Essays in Corporate Governance

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A Thesis
In the Department
of
Finance
John Molson School of Business

Presented in Partial Fulfillment of the Requirements
For the Degree of
Doctor of Philosophy (Business Administration, Finance) at
John Molson School of Business
Concordia University
Montreal, Quebec, Canada

August 2020

CONCORDIA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

This is to certify that the thesis prepared

By: Pedram Fardnia

Entitled: Essays in corporate governance

and submitted in partial fulfillment of the requirements for the degree of

Doctor of Philosophy (Finance)

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ABSTRACT

Essays in corporate governance

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Concordia University, 2020

Corporate governance is a heavily researched area in the finance literature, with previous studies exploring a multitude of variables that describe a firm's board structure, management, compensation, etc., and how they affect corporate decisions, firm performance, and various other aspects of corporate life. Corporate governance has important implications for nearly all business entities, yet many research questions within the field still remain unaddressed.

In the first part of my thesis, I explore the relation between corporate governance practices and shareholder litigation. At the same time, I explore whether firms improve any shortcomings in their governance structure and/or governance practices post-litigation. We find evidence that variables that describe a firm's corporate governance, the compensation of its CEO, as well as the CEO's characteristics have a significant influence on the firm's litigation risk. Our results further show that, after a lawsuit, sued firms tend to improve their corporate governance and the proportion of their independent directors. In summary, our results provide important insights into the role of ex-ante active monitoring (via the board of directors) versus ex-post passive monitoring (via shareholder litigation), and how litigation as a passive monitoring device can cause firms to improve their active monitoring.

In another research, I choose the aviation industry and examine the potential effects corporate governance policies may have on the safety record of that industry. Pilot errors and mechanical failures, which are responsible for 75% of all accidents, are, to some extent, preventable because they relate to the way an airline company is managed. My findings reveal that airline safety is significantly affected by a series of firm-level characteristics that describe an airline's governance as well as its financial well-being. In addition, I find that airline safety is affected by a variety of country-level factors that characterize the legal, institutional, and economic environment of a given country, as well as its air transport infrastructure. The results of this study have important policy implications for both the airline industry and regulators. To allocate resources more efficiently, regulators may find it beneficial to focus their supervision on airlines with poor governance practices as well as airlines that are in financial distress.

Acknowledgements

Firstly, I would like to express my sincere gratitude to my advisor Prof. Thomas Walker for the continuous support of my Ph.D. study, for his patience, and immense knowledge. His guidance helped me in all the time of research and writing of this thesis. I could not have imagined having a better advisor and mentor for my Ph.D. study.

Besides my advisor, I would like to thank the rest of my thesis committee: Prof. Maher Kooli, Prof. Frederick Davis, Prof. Ernest Biktimirov and Prof. Carmela Cucuzzella for their insightful comments.

I am grateful to my wife Parisa Rashno and my parents Parvin and Parviz, who have provided me through moral and emotional support in my life. I am also grateful to my other family members and friends who have supported me along the way.

And finally, last but by no means least, also to everyone in the PhD Program, it was great sharing office spaces with all of you during last five years.

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On the causes and consequences of shareholder class action litigation

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Abstract

In this paper, we investigate whether a firm's corporate governance characteristics affect its likelihood of being sued in a shareholder class action lawsuit after controlling for known determinants of shareholder litigation based on the extant literature. In addition, we explore whether shareholder litigation causes firms to overhaul and improve their corporate governance practices. We find evidence that variables that describe a firm's corporate governance, the compensation of its CEO, as well as the CEO's characteristics have a significant influence on the firm's litigation risk. Specifically, a firm's likelihood of being sued depends on board variables, including its board size, board independence, the size of the nominating committee, nominating committee independence, and CEO/chairman duality. In addition, firms whose CEOs have longer tenure or serve in a dual CEO/chairman role are more likely to be sued. Our results further show that, after a lawsuit, sued firms tend to improve their corporate governance and the proportion of their independent directors. In addition, we document that the accounting performance of sued firms decreases two years after a given lawsuit; however, if sued firms improve their governance, their accounting performance improves as well. In summary, our

results provide important insights into the role of ex-ante active monitoring (via the board of directors) versus ex-post passive monitoring (via shareholder litigation), and how litigation as a passive monitoring device can cause firms to improve their active monitoring.

Key Words: Litigation, Corporate Governance, Board of Directors

JEL Classification: G39, G30

1. Introduction

Corporate scandals occur frequently in the U.S., and often prompt practitioners and scholars to question the effectiveness of the corporate governance standards U.S. firms employ either voluntarily or in adherence to government regulations. Popular opinion is that managerial fraud and the associated accounting and/or financial scandals are the result of a deficiency in corporate governance, which explains why corporate governance has become the most discussed topic in the finance literature. For example, a 2018 Wall Street Journal article[1] looks into the failure of Wynn Resorts, the biggest casino and resort in Las Vegas. The author reports that after a series of sexual misconduct allegations against Steve Wynn, chairman and CEO of the company, shares of Wynn Resorts plunged drastically. Investigations into the matter by the Securities and Exchange Commission (SEC) uncovered serious corporate governance problems related to the company's board. The resultant report suggests that because of a lack of diversity and independence on the Wynn Resorts board, the company ranks last in corporate governance quality when compared to its peers and that the lack of active internal monitoring caused the firm's troubles.

The Sarbanes-Oxley Act of 2002 was a response to similar scandals (surrounding such firms as Enron and WorldCom, among many others) that shook the corporate landscape in the early 2000s. Congress passed the Act in an attempt to improve the quality of corporate governance in U.S. based corporations. A common finding of studies that explore the consequences of shareholder litigation is that corporate scandals result in considerable valuation losses for the affected firms (Fich and Shivdasani, 2007; Bernile and Jarrell, 2009; Chen, 2016); with a large proportion of the losses being linked to reputational costs for sued firms. Most shareholder class actions are filed under Section 10-b5 of the 1934 Securities Exchange Act which protects investors against outright fraudulent practices but also permits shareholders to file a lawsuit against managers who appear to act in their personal (rather than the shareholders') interest. For instance, a 2019 article by the Wall Street Journal[2] studies the lawsuit filed by Boaz Weinstein, the manager of a $1.7 billion hedge fund. Weinstein sued BlackRock Inc., the world's largest asset manager, arguing that they blocked outsiders from gaining board seats at three of its funds. The article's author alleges that corporate governance failures were the culprit for the lawsuit.

