM(0,3) = \sqrt[3]{\frac{1}{N}\sum_{i=1}^{N}(|R_{n,i}|)^3} \tag{2}$$

Here, $R_{n,i}$ denotes the negative daily return of firm i and N represents the number of observed negative daily returns of firm i in the respective year. Downside risk measures are calculated for each calendar year individually to retrieve a time series of downside risk measures that corresponds with the VaR and CVaR measures.

With regard to credit-based risk measures, which are, by definition, focused on default risk as a downside risk, we consider CDS (single-name credit default swap) spreads over 1 and 5 year periods as the purest measures of credit risk (Callen, Livnat, and Segal, 2009). Similarly to an insurance contract, the CDS spread is the fixed premium paid by the protection buyer to the protection seller for a period of time to receive compensation in case of a credit event. The risk of a credit event occurring should therefore be appropriately contained in the CDS spread (Bannier, Heidorn, and Vogel, 2014). As further measures of default risk, we also employ probabilities of default (over 12 months and 60 months, respectively) and the distance to default, calculated with

volatility-adjusted leverage based on Merton (1974). It measures the distance between the default point and the expected value of a firm's assets. A higher distance to default value hence implies a lower probability of default.

All our empirical models include firm leverage (proxied as debt divided by total assets), size (measured by the number of employees), growth (expressed with respect to sales), profitability (measured via operating income divided by total assets) and the dividend yield as control variables. This choice of control variables follows Hoepner, Oikonomou, Sautner, Starks, and Zhou (2016) and Bannier, Bofinger, and Rock (2019), who consider the effect of sustainability activities on firm risk. While the first four variables are standard controls in analyses of firm risk, the dividend yield is included as it indicates the managements' expectation of the level and volatility of future earnings. Moreover, dividend payments have a direct impact on the return distribution in the sense that high dividend payments reduce stock volatility (Oikonomou, Brooks, and Pavelin, 2012). In line with Callen, Livnat, and Segal (2009), we also control for the risk-free rate (given by the one-year German Bund rate), the firm's market capitalisation and equity return volatility (measured as the annualized standard deviation from daily stock returns) when studying a firm's credit risk.[9] The importance of including control variables from equity markets when assessing default risk is also supported by Benkert (2003) who refers to the structural modelling of default risk by Merton (1974).

Table 4 provides the descriptive statistics of our dependent and control variables over the full sample. It should be noted that our data are winsorized at the 1st and 99th percentiles to limit the influence of outliers. As can be seen from the table, the average value at risk over the sampling period is a daily stock return decline of 2.9%, the mean expected shortfall is 4.1% and the mean one-year CDS spread is 6.7 basis points, while the mean five-year CDS spread is 12.7 basis points. With regard to control variables, we find an average leverage of 0.63 in our sample, sales growth of 6%, profitability of 7% and a dividend yield of 2.2%. The average firm in our dataset is relatively large with more than 35.000 employees. The average risk-free rate throughout our sample period is negative at -0.5% and the average annualized equity return volatility is 1.9%. In general, our dataset exhibits quite some heterogeneity for most of the variables considered, which lends credence to the representativeness of our data.

[Insert Table 4 about here.]

[9]Callen, Livnat, and Segal (2009) use the type of restructuring clause as an additional control variable. As the NUS data does not provide this information, we abstain from controlling for this variable in our analyses.

4 Empirical Methodology

Empirical tests of the relation between corporate activities and corporate outcomes are often fraught with problems of endogeneity (Roberts and Whited, 2013; Li, 2016). Technically, endogeneity arises if an explanatory variable is correlated with the unobserved error term in a regression. This could be either caused by *(i)* measurement error in the explanatory variable, *(ii)* omitted explanatory variables in the regression or *(iii)* reverse causality. The latter refers to the case where the dependent variable (in our case: firm risk) drives the explanatory variable (the compliance score) rather than vice versa. In all three cases, internal validity is threatened as the estimated coefficients may be inconsistent so that standard inference testing will not allow a reliable verdict on the effect of interest.

We address concerns of a potential measurement error by compiling a compliance score based on a host of different compliance elements that have been derived on the basis of several broad compliance standards. In order to avoid misinterpretations regarding the reporting of individual compliance elements, we make sure that two independent investigators agree on each compliance item in the annual reports. In this way, we construct a score that is a deliberately conservative measure of the strength of a compliance management system. We also consider correlational structures within the elements of the compliance score via a factor analysis in later tests. In order to reduce the problem of omitted variables in our analyses, we make use of an extensive number of control variables, based on the earlier literature. Nevertheless, there might still be further variables that are relevant to explain firm risk. Also, reverse causality in the compliance-risk relation might be an issue, even though we should expect it to work in the opposite direction than indicated by Hypothesis 1: If at all, firms with higher (ex ante) firm risk might feel the need to engage in stronger compliance activity. In any case, we cannot fully exclude that endogeneity affects our estimation so that results from simple OLS regressions may be biased. We therefore try to solve this problem by employing two independent estimation approaches that consider different angles of the endogeneity issue. By doing so, we derive an upper and a lower bound for the compliance-risk relation as will be explained below. This allows us to draw robust conclusions regarding the existence and sign of the effect of interest despite the imperfections of each individual approach.

The first approach considers a simple fixed-effects panel estimation where the inherent differencing (or "within"-estimation) procedure allows to eliminate all time-invariant variables. Hence, if the only relevant omitted variables are fixed over time (such as, e.g., industry-related variables), their endogeneity effect is nullified via the fixed-effects estimation. In many cases, however, there may also be time-varying omitted variables and reverse causality may further contribute to their detrimental effect. For instance, it may be likely that a firm's risk history leads to certain com-

pliance choices and therefore also affects the current firm risk level. In this case, a dynamic panel model that includes the lagged dependent variable as a further explanatory variable might become helpful. The lagged dependent variable then essentially captures the effect of the omitted time-varying variables:

$$y_{i,t} = \beta_1 y_{i,t-1} + \beta_2 \phi_{i,t} + \beta_3 x_{i,t} + \upsilon_i + \varphi_t + \epsilon_{i,t} \tag{3}$$

Here, $y_{i,t-1}$ represents the lagged dependent variable, i.e. firm risk in our case. $\phi_{i,t}$ gives the compliance score, so that the coefficient β_2 demonstrates the contemporaneous impact of compliance activity on firm risk. $x_{i,t}$ is a vector of control variables. υ_i and φ_t are time-constant firm effects and firm-constant time effects, respectively. $\epsilon_{i,t}$ denotes the idiosyncratic error term in the regression.

If the dynamic panel equation (3) is estimated via a fixed-effects approach, the differencing procedure again eliminates the time-invariant part υ_i:

$$\Delta y_{i,t} = \beta_1 \Delta y_{i,t-1} + \beta_2 \Delta \phi_{i,t} + \beta_3 \Delta x_{i,t} + \Delta \varphi_t + \Delta \epsilon_{i,t} \tag{4}$$

However, consistency is nevertheless difficult to achieve by this fixed-effects estimation as the differenced error term $\Delta\epsilon_{i,t}$ and the lagged dependent variable $\Delta y_{i,t-1}$ are correlated via $\epsilon_{i,t-1}$, thus inducing endogeneity by construction. Fortunately, the system GMM estimation procedure introduced by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998) allows to solve this problem and we therefore choose it as our second approach. The system GMM estimation employs a two-step procedure that instruments the endogenous explanatory variable, $\Delta y_{i,t-1}$, with its lagged level, $y_{i,t-2}$. As long as this instrument is uncorrelated with $\epsilon_{i,t-1}$, this estimation approach will deliver consistent results. Unfortunately, however, this assumption cannot be easily taken for granted. Rather, the stronger the correlation between the instrument, $y_{i,t-2}$, and the endogeneous variable $\Delta y_{i,t-1}$, i.e. the "stronger" the instrument, the more likely it becomes that the identifying condition of the system GMM approach is violated. To see this for our problem at hand, consider the case where firm risk is serially correlated. Then, the firm's historic risk level may easily become correlated with the current error term. Particularly for credit risk, the typical temporal stability of credit ratings (Altman and Rijken, 2004; Löffler, 2005) shows that this concern cannot be easily dismissed.

To summarize, while the fixed-effects estimation procedure allows to deal with endogeneity issues arising from time-invariant omitted variables, the system GMM approach helps us to reduce endogeneity from reverse causality. Nevertheless, each method comes with restrictive identifying conditions that may not fully hold for our problem at hand. In order to make use of the beneficial effects of both methods despite their individual difficulties, we follow Angrist and Pischke

(2009) and employ both the fixed effects estimation method and the system GMM approach on our dynamic panel dataset in an attempt to capture their "bracketing property": If inappropriately applied, the fixed-effects estimation approach should overestimate, while the system GMM approach should underestimate a positive relation of interest. By applying both methods at the same time, we are therefore able to at least narrow down a causal effect. Our approach in this respect follows (Cremers, Litov, and Sepe, 2017) who also employ these two estimation methods to establish an effect of staggered boards on firm value. To consider additional heterogeneity issues, we furthermore use robust standard errors for both estimations: In the fixed-effects estimations, standard errors are robust to heteroscedasticity and autocorrelation. For the system GMM estimations, we apply robust standard errors as introduced by Windmeijer (2005) .

5 Results

5.1 The Compliance-Risk Relation

Our main analyses examine the effect of the compliance score on equity- and credit-based risks. Table 5 provides fixed-effects (Panel A) and system GMM (Panel B) estimates of a dynamic panel regression where the four different proxies for downside equity risk are employed as dependent variables. As can be seen from the table, a higher compliance score goes along with a significant reduction in all equity-risk measures: Both the fixed-effects estimation method and the system GMM approach show highly significant negative coefficients of the compliance score, pointing to a robust risk-reducing effect of a firm's compliance activities. Firms that have a stronger compliance management system hence show lower tail risks. Regarding economic significance, our results indicate that value at risk, for instance, decreases by about 7% (fixed-effects estimate) to 10% (system GMM estimate) for a one point increase in the total compliance score. Given that the median compliance score in our sample has increased from a level of 7 in 2014 to a level of 12 in 2018, this 5-point increase would decrease value at risk almost by half. Similarly large effects are also obtained for expected shortfall that falls by between 8% (fixed-effects estimate) and 13% (system GMM estimate) for each additional element added to the compliance management system. The results for the lower partial moments are equivalent. These findings robustly confirm Hypothesis 1: Stronger compliance management systems reduce downside equity risk.

Among the control factors, only the dividend yield shows a consistently positive effect on all measures of equity risk, while the financial leverage displays a positive impact only on value at risk. Profitability, on the other hand, appears to reduce equity risks measured via the lower partial moments and also firm size, approximated by the number of employees, shows a weakly reducing

effect on these risk measures.

[Insert Table 5 about here.]

Table 6 presents the corresponding results for our different proxies for credit-based risks as dependent variable, again employing fixed-effects (Panel A) and system GMM (Panel B) estimates on a dynamic panel regression. Surprisingly, we see a highly significant increase in short-term credit risks caused by a stronger compliance management system from both estimation approaches. An increase in the compliance score by 1 point raises the one-year CDS by about 0.4 basis points, for example. An increase in the compliance score by 5 points, as was the average gain over our five-year sampling period, would hence raise the spread by more than 2 basis points. Compared to an average spread of 6.7 basis points, this is admittedly not as strong an economic effect as on equity risk, but it is nevertheless statistically highly significant. Only the five-year probability of default and the distance to default appear unaffected by a change in the total compliance score. These findings hence partly support Hypothesis 2: For short-term debt investors, the risk-increasing effect of stronger compliance expenses seems to outweigh the risk-reducing effect of a lower likelihood of compliance breaches occurring.

Regarding the control variables we find consistent and, presumably, expected results from both estimation approaches: Leverage, dividend yield and equity return volatility increase credit risks at both short- and long-term horizons. Market capitalization has a negative effect on credit risks, while sales growth shows a - though not fully consistent over all estimation models - positive effect on long-term credit risks.

[Insert Table 6 about here.]

5.2 The Role of the Individual Compliance Factors

In order to understand which elements of a compliance management system drive the observed effects on firm risk, we next consider the individual compliance factors that are generated via the factor analysis described in Section 2. Essentially, we repeat the earlier analyses from Tables 5 and 6 but replace the total compliance score with the five individual compliance factors as the main explanatory factors. For reasons of brevity, we only report the coefficients of these five compliance factors in the following tables even though the analyses contain the same sets of control variables as before.[10]

[Insert Table 7 about here.]

[10]The corresponding results are available from the authors upon request.

As can be seen from Table 7, the equity-risk reducing effect of compliance is clearly driven by the "institutionalized " factor (*Factor_Inst.*). We observe highly significant negative coefficients of this factor in all regressions and also via both estimation methods (Panel A: fixed-effects estimates; Panel B: system GMM estimates). Interestingly, the fixed-effects estimation approach shows that also the "organization" factor (*Factor_Org.*) has a negative effect on equity risks. As both factors are driven by compliance items that refer to the internal elements of a corporate compliance system, this may be interpreted as a highly beneficial effect on equity risk by compliance engagement that focuses on the firm itself and anchors compliance activity and responsibility within the institution. Surprisingly, the "cultural" factor (*Factor_Cult.*) does not play a role for equity risk even though it could easily be seen as contributing to the internal elements of a compliance management system as well.

With regard to credit risk, Table 8 shows that different factors drive the credit-risk increasing effect of corporate compliance. It is particularly the "externally-orientated" compliance elements (*Factor_Ext.*) such as the external whistleblower facility, the reporting on the whistleblowing activity, membership in the UN Global Compact and subscription to the global COSO standard that cause credit risk to increase. We also see that this factor raises not only the short-term measures of credit risk but also the long-term default risk proxies. According to the fixed-effects estimation method, even the institutional and cultural elements of corporate compliance (*Factor_Inst.* and *Factor_Cult.*) contribute to increases in credit risk, though their effect applies only to short-term risks. The institutional elements of corporate compliance such as the implementation of a CCO in the organisation, an internal whistleblowing facility, internal risk controls or compliance checks of business partners clearly raise the day-to-day expenses of a corporate compliance system. This finding hence supports our earlier reasoning that short-term debt investors might be harmed by the regular compliance expenses more strongly than they benefit from a reduction in the extreme losses from non-compliant behavior. Surprisingly, however, certification of the corporate compliance system via the IDW standard (*Factor_Cert.*) reduces credit risks in the fixed-effects estimation model. Debt investors hence seem to see a benefit from auditing a firm's compliance management systems via external guidelines, but only when firm-specific characteristics are considered as the IDW PS 980 system does extensively. Orienting the compliance organization on more global and, hence, general standards such as COSO or the UN Global Compact, in contrast, is seen as increasing credit risk. As these findings are not supported by the system GMM estimation, however, we see them as indications rather than established facts.

[Insert Table 8 about here.]