[1] See https://www.wsj.com/articles/the-board-of-wynn-resorts-needs-to-go-too-1518042289 for details
[2] See https://www.wsj.com/articles/boaz-weinstein-sues-blackrock-alleging-corporate-governance-failings-11559746961 for details

The 2001 Enron Corporation case[3] epitomizes the issue of improper corporate governance. In 2001, Enron filed for bankruptcy because shareholders discovered that the management, acting in their self-interest, had fabricated accounting reports that inflated the firm's performance. Based on Stanford University's Securities Class Action Clearinghouse (http://securities.stanford.edu), from 1996 to 2019, there have been 2,419 settlements worth more than $98 billion in the U.S.; the Enron scandal resulted in the largest settlement in the database's history, worth more than $7 billion.

The plaintiff parties in securities class action lawsuits frequently argue that corporate governance failures allowed management to defraud investors. As such, it is reasonable to assume that good governance practices should be associated with less shareholder litigation, whereas bad practices should be linked to more lawsuits. This inspires our empirical research questions: Do a firm's corporate governance practices have predictive power with regard to class action lawsuits? And: Do firms change their corporate governance practices after being sued? To the best of our knowledge, our study is among the first to answer these two questions using a large number of governance measures.

Because of the significant stock price losses typically associated with a lawsuit, there has been considerable interest among academics and practitioners in the factors that drive securities class action lawsuits (Coles et al., 1994; 1998; Uzun et al., 2004; Peng and Roell, 2007; Jones and Wu, 2010). Other studies have closely looked at corporate governance changes after lawsuits and the ways firms have tried to improve their corporate governance practices after lawsuits (Agarwal et al., 1999; Minnick et al., 2015; Walker et al., 2017).

In this paper, we examine the relationship between corporate governance practices and litigation risk. We investigate the determinants of a firm's litigation risk using a series of logit models while controlling for known factors based on the existing literature. Because lawsuits lead to significant valuation losses for investors, and because both the public and the firm's shareholders tend to exert pressure on firms to reform their governance practices following a lawsuit, we also explore the aftermath of securities class action lawsuits. Specifically, we examine how a lawsuit affects a firm's corporate governance characteristics and performance by examining post-litigation changes in the firm's governance index, its board structure, and ROA.

[3] See http://securities.stanford.edu/filings-case.html?id=102098 for details

The remainder of this study is organized as follows: Section 2 summarizes the literature and develops our hypotheses, Section 3 describes the data and the sample selection process, Section 4 introduces our methodology and presents the empirical results of our regression analysis, Section 5 discusses the results for a series of robustness tests. Section 6 concludes the paper.

2. Literature Review and Hypothesis Development

Our study contributes to two substantial strands of the literature that examine (1) the determinants of lawsuits, and (2) the governance changes after lawsuits. Scholars have studied different aspects of corporate governance practices in relation to lawsuits, including a firm's compensation policy, board structure, ownership structure, and CEO characteristics, which we review in this section.

2.1 Compensation Policy

Many firms use stock options in executive compensation because, on one hand, stock options tend to link executive compensation with changes in shareholders' wealth. As a result, the use of stock options as part of managerial remuneration is perceived to increase shareholders' wealth while reducing agency problems. On the other hand, critics of stock options have argued that stock options motivate managers to take on additional risk and manipulate the company's stock price in an attempt to reap a higher value of their options. Denis et al. (2006) test the relationship between securities fraud allegations and a firm's compensation structure and find a significant positive relationship between the likelihood of litigation and a measure of executive stock option incentives. In another study, Peng and Roell (2007) test the association between executive options pay and the likelihood of litigation and find that incentive pay in the form of options increases the probability of securities class action litigation.

2.2 Board Structure

The board of directors is responsible for monitoring the actions of the CEO and the management team on behalf of shareholders. Ideally, the board provides full supervision and reduces agency problems; however, in many firms, boards may – for various reasons examined herein – not provide enough managerial oversight.

Examining the relation between board composition and firm performance is an important topic in the corporate governance literature. Many scholars argue that the composition of the board of directors affects its effectiveness. The literature generally offers two opposing views regarding the board of directors' effectiveness on corporate governance, particularly with respect to the membership of inside versus outside directors: the first view states that inside

directors follow managers' decisions and act in favor of CEOs, not shareholders; the opposing view claims that insiders are highly skilled decision-makers who enhance board monitoring power over a CEO, and therefore lead rather than follow other board members. In a litigation context, Helland and Sykuta (2005) suggest that sued firms have smaller boards and a higher proportion of insider directors than non-sued firms. Similarly, Uzun et al. (2004) report that firms with a higher proportion of outsiders on the board of directors, the board's audit, and the compensation committees are less likely to experience managerial fraud. In related research, Minnick et al. (2015) examine changes in governance, including board composition, that occur after a lawsuit. They report that firms tend to undergo considerable changes in corporate governance and that these changes improve the firm's performance in the years following the lawsuit.

2.3 Governance Index

Gompers, Ishii, and Metrick (2003) construct an index to proxy for the level of shareholder rights. Many scholars use the Gompers et al. index as a proxy for the balance of power between managers and shareholders. Most closely related to our study, Fich and Shivdasani (2007) use the index to measure the effect of a firm's governance characteristics on the firm's litigation risk, finding that weak governance significantly increases the likelihood of a lawsuit. In another study, Kalchev (2008) hypothesizes that the likelihood of a lawsuit decreases as a result of better-quality corporate governance. He constructs a governance index based on a series of principal components. Contrary to Gompers et al. (2003), he assigns different weights to the variables and finds evidence that the quality of corporate governance predicts the likelihood of shareholder litigation.