This more detailed analysis of the compliance-risk relation indicates that not all elements of a

compliance management system are equally effective. Moreover, it is remarkable that equity and debt investors value specific compliance factors rather differently. In this respect, it is predominantly the internally-oriented compliance elements that allow to reduce equity risks. At the same time, however, some of these elements also appear to raise compliance expenses which harms particularly the short-term debt investors. Externally-oriented compliance elements raise the short- and long-term credit risks even further. It is also interesting to note that while prior research emphasizes the importance of "softer" or cultural elements of a compliance management system (Krawiec, 2003; Parker and Nielsen, 2008; Rosen, 2003), these components do not seem to play a role for equity or debt investors' risk assessments in our analyses.

5.3 Time-Dependency of the Compliance-Risk Relation

In order to test whether the compliance-risk relation is stable throughout our sampling period or whether there is a temporal structure underlying it, we resort to a similar estimation procedure as used by Gompers, Ishii, and Metrick (2003) and, more recently, by Phalippou (2007) or Shah, Shah, Smith, and Labianca (2017). They employ a regression model introduced by Fama and MacBeth (1973) that allows estimating annual cross sections where the statistical significance is derived from the time-series standard error of the mean coefficient. This estimation procedure enables us to see how the regression coefficients develop over time. Though this method does not take endogeneity concerns into account, we nevertheless see it as appropriate for the question at hand as we have already established a valid relation between compliance and firm risk in our earlier fixed-effects and system GMM estimation procedures. Standard errors in the Fama-MacBeth estimation approach follow Newey and West (1987) and are robust to heteroscedasticity and autocorrelation.

Table 9 reports the resulting coefficients of the compliance score in the different equity-risk (Panel A) and credit-risk (Panel B) regressions for each year of our sampling period. The final row shows the average coefficients over the total time period. It should be noted that the regressions contain the same controls as before, but they are not reported to allow for a clearer presentation of the main results. As can be seen from Panel A, the decreasing effect of corporate compliance on equity risk has been building up over time. The absolute values of the compliance score coefficients tend to be largest in 2016 and 2017 and remain at that level in 2018. This is an interesting observation as it indicates that market participants appear to have been attentive to reported compliance activities even before this became compulsory: Only from business year 2017 on were German firms obliged to report on their compliance engagement in their annual reports. Since we have seen that firms have also consistently reported increasingly higher compliance levels from the beginning of our sampling period on, our results mirror a heightened sensitivity towards compliance

issues from both firms and market participants, even before the regulation was enacted. Regarding credit risks, Panel B does not show a similarly consistent picture. Rather, the risk-increasing effect of stronger compliance activities seems to be highest in years 2015 and 2017 and appears to level off in 2018.

[Insert Table 9 about here.]

6 Robustness Check - Financial Firms

In order to test the robustness of our results, we finally examine a subgroup of firms that are known to be strongly exposed to compliance risks. After various compliance scandals and the financial crisis of 2008/2009, financial firms in Germany have succumbed to a large number of additional regulations such as Basel III with a step-by-step implementation from 2013 to 2019, "Minimum Requirements for Risk Management" (MaRisk) implemented in a largely revised version in 2017, "Minimum Requirements on the System of Governance of Insurance Undertakings" (MaGo) since 2017, "Minimum Requirements for Risk Management for Alternative Investment Fund Managers" (KAMaRisk) in 2017, "Markets in Financial Instruments Directive II" (MiFID II) since 2018 or "Markets in Financial Instruments Regulation" (MiFIR) since 2018 (Bafin, 2018, 2019). Even though our compliance score has not been compiled with a special focus on financial firms, the fact that the average compliance score in the industry has been found to increase particularly strongly over the years 2016 and 2017 (see Table 2) reflects these political initiatives quite well. Given that the awareness of the danger of non-compliance seems to be particularly high among financial firms, this might be expected to lead to a corresponding sensitivity of capital market participants towards this topic. We therefore re-examine our earlier analyses for the 27 financial firms in our dataset in isolation. Given the small size of the sample, we only run our main analyses and do not consider a factor analysis nor a temporal analysis as both would lead to a further split of the already small sample and thus reduce the reliability of the results.

Tables 10 and 11 report the results regarding the compliance-risk relation for equity- and credit-risk, respectively. Indeed, we see from Table 10 that financial firms are also able to reduce equity-based risks via stronger reported corporate compliance. If we compare the coefficients of the compliance score with the respective results from the full sample (Table 5), we see that the effects are even stronger for financial firms. A one point increase in the compliance score, for instance, reduces financial firms's value at risk by 13% (fixed-effects estimate), respectively 18% (system GMM estimate). This is a much larger reduction than for the full sample and this effect is also supported by regression models (3) and (4) on the lower partial moments as further equity-

risk proxies. It hence seems to be the case that equity investors in financial firms benefit even more strongly from a strengthening of the compliance management system than stock holders in other industries. While this result might have been expected, given that the largest fines from non-compliant behavior are mostly observed in the financial industry, it nevertheless supports our earlier findings.

[Insert Table 10 about here.]

Interestingly, however, Table 11 shows that there is no robust effect of corporate compliance on credit risks for financial firms. Neither the fixed-effects estimation (Panel A) nor the system GMM estimation (Panel B) reports a significant effect of the compliance score on short-term credit risks. With regard to long-term credit risk, we only observe a weakly significant effect with respect to the five-year probability of default from the fixed-effects estimation model. In consequence, the risk assessments of debt investors in financial firms do not seem to be affected by the strength of these firms' compliance management systems, neither in a positive nor a negative sense.

[Insert Table 11 about here.]

7 Conclusion

In this paper, we consider the effect of the strength of compliance management systems on equity and debt investors' risk assessments. We study whether investors see a strong compliance management system as an efficient tool that helps to reduce the expected losses from compliance breaches more strongly than it raises costs. To determine the strength of a compliance management system, we compile a score based on 24 clearly distinguishable compliance elements for each of the 150 German firms listed in the German Prime Standard over the years 2014 to 2018. We observe that firms listed in the DAX30 show higher average compliance scores than firms listed in the MDAX, SDAX or TecDAX. However, the constituents of these subordinate indices display much stronger increases in their average compliance scores over our sampling period. Moreover, various industry-specific regulations over the last years appear to be well-reflected in our score: The compliance score of financial firms, for instance, nearly doubles within our observation period, reflecting the strengthening regulatory environment for firms in this industry. Based on a factor analysis, we also decompose our total compliance score into five factors in order to analyze whether specific parts of a compliance management system influence investors' risk assessments particularly strongly. More precisely, we distinguish between *(i)* a factor that covers institutionalized compliance elements, *(ii)* a factor that is externally-orientated, *(iii)* a factor that focuses on an external certification,

(iv) a factor addressing compliance culture and *(v)* a factor that emphasizes a firm's compliance organization.

Based on fixed-effects and system GMM dynamic panel regressions, we find that downside equity risk decreases significantly the stronger the compliance management system of the respective firm is. Our factor analysis highlights that this risk-reducing effect is mainly driven by institutionalized compliance elements, i.e. elements that clearly anchor compliance responsibility within the firm. Equity investors are hence willing to accept the ongoing compliance expenses as this allows to decrease the likelihood of compliance breaches sufficiently strongly. The extremely large losses from fines or reputational damages clearly affect the equity holders as the residual claimants on firms' free cash-flows particularly strongly. Debt investors, in contrast, hold a senior and typically fixed claim on firms' cash-flows. They will only be affected by compliance breaches if the firm's solvency is at risk. Insolvencies due to compliance breaches are scarce, however, and the losses from compliance breaches typically materialize only after years, for instance because lawsuits are long-lasting. As a consequence, it is not surprising that we find short-term debt investors to be more sensitive towards the ongoing compliance expenses than to the losses from non-compliant firm behavior: Short-term credit risk increases the stronger the compliance management system is. Based on our factor analysis, we can furthermore show that this risk-increasing effect is mainly driven by externally-oriented compliance elements. Debt investors thus seem to question the value of memberships in global, general compliance organizations. A firm-specific audit of the compliance management system by independent auditors, in contrast, appears to reduce risk for debt investors.

As our analysis is based on a time period in which not only compliance regulations tightened, for instance in the financial industry, but also non-financial disclosure requirements were set in place, it may be not surprising that the number of reported compliance elements increases over our sampling period, leading to higher compliance scores over time. In order to test whether also the risk-effects of compliance changed over time, i.e. whether financial market participants became more sensitive to this issue, we run also a temporal analysis. We find that, indeed, the reducing effect on downside equity risk strengthens over time. It is particularly strong in 2016 and 2017 and remains constant in 2018. Regarding credit risks, the risk-increasing effect of stronger compliance activities seems to be highest in 2015 and 2017 and appears to level off in 2018.

In sum, our analyses contribute to the literature by studying the association between the strength of compliance management systems and compliance-based risk in a comprehensive sense. By establishing a novel procedure to approximate the strength of management compliance systems, we hope that our paper may provide fertile ground for future analyses that could study further

moderators of the compliance-risk relation. It may, for instance, be interesting to examine whether the relation is affected by firm characteristics such as age or reputation, or by market characteristics such as bear or bull. Furthermore, an analysis of the trailing effects of compliance breaches or of network effects on the compliance-risk relation might prove relevant.

Despite thorough attempts at robustness and comprehensiveness, our study nevertheless has to admit to several limitations. First, though we try hard to reduce potential endogeneity problems in our estimation approaches, further tests will certainly be helpful to support the robustness of our result. Second, the construction of our compliance score relies on firms neither over- nor under-reporting their compliance activities. Unless there is reason to believe that firms consistently over-report and market participants are unable to detect this, we believe that our results should rather be a conservative estimate of the true effects. Indeed, given the strong sensitivity regarding CSR reporting in Europe, we feel vindicated that our findings are robust on this count. Furthermore, recent research also indicates that firms react to higher litigation risk by stronger voluntary disclosures (Dong and Zhang, 2018), which should support our results. Nevertheless, corroborating our measurement approach via further survey analyses would be highly appreciated. The ongoing strengthening of the regulatory environment in most industries should in this respect provide a fertile ground for future research.

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Tables

Table 1: Descriptive statistics of the compliance score - Total and market index split

This table presents descriptive statistics - mean, median, standard deviation, minimum and maximum - of the compliance score for each year of the sampling period 2014-2018 and as an average over the period. The first part of the table refers to the full sample, the lower parts refer to the constituents of the individual market indices DAX30, MDAX, TecDAX, SDAX individually.

All firms	2014	2015	2016	2017	2018	Avg.(2014 - 2018)
Mean	7.31	8.15	8.87	11.07	11.47	9.37
Median	7	8	9	11	12	10
Std. Dev.	5.38	5.46	5.53	4.72	4.54	5.38
Minimum	0	0	0	0	0	0
Maximum	21	22	22	22	22	22

DAX30	2014	2015	2016	2017	2018	Avg.(2014 - 2018)
Mean	13.8	14.17	15.1	16.4	16.3	15.13
Median	15	15	15	16	16	15
Std. Dev.	4.22	4.00	3.38	2.91	2.72	3.61
Minimum	2	2	9	12	12	2
Maximum	21	22	22	22	22	22

MDAX	2014	2015	2016	2017	2018	Avg.(2014 - 2018)
Mean	7.74	8.98	9.57	11.85	12.09	10.05
Median	8	9	10	12	12	11
Std. Dev.	4.51	4.72	4.89	3.41	3.70	4.57
Minimum	0	0	1	0	0	0
Maximum	18	17	20	20	21	21

TecDAX	2014	2015	2016	2017	2018	Avg.(2014 - 2018)
Mean	4.10	4.97	5.48	8.03	8.48	6.21
Median	4	5	6	8	9	7
Std. Dev.	3.24	3.69	3.81	3.31	3.34	3.85
Minimum	0	0	0	0	0	0
Maximum	11	12	14	15	15	15

SDAX	2014	2015	2016	2017	2018	Avg.(2014 - 2018)
Mean	4.52	5.27	6.11	8.59	9.48	6.80
Median	4	5	6	9	10	6
Std. Dev.	3.91	4.30	4.49	4.35	4.21	4.63
Minimum	0	0	0	0	0	0
Maximum	14	16	16	16	18	18

Table 2: Descriptive statistics of the compliance score - Industry split and development over time

This table illustrates the development of average compliance scores per industry over the years 2014 to 2018. Mean refers to the average per industry over the five-year time period. Growth refers to the percentage growth rate of the industry's average compliance score over the five-year time period.

Industry	N	2014	2015	2016	2017	2018	Mean 2014 - 2018	Growth 2014 - 2018
Basic Materials	16	11.69	12.50	12.75	14.06	14.75	13.15	26.18%
Consumer Cyclicals	24	7.08	8.29	9.13	11.58	12.13	10.03	71.33%
Consumer Non-Cyclicals	4	8.25	9.25	12.50	11.75	13.00	10.95	57.58%
Healthcare	15	7.87	8.80	9.53	11.40	11.47	9.81	40.59%
Industrials	38	7.42	8.24	8.92	11.21	11.68	9.49	57.41%
Technology	18	4.78	5.28	6.28	8.83	8.78	6.79	83.68%
Telecommunications Services	6	6.67	8.33	8.83	11.17	12.17	9.43	82.46%
Utilities	2	14.50	14.50	15.00	16.50	15.50	15.2	6.90%
Financials	27	5.59	6.22	6.67	9.41	9.74	7.53	74.24%

Table 3: Factor analysis of the compliance score

This table presents the factor loadings for the five factors with eigenvalues larger than 1 from a factor analysis on the 24 compliance elements.

Variable	$\text{Factor}_{Inst.}$	$\text{Factor}_{Ext.}$	$\text{Factor}_{Cert.}$	$\text{Factor}_{Cult.}$	$\text{Factor}_{Org.}$
CCO	**0.5334**	0.1053	0.128	0.1094	0.1536
BOARD	0.289	-0.0358	0.0791	-0.0405	**0.6573**
C_ORG	0.4666	-0.0219	0.1149	0.3964	0.3073
COSO	0.1098	**0.5656**	0.0205	-0.0177	0.0156
C_CULT	0.3194	-0.1195	0.188	**0.5848**	-0.1093
TONE	0.0955	0.1441	-0.0126	**0.8283**	0.0606
UN GLOBAL COMPACT	0.2676	**0.5824**	0.2672	0.1833	0.1265
COC	**0.7177**	0.0374	0.0751	-0.0217	0.0402
SUP_COC	0.4992	0.3693	0.2089	0.1799	-0.2682
TRAINING	**0.7634**	0.1291	0.1006	0.0006	0.0666
INCENT	-0.0205	0.4271	0.1525	**0.5178**	0.0396
SANCT	0.4767	0.2459	0.2113	0.224	0.25
ROTATION	0.0197	0.1974	0.2111	0.1123	**0.6512**
CONT_INT	**0.5098**	-0.0091	0.1033	0.1825	0.2879
CONT_EXT	0.0812	0.1072	**0.81**	0.1381	0.0919
IDWPS980	0.104	0.0316	**0.8772**	-0.0306	0.0623
SUP	**0.5678**	0.3746	0.3095	0.1573	-0.1467
WHISTLE INT	**0.6162**	0.044	0.1036	0.2824	0.0974
WHISTLE EXT	0.4899	**0.5444**	-0.1231	0.1457	0.1797
WHISTLE REPORT	0.1624	**0.6376**	0.1363	0.0613	0.0206
WHISTLE OMBUD	0.1613	0.0148	0.1246	0.0604	-0.0268
WHISTLE ANON	**0.6734**	0.2992	-0.0636	0.1282	0.1563
RISK	**0.5691**	0.1017	0.2433	0.1638	0.1048
CULT_CHECK	0.0046	0.2082	0.1232	0.1436	0.2303

Table 4: Descriptive statistics of dependent and control variables

This table provides descriptive statistics - number of observations, mean, standard deviation, minimum and maximum - of the dependent and control variables in our analyses. Variable descriptions are provided in Section 3.