2.4 Ownership Structure

Another effective governance mechanism that has been shown to successfully reduce agency problems is a firm's equity ownership structure, i.e., the identities of investors and the magnitude of their positions. The recent literature regarding shareholder litigation proposes that institutional investors can affect a firm's litigation risk. Mohan (2007) claims that firms with lower institutional holdings are more likely to be sued. In contrast, Denis et al. (2006) find no significant relationship between institutional ownership or block ownership and the likelihood of fraud allegations; however, in firms with higher institutional ownership, they report a strong positive relation between option intensity and the probability of being sued.

Finally, several studies have examined the effect of CEO stock ownership on a firm's decisions. For instance, Baker and Mueller (2002) study the determinants of firms' R&D spending, including the CEOs' stock ownership of these firms. They expect a positive

relationship between a firm's R&D expenditures and the extent of its CEO's stock ownership, showing that the higher the CEO's stock ownership, the higher the firm's R&D expenditures. As an extension, they argue that this also leads to a higher probability of fraud because research and development is risky due to its long-term objectives and high failure rates. Conversely, agency theory suggests that the increased at-risk wealth of CEOs encourages managers to align their objectives with the goal of shareholder wealth maximization, hence lowering the likelihood of a shareholder lawsuit. Therefore, the effect of CEO stock ownership on the probability of a lawsuit is inconclusive.

2.5 Hypotheses

Corporate governance includes a range of issues pertaining to the direction and management of firms. In general, strong corporate governance is both legally mandated and, in most firms, voluntarily pursued, thereby involving both management compliance and discretionary judgment. As outlined in our literature review, high-quality corporate governance, and the associated active monitoring of the firm's management, has been associated with numerous benefits in prior studies. As an extension of this discussion, we expect that poor active monitoring increases the need for passive monitoring or, in our context, shareholder litigation. We thus postulate the following hypothesis:

Hypothesis 1: *Firms with poor corporate governance are more likely to be sued.*

To test this hypothesis, we construct an index similar to the Gompers, Ishii, and Metrick (2003) governance index to measure the governance quality of firms, where a high governance index indicates weak governance. Another aspect of corporate governance that we consider in this study relates to the characteristics of the board of directors. Many scholars have tested the managerial power hypothesis, which states that the managers' influence over the board of directors allows the former to extract rent (Dechow et al., 1996; Karpoff et al., 1996; Weisbach, 1988; Mauslis et al., 2011). The assumption is that by making boards more independent from management, the possibility of the aforementioned exploitations decreases, and hence a firm's corporate governance improves. In another study, Fich and Shivdasani (2007) test the endogenous board hypothesis, which states that lawsuits are a threat to a firm and its continued existence, therefore causing the board's outside directors to spend more time monitoring the company. The authors also find a significant decline in outside directorships following a lawsuit as outside board members seek associations with 'better' firms; conversely, Helland (2006) shows that the number of board seats occupied by outside directors increases after a firm is sued, likely due to the pressure a lawsuit exerts on a sued firm's board.

Therefore, the literature suggests that the size and structure of the board influence the effectiveness of internal monitoring mechanisms. Weisbach (1988) finds evidence that a high percentage of outsiders on the board of directors will be more concerned about shareholder benefits and firm performance than a board with a low percentage of outsiders on the board. In addition, Yermack (1996) reports that firms with small boards are more effective and perform better.

Other scholars (e.g., Strahan, 1998; Niehaus and Roth, 1999; Ferris et al., 2007) examine the board structure following a lawsuit. Their findings confirm that firms implement value-enhancing improvements in corporate governance in the aftermath of a lawsuit. They argue that this upturn is partially caused by the fact that, following a lawsuit, the current CEO of a sued firm tries to improve the firm's corporate governance practices to signal to shareholders and directors that the firm will recover from the lawsuit-induced valuation loss. In line with these arguments, we propose the following hypotheses.

Hypothesis 2a: *Firms with larger boards are more likely to be sued.*

Hypothesis 2b: *Firms with less independent boards are more likely to be sued.*

Hypothesis 2c: *Firms with less independent nominating committees are more likely to be sued.*

We use several variables to proxy for the quality of a firm's corporate governance mechanisms. Specifically, based on the literature, we create the following variables related to the board of directors: the *board size*, the *ratio of independent directors,* the *ratio of insiders who hold independent outside directorships*, the *ratio of independent directors who are also part of the nominating committee*, the *ratio of board members who sit on more than one board*, the *ratio of nominating committee members*, a *CEO/chairman duality dummy*, and the *proportion of non-employee block holders*.

We define board size as the number of directors serving on the board of a firm and use this value as the denominator of other governance ratios to scale those values to a range between 0 and 1. Following Masulis and Mobs (2011), we define a unique variable to develop a differentiation method among executives. Specifically, we refer to inside directors with outside directorship(s) as externally certified inside directors (CIDs)[4] and postulate the following hypothesis:

[4] For consistency with the literature, we exclude appointments to affiliated insiders and insiders with family connections and only include independent outside directorships in our definition of CIDs.