	Firm-year Obs.	Mean	Std. Dev.	Minimum	Maximum
VaR (%)	745	2.90	0.91	1.20	5.46
CVaR (%)	745	4.13	1.38	1.74	8.50
LPM(0,2) (%)	745	1.87	0.61	0.84	3.81
LPM(0,3) (%)	745	2.41	0.90	1.02	5.83
CDS1Y (bp)	675	6.67	9.01	0.05	45.99
CDS5Y (bp)	675	12.65	9.40	1.20	46.24
PD12month (bp)	675	0.00095	0.00136	0.00001	0.00699
PD60month (bp)	675	0.00923	0.00702	0.00054	0.03369
DTD	675	5.84	2.86	-0.22	14.26
Leverage	749	0.63	0.24	0.12	1.46
Sales Growth	747	0.06	0.14	-0.46	0.58
Profitability	749	0.07	0.07	-0.13	0.38
Dividend Yield (%)	745	2.17	1.78	0.00	8.53
Employees	743	35748.40	83857.22	0.00	664496.00
Log(Market Capitalisation)	740	8.04	1.47	5.09	11.42
Risk-free Rate (%)	750	-0.46	0.27	-0.77	-0.05
Equity Return Volatility (%)	745	1.89	0.60	0.87	3.70

Table 5: Compliance effects on downside equity risk

This table presents the dynamic panel estimations of the effects of the compliance score on different proxies for downside equity risks. Coefficients are estimated using a fixed-effects approach (Panel A) and a two-step system GMM approach (Panel B). The system GMM estimation approach employs lagged levels as instruments. The dependent variables are VaR in model (1), CVaR in model (2), LPM(0,2) in model (3) and LPM(0,3) in model (4). Descriptions of these variables are given in Section 3. Standard errors are robust and reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Panel A	FE	FE	FE	FE	Panel B	Sys. GMM	Sys. GMM	Sys. GMM	Sys. GMM
	(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)
	VaR	CVaR	LPM(0,2)	LPM(0,3)		VaR	CVaR	LPM(0,2)	LPM(0,3)
Lagged Dep. Var	-0.316***	-0.319***	-0.307***	-0.315***	Lagged Dep. Var	-0.313**	-0.196	-0.103	0.150
	(0.0472)	(0.0472)	(0.0483)	(0.0468)		-0.137	(0.167)	(0.146)	(0.126)
Compliance Score	-0.0721***	-0.0762***	-0.0415***	-0.0450***	Compliance Score	-0.102***	-0.127***	-0.0650***	-0.0713***
	(0.0122)	(0.0188)	(0.00826)	(0.0131)		-0.0281	(0.0459)	(0.0184)	(0.0259)
Leverage	0.491**	0.505	0.221	0.185	Leverage	0.916	0.756	0.347	0.158
	(0.238)	(0.365)	(0.160)	(0.253)		-0.712	(1.118)	(0.386)	(0.377)
Sales Growth	-0.368	-0.637*	-0.233	-0.389	Sales Growth	-0.519	-0.836	-0.284	0.0449
	(0.234)	(0.360)	(0.158)	(0.251)		-0.679	(1.026)	(0.465)	(0.561)
Profitability	-1.076	-2.506	-1.203*	-2.204*	Profitability	-3.077	-2.259	-1.856	-3.206
	(1.075)	(1.655)	(0.726)	(1.151)		-3.157	(5.015)	(2.021)	(2.350)
Dividend Yield	0.0872***	0.145***	0.0611***	0.0896***	Dividend Yield	0.238**	0.393*	0.201**	0.327***
	(0.0318)	(0.0486)	(0.0214)	(0.0332)		-0.121	(0.205)	(0.0835)	(0.0953)
Employees	-1.98e-06	-3.54e-06	-3.81e-06	-4.05e-06	Employees	4.48E-06	5.64e-06	-4.73e-07	-7.94e-06**
	(6.09e-06)	(9.35e-06)	(4.10e-06)	(6.50e-06)		-1.32E-05	(1.83e-05)	(6.08e-06)	(3.09e-06)
Constant	4.229***	5.951***	2.830***	3.638***	Constant	3.736***	4.791***	2.169***	2.384***
	(0.333)	(0.499)	(0.227)	(0.338)		-0.696	(1.166)	(0.443)	(0.524)
Firm-year Obs.	592	592	592	592	Firm-year Obs.	592	592	592	592
Obs.	150	150	150	150	Obs.	150	150	150	150
R^2	0.198	0.178	0.174	0.155	χ^2	47.87	29.80	29.80	35.55

Table 6: Compliance effects on credit risk

This table presents the dynamic panel estimations of the effects of the compliance score on different proxies for credit risk. Coefficients are estimated using a fixed-effects approach (Panel A) and a two-step system GMM approach (Panel B). The system GMM estimation approach employs lagged levels as instruments. The dependent variables are the 1-year CDS spread in model (1), 5-year CDS spread in model (2), 1-year probability of default in model (3), 5-year probability of default in model (4) and distance to default in model (5). Descriptions of these variables are given in Section 3. Standard errors are robust and reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Panel A	FE	FE	FE	FE	FE	Panel B	Sys. GMM	Sys. GMM	Sys. GMM	Sys. GMM	Sys. GMM
	(1)	(2)	(3)	(4)	(5)		(1)	(2)	(3)	(4)	(5)
	CDS1Y	CDS5Y	PD12month	PD60month	DTD		CDS1Y	CDS5Y	PD12month	PD60month	DTD
Lagged Dep. Var	-0.196***	-0.124***	-0.209***	-0.122***	-0.0708**	Lagged Dep. Var	0.0325	0.0981	-0.0501	0.1000	-0.00641
	(0.0476)	(0.0411)	(0.0489)	(0.0424)	(0.0358)		(0.112)	(0.109)	(0.148)	(0.105)	(0.0988)
Compliance Score	0.425***	0.205*	6.89e-05***	6.66e-05	-0.0192	Compliance Score	0.365***	0.215*	8.84e-05***	5.24e-05	-0.0169
	(0.116)	(0.107)	(1.78e-05)	(8.16e-05)	(0.0294)		(0.136)	(0.120)	(2.34e-05)	(9.78e-05)	(0.0445)
Leverage	7.336***	11.80***	0.00105***	0.00940***	-3.666***	Leverage	7.177**	12.53***	0.00181***	0.00947***	-4.094***
	(1.983)	(1.842)	(0.000305)	(0.00141)	(0.497)		(3.598)	(4.595)	(0.000523)	(0.00339)	(0.931)
Sales Growth	-0.749	1.726	-0.000176	0.00148	-0.492	Sales Growth	2.535	5.466***	-0.000140	0.00452***	-1.086
	(2.020)	(1.857)	(0.000311)	(0.00142)	(0.500)		(2.241)	(2.036)	(0.000415)	(0.00151)	(0.664)
Profitability	-3.479	-0.716	-0.000538	-0.000338	-0.764	Profitability	15.84	4.876	-0.000942	2.87e-05	-7.807
	(10.30)	(9.525)	(0.00158)	(0.00727)	(2.558)		(20.44)	(29.81)	(0.00295)	(0.0220)	(5.210)
Dividend Yield	0.943***	0.533*	0.000148***	0.000397*	-0.156**	Dividend Yield	1.597**	0.931*	0.000273***	0.000698*	-0.348**
	(0.300)	(0.276)	(4.62e-05)	(0.000211)	(0.0752)		(0.663)	(0.541)	(8.58e-05)	(0.000382)	(0.150)
Employees	4.84e-05	6.25e-05	6.71e-09	5.16e-08	-1.02e-05	Employees	0.000146*	0.000113*	1.53e-08	8.19e-08*	-2.52e-05
	(5.43e-05)	(5.00e-05)	(8.35e-09)	(3.82e-08)	(1.36e-05)		(7.59e-05)	(6.58e-05)	(1.11e-08)	(4.73e-08)	(1.86e-05)
Market Value	-8.556***	-6.157***	-0.00133***	-0.00423***	1.047***	Market Value	-8.362***	-6.561***	-0.00133***	-0.00435***	1.079***
	(1.104)	(1.017)	(0.000170)	(0.000776)	(0.275)		(2.229)	(2.295)	(0.000357)	(0.00166)	(0.379)
Risk-free Rate	-1.284	-1.789	-0.000182	-0.00142	-0.957***	Risk-free Rate	-0.928	-1.479	1.86e-05	-0.00129	-0.453
	(1.434)	(1.326)	(0.000221)	(0.00101)	(0.364)		(1.425)	(1.601)	(0.000263)	(0.00117)	(0.492)
Return Volatility	5.146***	6.766***	0.000745***	0.00479***	-2.530***	Return Volatility	4.298***	6.412***	0.000598***	0.00460***	-2.776***
	(0.734)	(0.676)	(0.000113)	(0.000516)	(0.183)		(0.719)	(0.876)	(0.000129)	(0.000637)	(0.267)
Constant	54.81***	37.82***	0.00862***	0.0258***	5.221**	Constant	47.20***	35.11*	0.00768***	0.0230	6.945**
	(9.404)	(8.691)	(0.00145)	(0.00663)	(2.339)		(18.06)	(19.99)	(0.00292)	(0.0143)	(3.156)
Firm-year Obs.	531	531	531	531	531	Firm-year Obs.	531	531	531	531	531
Obs.	136	136	136	136	136	Obs.	136	136	136	136	136
R^2	0.463	0.477	0.461	0.449	0.588	χ^2	162.5	295.3	153.8	230.4	251.1

Table 7: Individual compliance factors and equity risk

This table presents the dynamic panel estimations of the effects of the five individual compliance factors on different proxies for equity risk. Coefficients are estimated using a fixed-effects approach (Panel A) and a two-step system GMM approach (Panel B). The system GMM estimation approach employs lagged levels as instruments. The dependent variables are VaR in model (1), CVaR in model (2), LPM(0,2) in model (3) and LPM(0,3) in model (4). Descriptions of these variables are given in Section 3. The estimations have been run with the same list of control variables as in Table 5. Standard errors are robust and reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Panel A	FE (1) VaR	FE (2) CVaR	FE (3) LPM(0,2)	FE (4) LPM(0,3)
Lagged Dep. Var	-0.315***	-0.316***	-0.303***	-0.312***
	(0.0475)	(0.0475)	(0.0487)	(0.0472)
$\text{Factor}_{Inst.}$	-0.106***	-0.135***	-0.0670***	-0.0785**
	(0.0331)	(0.0508)	(0.0224)	(0.0354)
$\text{Factor}_{Ext.}$	-0.0682	0.0601	-0.0106	0.0410
	(0.127)	(0.196)	(0.0862)	(0.136)
$\text{Factor}_{Cert.}$	-0.0721	-0.0635	-0.0661	-0.110
	(0.0951)	(0.146)	(0.0641)	(0.102)
$\text{Factor}_{Cult.}$	-0.189*	-0.0947	-0.0729	-0.0542
	(0.108)	(0.166)	(0.0728)	(0.115)
$\text{Factor}_{Org.}$	-0.358**	-0.545**	-0.218**	-0.259
	(0.154)	(0.237)	(0.104)	(0.165)
Leverage	0.493**	0.494	0.219	0.179
	(0.239)	(0.366)	(0.161)	(0.254)
Sales Growth	-0.355	-0.603*	-0.221	-0.373
	(0.235)	(0.361)	(0.159)	(0.252)
Profitability	-1.188	-2.654	-1.258*	-2.256*
	(1.076)	(1.656)	(0.727)	(1.154)
Dividend Yield	0.0841***	0.141***	0.0603***	0.0888***
	(0.0319)	(0.0488)	(0.0215)	(0.0334)
Employees	-1.40e-06	-2.44e-06	-3.41e-06	-3.54e-06
	(6.10e-06)	(9.37e-06)	(4.12e-06)	(6.53e-06)
Constant	4.198***	5.891***	2.799***	3.593***
	(0.337)	(0.505)	(0.231)	(0.343)
Firm-year Obs.	592	592	592	592
Obs.	150	150	150	150
R^2	0.205	0.185	0.178	0.158

Panel B	Sys. GMM (1) VaR	Sys. GMM (2) CVaR	Sys. GMM (3) LPM(0,2)	Sys. GMM (4) LPM(0,3)
Lagged Dep. Var	-0.341**	-0.218	-0.0983	0.160
	(0.139)	(0.180)	(0.154)	(0.134)
$\text{Factor}_{Inst.}$	-0.150*	-0.256*	-0.134**	-0.166**
	(0.0887)	(0.138)	(0.0552)	(0.0760)
$\text{Factor}_{Ext.}$	-0.289	-0.0918	0.0580	0.259
	(0.341)	(0.541)	(0.238)	(0.376)
$\text{Factor}_{Cert.}$	0.0267	0.174	-0.00210	0.00324
	(0.226)	(0.313)	(0.115)	(0.142)
$\text{Factor}_{Cult.}$	-0.271	-0.246	-0.128	-0.160
	(0.213)	(0.343)	(0.152)	(0.200)
$\text{Factor}_{Org.}$	-0.408	-0.445	-0.225	-0.318
	(0.313)	(0.480)	(0.220)	(0.273)
Leverage	0.860	0.741	0.350	0.198
	(0.695)	(1.105)	(0.377)	(0.371)
Sales Growth	-0.468	-0.736	-0.230	0.100
	(0.659)	(0.984)	(0.443)	(0.537)
Profitability	-3.017	-2.557	-1.982	-3.425
	(3.072)	(4.934)	(2.016)	(2.356)
Dividend Yield	0.234*	0.379*	0.201**	0.328***
	(0.121)	(0.208)	(0.0844)	(0.0977)
Employees	4.39e-06	5.75e-06	-8.41e-07	-8.89e-06***
	(1.30e-05)	(1.90e-05)	(6.33e-06)	(3.32e-06)
Constant	3.929***	4.982***	2.164***	2.318***
	(0.728)	(1.295)	(0.490)	(0.574)
Firm-year Obs.	592	592	592	592
Obs.	150	150	150	150
χ^2	54.29	30.96	32.96	39.06