Hypothesis 3: *Firms with a higher proportion of externally certified inside directors (CIDs) are less likely to be sued.*

When examining the influence of CEO characteristics on firm performance and corporate decisions, Baker and Mueller (2002) find that R&D spending is higher when CEOs are younger. They explain their findings by showing that older CEOs are more conservative and tend to be more risk-averse in the management of their company, compared to younger CEOs. Denis et al. (2006) find that the age of the CEO is lower in firms that committed fraud and that the difference is statistically significant, in turn also suggesting that firms with younger CEOs are more likely to be involved in a lawsuit. In contrast, Nelson (2005) finds no relationship between CEO age, tenure, and governance changes. This prompts our fourth hypothesis, again with two sub-hypotheses:

Hypothesis 4a: *Firms with older CEOs are less likely to be sued.*

Hypothesis 4b: *Firms with CEOs who have long tenure are less likely to be sued.*

Another factor that affects the active monitoring ability of a firm is its ownership structure. High analyst coverage, as well as a large portion of institutional investors, are both considered as positive influences for a firm's monitoring ability. Mohan (2004) finds that firms with large institutional block holders are less likely to be sued, referring to the monitoring role of institutional investors. In line with this literature, we determine Hypotheses 5a and 5b as follows:

Hypothesis 5: *Firms with higher institutional ownership are less likely to be sued.*

Murphy (1999) summarizes the empirical and theoretical research in the literature on executive compensation. Although there are various executive compensation packages across firms and industries, most CEO pay packages contain four components: a base salary, an annual performance bonus, stock options, and long-term incentive plans (restricted shares, etc.). The base salary is a fixed component in executive contracts, and if it comprises a dominant portion of a CEO's compensation package, executives will avoid taking on unnecessary additional risks, which would otherwise increase the other components of their compensation package. In the end, a higher proportion of fixed compensation should, therefore, reduce the chances of being sued because of the reduced managerial risk taking.

In the empirical research literature, scholars have linked executive stock options to both earnings and stock price manipulations. In addition, stock option incentive plans have been shown to increase the likelihood of a firm being sued (Peng and Roell, 2008; Jones and Wu, 2010). In theory, both stock options and long-term incentive plans, such as restricted shares, are meant to align managerial incentives with shareholder interests. This paper attempts to

determine which of these two effects dominates in practice and whether stock option incentive plans increase or decrease the likelihood of a lawsuit. We hypothesize the following links between CEO compensation and a firm's litigation likelihood:

Hypothesis 6a: *Firms whose CEOs receive a higher proportion of performance-based compensation are more likely to be sued.*

Hypothesis 6b: *Firms whose CEOs receive a higher proportion of compensation from long-term incentive plans are more likely to be sued.*

There are many papers in the financial and legal literature that investigate what happens after a firm has been sued (e.g., Fich and Shivdasani, 2007; Gande and Lewis, 2009; Volker Laux, 2010; Humphery-Jenner, 2012; Hutton et al., 2014; Minnick et al., 2015; Walker et al., 2017). While lawsuits may have adverse effects on a firm as well as its managers and board members, they may also improve its corporate governance characteristics. For instance, McTier and Wald (2011) document various changes in firm policy following a lawsuit, all in accordance with a reduction in agency costs. Similarly, Ferris et al. (2007) show improvements in several governance measures after derivative lawsuits. In another study, Helland (2006) finds that after a lawsuit, the number of outside directors in the corporation's board increases. Our paper elucidates this matter by examining developments in our governance measures following a lawsuit. We expect that, following a lawsuit, firms revise their board structure and corporate governance policies in response to public and shareholder pressure, and to avoid future lawsuits.

Hypothesis 7a*: Following a lawsuit, firms will improve their governance practices.*

Hypothesis 7b*: Following a lawsuit, firms will improve their board structure.*

3. Methodology and Data Description

3.1 Model Specification and Empirical Approach

We follow the extant literature and employ a series of logit regression models to identify the determinants of a firm's litigation risk. In addition, when examining the consequences of shareholder class action lawsuits, we use a series of ordinary least squares (OLS) regressions with a firm's accounting performance and various governance measures as dependent variables. To address the potential endogeneity concerns which are common in corporate governance research, we estimate our models using different methods, including an instrumental variable Probit regression.

Our main logit regression model can be specified as follows:

$$Sued_i = f(Corporate\ Governance\ Proxies_i, Control\ Variables_i)$$

where:

$Sued_i$ is a dummy variable that identifies whether a firm was sued in a securities class action lawsuit (1=yes, 0=no),

$Corporate\ Governance\ Proxies_i$ represent a set of variables that measure a firm's corporate governance, including the *G-index*, *board size,* the *ratio of independent directors,* the *ratio of directors holding more than 1 seat,* the *ratio of non-employee block holders,* a *CEO/chairman duality dummy*, and

$Control\ Variables_i$ are a set of variables that have previously been associated with shareholder class action litigation, including a firm's *book-to-market ratio*, *ROA, intangible assets, leverage, dividend payout ratio, price volatility, stock turnover, and the firm's prior return*.

We estimate the above regression for our sample of sued firms and a sample of propensity score-matched non-sued firms to avoid selection biases in our sample. For each sued and non-sued firm, we collect information from various different databases, including COMPUSTAT, CRSP, ISS Directors, ISS Governance, Execucomp, IBES, and Thompson 13f. Specifically, we create a sample of firm-year observations by merging the various databases (see our discussion below regarding our filtering criteria and our treatment of firms with missing information).

In our propensity score matching approach, our treatment variable is a dummy that equals one if a firm was sued. We use the firm's size and book-to-market ratio as matching criteria. To address potential endogeneity concerns, we estimate our models using an instrumental variable Probit regression. Specifically, we first regress the endogenous covariate on a set of variables. We then use an instrumental variable Probit model as a control function estimator for two reasons: first, our dependent variable is a dummy variable—being sued or not sued—and second, our endogenous covariate in this model is a continuous variable—the ratio of certified inside directors.

Finally, we use the Sarbanes-Oxley Act of 2002 as an exogenous shock to the composition of many U.S. boards of directors because it forced them to replace some of their inside directors with outside directors. Our instrumental variable is correlated with our endogenous variable but uncorrelated with our regression's error term. To test the validity of our instrumented

variable, we run a Wald test for exogeneity and reject the null hypothesis of no endogeneity, confirming our instrumental variable validity.