Table 8: Individual compliance factors and credit risk

This table presents the dynamic panel estimations of the effects of the total compliance score on different proxies for credit risk. Coefficients are estimated using a fixed-effects approach (Panel A) and a two-step system GMM approach (Panel B). The system GMM estimation approach employs lagged levels as instruments. The dependent variables are the 1-year CDS spread in model (1), 5-year CDS spread in model (2), 1-year probability of default in model (3), 5-year probability of default in model (4) and distance to default in model (5). Descriptions of these variables are given in Section 3. The estimations have been run with the same list of control variables as in Table 6. Standard errors are robust and reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Panel A	FE (1) CDS1Y	FE (2) CDS5Y	FE (3) PD12month	FE (4) PD60month	FE (5) DTD
Lagged Dep. Var	-0.206***	-0.131***	-0.219***	-0.130***	-0.0652*
	(0.0479)	(0.0413)	(0.0492)	(0.0428)	(0.0360)
$\text{Factor}_{Inst.}$	0.689**	0.251	0.000113**	3.89e-06	0.0163
	(0.299)	(0.276)	(4.59e-05)	(0.000211)	(0.0754)
$\text{Factor}_{Ext.}$	1.932*	1.759*	0.000292*	0.000990	-0.509*
	(1.087)	(1.003)	(0.000167)	(0.000768)	(0.273)
$\text{Factor}_{Cert.}$	-1.603**	-1.436**	-0.000239**	-0.00103*	0.0183
	(0.780)	(0.721)	(0.000120)	(0.000551)	(0.195)
$\text{Factor}_{Cult.}$	1.611*	1.268	0.000250*	0.000892	-0.195
	(0.901)	(0.829)	(0.000139)	(0.000634)	(0.224)
$\text{Factor}_{Org.}$	-0.668	-1.144	-8.95e-05	-0.000627	0.419
	(1.368)	(1.262)	(0.000211)	(0.000965)	(0.343)
Controls	Yes	Yes	Yes	Yes	Yes
Firm-year Obs.	531	531	531	531	531
Obs.	136	136	136	136	136
R^2	0.477	0.489	0.474	0.458	0.593

Panel B	Sys. GMM (1) CDS1Y	Sys. GMM (2) CDS5Y	Sys. GMM (3) PD12month	Sys. GMM (4) PD60month	Sys. GMM (5) DTD
Lagged Dep. Var	0.0325	0.131	-0.0455	0.132	0.0166
	(0.112)	(0.110)	(0.151)	(0.107)	(0.102)
$\text{Factor}_{Inst.}$	0.294	-0.0927	9.93e-05**	-0.000357	0.0822
	(0.355)	(0.330)	(5.04e-05)	(0.000278)	(0.114)
$\text{Factor}_{Ext.}$	2.744*	2.679**	0.000674***	0.00193*	-0.778*
	(1.557)	(1.358)	(0.000222)	(0.00101)	(0.463)
$\text{Factor}_{Cert.}$	0.346	0.843	1.70e-05	0.000704	-0.187
	(0.792)	(0.879)	(0.000213)	(0.000611)	(0.175)
$\text{Factor}_{Cult.}$	1.066	0.880	-1.02e-06	0.000601	-0.340
	(1.078)	(0.949)	(0.000156)	(0.000695)	(0.252)
$\text{Factor}_{Org.}$	1.771	1.286	0.000148	0.00131	0.297
	(1.357)	(1.393)	(0.000188)	(0.00103)	(0.465)
Controls	Yes	Yes	Yes	Yes	Yes
Firm-year Obs.	531	531	531	531	531
Obs.	136	136	136	136	136
χ^2	171.8	284.8	195.0	233.7	261.5

Table 9: Time-dependency of compliance-risk effects

This table presents Fama-MacBeth estimation results on downside equity risks (Panel A) and on credit risks (Panel B). Descriptions of the dependent variables are given in Section 3. All regressions contain the same set of control variables as in Tables 5 and 6. Standard errors are calculated according to Newey and West (1987). They are robust to heteroscedasticity and autocorrelation (with a lag length of 1) and reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Panel A: Equity Risks	FMB (1) VaR	FMB (2) CVaR	FMB (3) LPM(0.2)	FMB (4) LPM(0.3)
2014	-0.0270	-0.0447	-0.0178	-0.0234
2015	-0.0368	-0.0486	-0.0203	-0.0224
2016	-0.0464	-0.0599	-0.0264	-0.0328
2017	-0.0448	-0.0625	-0.0293	-0.0407
2018	-0.0397	-0.0657	-0.0299	-0.0398
Mean	-0.0389***	-0.0563***	-0.0248***	-0.0318***

Panel B: Credit Risks	FMB (1) CDS1Y	FMB (2) CDS5Y	FMB (3) PD12Month	FMB (4) PD60Month	FMB (5) DtD
2014	0.0212	0.0885	0.000002	0.0001	-0.0347
2015	0.2519	0.3788	0.00004	0.0003	-0.0780
2016	0.1676	0.2570	0.00002	0.0002	-0.0743
2017	0.2921	0.5105	0.00004	0.0004	-0.0970
2018	0.3122	0.3835	0.00005	0.0003	-0.0477
Mean	0.209**	0.324***	2.99e-05**	0.000238***	-0.0663***

Table 10: Compliance effects on downside equity risk - Financial firms

This table presents the dynamic panel estimations of the effects of the compliance score on different proxies for downside equity risks for the 27 financial firms in our sample. Coefficients are estimated using a fixed-effects approach (Panel A) and a two-step system GMM approach (Panel B). The system GMM estimation approach employs lagged levels as instruments. The dependent variables are VaR in model (1), CVaR in model (2), LPM(0,2) in model (3) and LPM(0,3) in model (4). Descriptions of these variables are given in Section 3. Standard errors are robust and reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Panel A	FE	FE	FE	FE	Panel B	Sys. GMM	Sys. GMM	Sys. GMM	Sys. GMM
	(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)
	VaR	CVaR	LPM(0,2)	LPM(0,3)		VaR	CVaR	LPM(0,2)	LPM(0,3)
Lag. Dep. Var	-0.338***	-0.375***	-0.304***	-0.297***	Lagged Dep. Var	-0.339**	-0.341***	-0.313**	-0.283**
	(0.0954)	(0.103)	(0.107)	(0.107)		(0.140)	(0.132)	(0.124)	(0.127)
Compliance Score	-0.130***	-0.153***	-0.0719***	-0.0824***	Compliance Score	-0.180***	-0.231***	-0.109***	-0.130***
	(0.0270)	(0.0410)	(0.0177)	(0.0238)		(0.0284)	(0.0490)	(0.0174)	(0.0227)
Leverage	0.105	-0.479	-0.0394	-0.188	Leverage	-0.248	-0.739	-0.252	-0.323
	(0.372)	(0.560)	(0.246)	(0.330)		(0.367)	(0.619)	(0.249)	(0.339)
Sales Growth	0.664*	0.987*	0.505**	0.579*	Sales Growth	1.221***	1.606*	0.748***	0.798**
	(0.333)	(0.503)	(0.218)	(0.292)		(0.468)	(0.856)	(0.270)	(0.363)
Profitability	-5.523	-5.547	-3.749	-4.089	Profitability	-8.194	-9.985	-6.306*	-6.475
	(4.404)	(6.663)	(2.890)	(3.867)		(8.182)	(15.85)	(3.683)	(5.913)
Dividend Yield	-0.0257	0.0107	-0.0111	0.0172	Dividend Yield	0.0640	0.0150	0.0351	0.0759
	(0.0714)	(0.108)	(0.0477)	(0.0631)		(0.136)	(0.207)	(0.0847)	(0.0862)
Employees	-4.93e-05	-9.24e-05	-2.72e-05	-4.33e-05	Employees	6.13e-05**	7.59e-05*	3.54e-05*	4.43e-05*
	(6.75e-05)	(0.000102)	(4.44e-05)	(5.95e-05)		(2.93e-05)	(4.43e-05)	(2.01e-05)	(2.65e-05)
Constant	5.367***	7.962***	3.245***	4.119***	Constant	4.357***	6.379***	2.811***	3.241***
	(1.185)	(1.812)	(0.803)	(1.070)		(1.034)	(1.143)	(0.463)	(0.537)
Firm-year Obs.	103	103	103	103	Firm-year Obs.	103	103	103	103
Obs.	27	27	27	27	Obs.	27	27	27	27
R^2	0.384	0.330	0.319	0.272	χ^2	88.41	90.72	96.14	78.28

Table 11: Compliance effects on credit risk - Financial firms

This table presents the dynamic panel estimations of the effects of the compliance score on different proxies for credit risk for the 27 financial firms in our sample. Coefficients are estimated using a fixed-effects approach (Panel A) and a two-step system GMM approach (Panel B). The system GMM estimation approach employs lagged levels as instruments. The dependent variables are the 1-year CDS spread in model (1), 5-year CDS spread in model (2), 1-year probability of default in model (3), 5-year probability of default oin model (4) and distance to default in model (5). Descriptions of these variables are given in Section 3. Standard errors are robust and reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Panel A	FE	FE	FE	FE	FE	Panel B	Sys. GMM	Sys. GMM	Sys. GMM	Sys. GMM	Sys. GMM
	(1)	(2)	(3)	(4)	(5)		(1)	(2)	(3)	(4)	(5)
	CDS1Y	CDS5Y	PD12month	PD60month	DTD		CDS1Y	CDS5Y	PD12month	PD60month	DTD
Lag. Dep. Var	-0.350***	-0.185*	-0.400***	-0.237**	-0.0760	Lagged Dep. Var	-0.0603	0.00927	0.0298	0.0291	0.0886
	(0.123)	(0.0957)	(0.131)	(0.0941)	(0.0972)		(0.373)	(0.605)	(0.269)	(0.569)	(0.211)
Compliance Score	0.261	0.0509	4.42e-05	-0.000241*	0.106	Compliance Score	0.268	0.195	9.30e-05	-2.60e-05	0.0346
	(0.231)	(0.180)	(3.71e-05)	(0.000133)	(0.0789)		(0.871)	(0.367)	(6.96e-05)	(0.000320)	(0.0965)
Leverage	2.640	5.755**	0.000369	0.00504***	-1.402	Leverage	5.068	8.352	0.00179***	0.00645	-1.733
	(2.921)	(2.299)	(0.000469)	(0.00170)	(0.977)		(5.214)	(6.289)	(0.000648)	(0.00471)	(1.227)
Sales Growth	5.245**	4.560**	0.000809**	0.00357**	-1.573*	Sales Growth	4.436	3.164	0.000608	0.00271	-1.388
	(2.504)	(1.963)	(0.000403)	(0.00145)	(0.866)		(5.340)	(4.005)	(0.000406)	(0.00272)	(1.402)
Profitability	-46.84	-42.18*	-0.00723	-0.0234	21.69**	Profitability	-115.4	-23.88	-0.00981	-0.0142	22.58*
	(32.26)	(24.95)	(0.00519)	(0.0185)	(10.70)		(219.4)	(90.50)	(0.0142)	(0.0542)	(12.54)
Dividend Yield	0.537	0.123	8.88e-05	0.000236	-0.00496	Dividend Yield	1.103	1.017	0.000166	0.000673	-0.160
	(0.545)	(0.417)	(8.77e-05)	(0.000309)	(0.179)		(0.838)	(0.666)	(0.000116)	(0.000469)	(0.347)
Employees	0.000909	0.000914**	1.32e-07	4.00e-07	-2.03e-05	Employees	0.000983	0.00108	1.70e-07**	5.23e-07	-4.53e-05
	(0.000571)	(0.000443)	(9.17e-08)	(3.28e-07)	(0.000188)		(0.000773)	(0.000820)	(8.25e-08)	(7.80e-07)	(9.00e-05)
Market Value	-12.76***	-8.084***	-0.00206***	-0.00288	0.443	Market Value	-18.27	-7.902	-0.00439***	-0.00266	0.443
	(3.349)	(2.525)	(0.000539)	(0.00187)	(1.055)		(11.24)	(6.667)	(0.00135)	(0.00778)	(1.005)
Risk-free Rate	1.332	0.574	0.000223	-0.000301	-0.358	Risk-free Rate	-0.152	0.0493	-6.70e-05	0.000199	-0.298
	(2.801)	(2.202)	(0.000451)	(0.00163)	(1.001)		(3.629)	(3.819)	(0.000354)	(0.00275)	(1.281)
Return Volatility	-0.571	1.895	-0.000145	0.00105	-1.974***	Return Volatility	-2.246	2.023	-0.000784	0.00117	-2.344***
	(1.773)	(1.364)	(0.000285)	(0.00101)	(0.583)		(4.380)	(3.673)	(0.000508)	(0.00277)	(0.807)
Constant	94.74***	56.64***	0.0155***	0.0225	4.512	Constant	138.0	46.32	0.0327***	0.0141	5.918
	(25.11)	(18.85)	(0.00405)	(0.0140)	(8.077)		(94.84)	(54.88)	(0.0108)	(0.0579)	(8.788)
Firm-year Obs.	102	102	102	102	102	Firm-year Obs.	102	102	102	102	102
Obs.	27	27	27	27	27	Obs.	27	27	27	27	27
R^2	0.490	0.535	0.493	0.489	0.499	χ^2	71.19	62.64	50.44	53.57	107.8

Appendix

Elements of the compliance score

CCO (#1)	Existence of chief compliance officer (CCO) or other compliance officer
BOARD (#2)	Existence of compliance committee at board level
C_ORG (#3)	Company uses specific compliance organization
COSO (#4)	Internal system of control follows COSO standard
C_CULT (#5)	Compliance culture mentioned as essential factor of corporate culture
TONE (#6)	Executive team recognizes compliance as relevant component of tone at the top
UN Global Compact (#7)	Member of UN Global Compact
COC (#8)	Existence of a code of conduct
SUP_COC (#9)	Existence of a code of conduct for suppliers
TRAINING (#10)	Compliance trainings offered
INCENT (#11)	Compliance is a target in management compensation system
SANCT (#12)	Penalization of compliance infringements
ROTATION (#13)	Job rotation
CON_INT (#14)	Internal compliance controls
CON_EXT (#15)	External compliance controls
IDWPS980 (#16)	Compliance system certified according to IDW PS 980
SUP (#17)	Compliance check of business partners (customers, suppliers, licensees)
WHISTLE INT (#18)	Existence of internal whistleblower facility (e.g. compliance officer, work council)
WHISTLE EXT (#19)	Existence of external whistleblower facility (e.g. hotline)
WHISTLE REPORT (#20)	Reporting of the whistleblowing activities
WHISTLE_ OMBUD (#21)	Existence of an ombudsman as whistleblowing facility
WHISTLE_ AN (#22)	Whistleblowing system guarantees anonymity
RISK (#23)	Existence of a compliance risk assessment
CULT_CHECK (#24)	Regular employee surveys regarding compliance culture