When examining the aftermath of lawsuits, our main models can be specified as follows:

$$\Delta\, Corporate\ Governance\ Index_i = f(Sued_i, \Delta Control\ Variables_i)$$

and

$$\Delta\, Board\ of\ Directors\ Characteristics_i = f(Sued_i, \Delta Control\ Variables_i)$$

where:

$Corporate\ Governance\ Index_i$ is an index that represents the sum of 13 indicators of governance quality (see Table A1 for details),

$Board\ of\ Directors\ Characteristics_i$ include *board size,* the *ratio of independent directors,* the *ratio of directors holding more than 1 seat,* the *ratio of non-employee block holders,* a *CEO/chairman duality dummy*, and

$Sued_i$ is our aforementioned dummy variable that identifies whether a firm was sued in a securities class action lawsuit (1=yes, 0=no).

Regarding the analysis pertaining to the aftermath of lawsuits, we estimate a two-stage least squares (2SLS) instrumental variable (IV) regression to address potential reverse causality that may bias our primary independent variable (the governance index).

3.2 Securities Class Action Lawsuits

We collect data on securities class action cases filed against U.S. firms from Stanford University's Securities Class Action Clearinghouse (http://securities.stanford.edu). The Stanford database features 4,598 lawsuits between January 1996 and 2017. In line with the extant literature (Peng and Roell, 2007; 2008; Walker et al., 2018), we exclude lawsuits against private firms, firms that trade in the over-the-counter (OTC) market, and open-ended funds. We also exclude lawsuits against financial firms (by excluding firms with a standard industry classification (SIC) code between 6000 and 6999). Our final sample of lawsuits thus consists of 3,728 cases. In addition, depending on our respective models, we exclude a considerable number of firms because they are missing information in the databases we consulted for our

study. Table 1 provides an overview of our sample formation procedure and outlines the number of firms discarded at each step.

*** Move Table 1 About Here ***

In order to address any concerns regarding potential selection biases, we employ a propensity score matching procedure using the nearest neighbour Caliper matching technique using a firm's size and book-to-market ratio to establish a sample of non-treated (non-sued) firms that are matched to the firms in our treatment (sued) sample. Hence, our treatment variable is defined as a dummy variable that equals one if a firm is sued and 0 otherwise.

3.3 Corporate Governance Data

We collect corporate governance data from the ISS (formerly RiskMetrics) database. Specifically, the ISS data is organized two databases: Directors and Governance. The Directors database covers a range of variables related to the structure and practices of the boards of directors of S&P 1500 companies, whereas the Governance database provides data on corporate governance provisions and classic takeover defences for major U.S. firms. Both the Governance and Directors databases are further divided into two sub-samples: Governance and Governance Legacy, and Directors and Directors Legacy.

Prior to the 2007 data year, RiskMetrics conducted the data collection for the Legacy databases using a different methodology. For instance, RiskMetrics stored governance variables using a 0/1 format and numerical values (in contrast to the ISS methodology which used "Yes/No" format and qualitative values). After the 2007 data year, ISS changed its data collection methodology and implemented the new Directors and Governance databases. Due to this change in methodology, we modify several variables to keep all data in a consistent format. For example, if a variable is stored in "YES/NO" format in the Director and/or Governance databases and as 1/0 format in Legacy, we change all variables saved in the YES/NO format into a 1/0 format.

Similarly, in 2007, the ISS also made significant changes to their data sources and methodology used to construct their Governance database. As a result, many of the inputs needed to calculate the Gompers, Ishii, and Metrick (2003) governance index (G Index) are no longer available. Therefore, we build a governance index similar to the G Index using a subset of continuously available variables. In addition, following the literature (cf., Bebchuk et al., 2008), we fill in data for missing years by forward-projecting the most recent available ISS Legacy and Governance data. For instance, ISS Governance data from 1995 is used for 1996.

Our governance index (G.I.) thus consists of 13 provisions that are available throughout most of the sample period in both the Legacy and Governance databases. The G.I. ranges from -2 to 11, with higher scores representing poorer corporate governance quality. The G.I. can be as low as -2 because of two provisions that, if present, have a positive effect on the governance quality of a firm, therefore lowering the G.I. (see Table A1 in the Appendix for more details). Specifically, we assign a value of -1 to the provisions *cumulative voting* and *confidential voting* (*secret ballots*) if they exist, and 0 otherwise. Table 2 shows the list of variables used in the calculation of our G.I. These include *Limits to the ability to amend the charter*, *Limits to the ability to amend bylaws, Limits to the ability to act by written consent,* and *Limits to the ability to call a special meeting*. We replace any missing values of the aforementioned variables with one if the values of *Vote % required to amend charter, Vote % required to amend bylaws, Vote % required for written consent,* and *Vote % required to call special meeting, respectively,* are above 66.66%.

*** Move Table 2 About Here ***

3.4 Execucomp, 13f Thompson Reuters, I/B/E/S, COMPUSTAT, and CRSP

We collect variables on CEO compensation from Execucomp, basing our analysis on four specific variables: *CEO salary compensation* (i.e., the value of the CEO's base salary over total compensation), *CEO long-term incentive plan compensation* (the value of long-term incentive programs over total compensation), *CEO bonus compensation* (the value of bonuses over total compensation), and *CEO options compensation* (the value of executive stock options over total compensation). In addition, we collect ownership data, such as *institutional investor ownership*, the *number of institutional owners,* and the *number of institutional block owners*, from the Thompson database.

We define *analyst coverage* as the number of analysts covering the firm on a given date, which we collect from the Institutional Brokers' Estimate System (I/B/E/S). All other variables, including the *book-to-market ratio*, *ROA, intangible assets, leverage, dividend payout ratio, price volatility, stock turnover, buy and hold return,* are collected from CRSP and COMPUSTAT. Table A1 in the Appendix contains a detailed description of the variables.

4. Empirical Results

4.1 Summary Statistics

Table 3 provides summary statistics for our sample, divided into two-subsamples based on whether or not a firm was sued during our sample period. In the last two columns, we test for the equality of means and medians between the two subsamples and report the p-values for

both a t-test for the difference in means and a Wilcoxon median test for the difference in medians. As expected, the mean and median values of the governance index are significantly higher in sued firms than in non-sued firms. Regarding the board structure – again in line with our expectations – the mean and median of the *ratio of the independent nominating committee members* is significantly higher for non-sued firms than for sued firms, showing that firms with more independent nominating committee members are less likely to face shareholder litigation. Also, the mean and median *ratio of directors holding more than one seat* are significantly higher for sued firms than for non-sued firms, showing that firms with busier directors (directors who hold more than one seat at the same time) are more likely to become the target of a shareholder class action lawsuit. Moreover, sued firms are more likely to have CEOs who also serve as chairmen of the board of directors. We argue that in these firms (where the CEOs also serve as chairmen), the CEOs have more power over the board, which they may exploit to their advantage.

The mean and median proportional *CEO salary compensation* are significantly higher for the non-sued group than for the sued group, confirming our expectation that a higher fixed salary component reduces managerial risk-taking and thus a firm's litigation risk. The mean and median *CEO option compensation* are significantly higher for the sued group than the non-sued group. The literature on this subject, which links option compensation to an increased likelihood of managerial fraud, can explain this finding.

Also, importantly, before we estimate our regressions, we calculate the Pearson correlation coefficients between each variable pair. The correlations are reported in an online appendix to this study. In order to mitigate multicollinearity concerns, we do not jointly include variables in our multivariate analysis whose correlation coefficients exceed a threshold of 0.6 in absolute terms.

*** Move Table 3 About Here ***

4.2 Results for the PSM Matched Sample

Table 4 provides the results for our logit regression analysis in which we explore the determinants of a firm's litigation risk after propensity score matching. In all the models, the dependent variable is the sued dummy, which equals one if a firm was sued and zero otherwise. In the first model, we use the governance index as our primary independent variable and include our set of control variables. The coefficient of the governance index is positive and significant at the 1% level, showing that if the corporate governance 'misquality' of a firm (as measured by the G Index) increases, the probability of a firm being sued increases, too. The subsequent

models examine other aspects of a firm's governance and ownership structure. We employ our variables of interest in separate tranches to reduce any related multicollinearity concerns.

In the second model, which focuses on a firm's board structure, we find that if the *ratio of independent directors* in a firm increases, the likelihood of a firm being sued decreases. The respective coefficient is statistically significant. In contrast, *board size* has a positive but insignificant coefficient, providing weak support for the notion that the bigger the board of directors, the more likely a firm will be sued. The duality dummy variable is also positive, showing that when the CEO of a firm also serves as chairman, the probability of the firm being sued increases. This could be due to the CEOs' extra power to exploit and affect boards to their own advantage, thus increasing the probability of a shareholder lawsuit.

In the third model, we examine how the nominating committee structure affects a firm's litigation risk. The nominating committee is responsible for helping the board of directors with its supervising responsibilities regarding the board's structure. As expected, we find that if the nominating committee has an independent director, the likelihood of a firm being sued decreases; in contrast, by simply increasing the size of the nominating committee, the likelihood of a firm being sued increases. The coefficient of the *CEO/chairman duality dummy* remains positive and insignificant.

Our fourth model focuses on CEO characteristics as our main independent variables. These include the CEO's age, the CEO's tenure, and the CEO's voting power (defined as the percentage of votes held by the CEO). The coefficient of *Ln (CEO Tenure)* is negative but not significant, providing weak evidence for the notion that the longer the tenure of a CEO (and thereby the higher the CEO's risk aversion), the less likely a firm will be sued. Finally, in line with our CEO/chairman duality results, but now marginally significant at the 10% level, we find that the higher the *CEO voting power*, the higher the probability of the firm being sued. Arguably, this is driven by the fact that when a CEO's voting power increases, the CEO can align his/her managerial decisions with their personal interests instead of the shareholders' interests. The coefficient of *Ln (CEO Age)* is positive (albeit insignificant), weakly indicating that firms with older CEOs have a higher likelihood of being sued.

In the fifth model, we test the potential effects of ownership structure on a firm's litigation risk. We include three different variables to capture the associated monitoring effects for a firm: the *number of institutional block owners*, *institutional investor ownership*, and the *number of institutional owners*. All variables exhibit negative (albeit insignificant) coefficients, providing a weak indication that a higher level of active monitoring by institutional investors decreases a firm's likelihood of being sued. We also include the CEO stock ownership in this

model and obtain a positive but insignificant coefficient, hinting to the possibility that higher *CEO stock ownership* increases the likelihood of litigation.

In the sixth and seventh models, we test how different aspects of a CEO's compensation package affect the likelihood of a lawsuit. To mitigate multicollinearity concerns and ensure a sufficient number of observations for each model, we employ two separate regression models with different compensation components. Specifically, in model six, we include both the CEO's bonus and option package. The coefficient of the *CEO bonus compensation* is significantly positive, showing that if CEOs are compensated to a large extent by bonuses, the firm's litigation risk increases. This may be driven by the managers acting more in their own interest if a larger proportion of their remuneration is performance-based. In the seventh model, we include *CEO salary compensation* (as a proxy for how much of a manager's compensation is fixed) and *long-term incentive plan compensation*. We obtain insignificant negative (positive) coefficients for the two variables, weakly suggesting that if CEOs are remunerated to a larger extent via fixed salary (long-term performance-based compensation), the probability of a firm being sued decreases (increases). This result is consistent with the notion that executives avoid taking unnecessary risks when they have a fixed salary, but increase their risk taking when their salary is to a larger extent performance-based.

*** Move Table 4 About Here ***

4.3 Addressing Potential Endogeneity

As an alternative approach to addressing endogeneity in our empirical analysis, we use a two-stage Probit instrumental variable model. Here, the *ratio of certified inside directors*, the endogenous covariate, is regressed on a variable correlated with the ratio of certified inside directors but completely uncorrelated with the error term of the regression in which we model a firm's likelihood of being sued. We use the Sarbanes-Oxley Act as an exogenous shock to obtain an instrumented variable for the ratio of certified inside directors. We include a Sarbanes-Oxley indicator in our first-stage model, and in the second stage of the Probit regression, we utilize the instrumented variable. The ratio of certified inside directors is negative and significant in almost all models, suggesting that an increase in the ratio of insider directors with outside directorship decreases the Z value of the Probit function. As a result, it is less likely that a firm is sued if it has more outside directors.

Consistent with our main regression, the governance index and the ratio of independent directors retain their sign, and the latter stays statistically significant. Furthermore, the duality variable in Table 5 now becomes statistically significant at the 1% level, suggesting that if a CEO also serves as chairman, the probability of being sued increases. Similar to our main

regression findings, the coefficient of the *logged CEO age* maintains its sign and also becomes statistically significant, indicating that firms with older CEOs have a higher likelihood of being sued. Although this finding contrasts with our hypothesis, this inconsistency may be due to the perception that older CEOs become more complacent and less likely to initiate critical changes when needed, or they may lose touch with emerging corporate governance reforms.

*** Move Table 5 About Here ***

In order to test whether industry effects influence our results, we re-run the IV Probit model again and add industry dummies that reflect the Fama-French 17 industry classification to our models. We obtain very similar results, which are summarized in Table 6.

*** Move Table 6 About Here ***

4.4 The Aftermath of Lawsuits

Table 7 provides results for a series of univariate analyses of selected corporate governance characteristics. In Panel A, we compare the mean and median governance characteristics of firms one year before the filing of a lawsuit with the characteristics one year after the lawsuit and report the results for a t-test (Wilcoxon test) of the significance of differences between the two means (medians). Similarly, Panel B of Table 7 provides a comparison of a firm's governance characteristics one year before the lawsuit filing with its characteristics two years after the filing.

Our results in Panel A show that the mean governance index is lower in the year after the lawsuits compared to the year prior, with the difference being significant at the 10% level. This difference illustrates sued firms' attempt to improve their governance structure in response to litigation. In Panel B, the mean governance index decreases two years after a lawsuit, but the difference is no longer significant. More interestingly, the mean *ratio of independent directors* increases after lawsuits in both Panel A and B, with the difference being statistically significant in Panel B. Finally, the means ratio of independent nominating committee members increases in both panels, with the differences again being statistically significant. Overall, these changes suggest that firms tend to improve their corporate governance characteristics (whether mandated by derivate lawsuits or voluntarily) in the one to two years after a lawsuit.

*** Move Table 7 About Here ***

We summarize the result of our hypotheses regarding the effects of a lawsuit on different aspects of a firm in Table 8, examined via a series of multivariate OLS regressions. Panel A examines changes from one year prior to a given lawsuit to one year after the lawsuit. Panel B considers the changes from one year prior to the lawsuit to two years afterwards. In both panels,

we control for changes in *ROA*, *price volatility, intangible assets, leverage, size, book-to-market ratio, board size,* and *free cash flow*.

In the first model of Panel A, the coefficient of the sued dummy is negative but insignificant, showing that firms change their governance structure one year after being sued. In the second model, the change in the *ratio of certified inside directors* acts as our dependent variable. The coefficient of the sued dummy is positive but not significant, providing weak support for the notion that decision-makers improve the composition of the board of directors one year after a firm faces litigation. The sued dummy is insignificant in most models. Unrelated, but interestingly, when examining the effect of litigation on the *CEO*/chairman duality dummy in the last model, the change in the logged CEO age is positively related to the change in duality at the 5% level of significance, suggesting that CEOs are more likely to serve in a dual CEO/chairman role as they get older. In the same model, the changes in the *logged CEO tenure* also has a significant positive coefficient, suggesting that the longer the CEO's tenure, the more likely they are to serve in a dual CEO/chairman role after a firm was sued.

In the first model of Panel B, the dependent variable is the changes in the governance index from one year before the lawsuit to two years after the lawsuit. The coefficient of the sued dummy is negative and significant at the 5% level, indicating that being sued causes the governance index to decrease by 0.680 units two years after the lawsuits. In other words, after being sued, firms appear to improve their corporate governance policies, as captured by the changes in the governance index. Similar to Panel A, we do not observe any significant effects of litigation on other (individual) aspects of a firm's corporate governance, however.

*** Move Table 8 About Here ***

In Table 9, we extend our previous analysis by examining the effect of a lawsuit on a firm's performance. Using the change in a firm's *ROA* as the dependent variable in both models, we estimate a 2SLS IV regression to address potential reverse causality that may bias our primary independent variable (the governance index).

In Model 1, all changes are calculated using variables one year after the lawsuit minus one year before the lawsuit. In Model 2, we employ the same regression model as in Model 1, but this time we calculate changes using the variables two years after the lawsuit minus variables one year before the lawsuit. Our results in both models show that shareholder class action litigation significantly and negatively affects the accounting performance of firms. In both models, we also observe negative coefficients for changes in the governance index (significant in Model 2), which suggest that a firm's improvement in its governance index also improves its accounting performance.

*** Move Table 9 About Here ***

After estimating our 2SLS IV regressions, we test the validity of our instrumental variables in both regressions using a Wald test. Based on the F statistics for both models, we can reject the null hypothesis that the instruments are weak.

5. Robustness Tests

In this section, we briefly discuss the results of a series of unreported robustness tests designed to ensure that our results are not driven by methodological choices and/or our sample selection criteria. In a first robustness test intended to rule out the possibility that insiders were aware of a forthcoming class action lawsuit, we re-run our main regression models using data from one year before the beginning of the class action period (i.e. the period during which the fraud allegedly took place) instead of data from one year before the lawsuit filing. Our results are little affected by this change. In a second test, we split our sample into two subgroups, i.e., a tech and non-tech subsample, to explore whether our results hold for both technology and non-technology firms. We again obtain similar results for both subgroups. Third, we re-run our PSM regression analysis and include industry dummies based on the Fama-French 17 industry classification along with size and book to market ratio as matching criteria to rule out the influence of industry effects. The resultant tests are again in line with our main models and are available upon request.

6. Conclusions

The purpose of this study is to examine whether firms that exhibit shortcomings in their corporate governance face an increased risk of shareholder class action litigation. Specifically, we explore whether ex-post passive monitoring by the firm's shareholders acts a substitute for insufficient ex-ante active monitoring by the firm's board. To address this question, we estimate a series of logit models in which we regress the litigation propensity of a set of sued firms and a propensity-score matched sample of non-sued firms against various variables that characterize the firms' corporate governance during the period from January 1996 and 2017.

In addition, we explore the consequences of shareholder litigation for a given firm by examining how it affects the firm's performance and its corporate governance. The latter analysis shines a light on the notion that ex-post passive monitoring forces firms and their boards to improve their active monitoring.

We find evidence that the litigation risk of firms can be explained by variables that describe a firm's corporate governance, the compensation of its CEO, as well as the CEO's

characteristics. Board variables, including board size, board independence, the size of the nominating committee, nominating committee independence, and CEO/chairman duality, all serve as significant predictors of shareholder litigation. Our results are robust to controlling for a set of Fama-French industry dummies as additional matching criteria (along with the *size* and the *book-to-market ratio*) to rule out the influence of potential industry effects. In addition, they are insensitive to employing a two-stage Probit instrumental variable model to address potential endogeneity concerns in our main regressions. Also, for robustness, we include dummies based on the Fama-French 17 industry classification in each model to control for the effect of different industries on the likelihood of a lawsuit.

In the aftermath of a lawsuit, our results show that sued firms improve certain aspects of their corporate governance such as the proportion of independent directors. We further document that the accounting performance of sued firms decreases two years after a lawsuit; however, firms that improve their governance experience an improvement in their accounting performance. To address potential reverse causality problems that may affect our primary independent variable (the governance index), we estimate a two-stage least squares (2SLS) instrumental variable regression to further understand the effect of a lawsuit on a firm's performance, using changes in *ROA* as the dependent variable. The results of that regression show that shareholder class action litigation significantly and negatively affects the accounting performance of firms. Also, we observe negative coefficients for changes in the governance index, which suggest that firms that improve their governance index also improve their accounting performance.

The findings of this study have important corporate implications for corporate boards and regulators who are concerned about the high costs associated with shareholder litigation. Specifically, they show that firms that employ good corporate governance practices may reduce their risk of class action litigation and the associated direct and indirect burdens such litigation places on a firm.

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Table 1: Sample Formation

This table provides an overview of our sample formation procedure and outlines the number of firms we lose as a result of various filters we apply during our sample selection process and due to missing information in the databases we employ in this study. Our litigation sample covers the period from January 1996 to December 2017.

	Filters / Data Exclusion Conditions	Number of Firms
	Lawsuits listed on Stanford's SCAA database	4,598
Minus	Lawsuits against private firms, OTC traded firms, and open-end funds	4,331
Minus	Lawsuits against financial firms (SIC codes 6000-6999)	3,728
Minus	Firms with missing CUSIPs	3,604
Minus	Firms with missing information on Compustat	3,356
Minus	Firms with missing information on Thomson Reuters	2,170
Minus	Firms with missing information on IBES	1,905
Minus	Firms with missing information on CRSP	1,027
Minus	Firms with missing information on Execuecomp	490
Minus	Firms with missing information on ISS Directors	375
Minus	Firms with missing information on ISS Governance	**299**

Table 2: Governance Index Breakdown

This table provides an overview of the corporate governance provisions we employ in calculating our governance index. The governance index (G.I.) consists of 13 provisions with full data available in both the ISS Legacy and Governance databases. The G.I. ranges from -2 to 11, with a higher index representing poorer corporate governance quality. The G.I. can be as low as -2 because of two provisions (cumulative voting and confidential voting) that, when present, have a positive effect on the corporate governance quality of a firm, and thus a negative effect on the G.I.

Variable Name (ISS Abbreviation)	Description / Explanation	Effect on Governance Index if Present
Blank check for preferred stock (blankcheck)	This provision gives the board of directors the ability to issue preferred stock without shareholder approval; this will dilute the common stock and make an acquisition less attractive or even impossible.	+1
Classified board/Staggered board (cboard)	A classified board has different classes of directors with overlapping terms. With a classified board, only part of the board can be replaced each year, so an outsider has to wait for up to two years to gain full control of the board.	+1
Limits to the ability to call a special meeting (lspmt)	In the case of a takeover attempt, this will add extra time to proxy fights because bidders must wait until the regularly scheduled annual meeting to replace board members or dismantle takeover defences.	+1
Limits to the ability to act by written consent (lwcnst)	In the case of a takeover attempt, this will add extra time to proxy fights, because bidders must wait until the regularly scheduled annual meeting to replace board members or dismantle takeover defences.	+1
Cumulative voting (cumvote)	A provision that allows shareholders to allocate the votes for the election of directors in any way they desire. The provision enables holders of minority stakes to elect one or more directors if they can assemble sufficient support.	-1
Confidential voting / secret ballots (confvote)	A provision that does not allow the management to know how shareholders vote on their proxy cards, or to view ballots.	-1
Limits to the ability to amend the bylaws (labylw)	This provision limits shareholders' ability to amend the bylaws of the corporation.	+1

Limits to the ability to amend the charter (lachtr)	This provision limits shareholders' ability to amend the charter of the corporation.	+1
Unequal voting rights (uneqvote)	This provision limits the voting power of shareholders who have exceeded a certain threshold of ownership.	+1
Fair price (fairprice)	The fair price provision requires a bidder to pay all shareholders a "fair price", usually defined as the highest price the bidder paid for any of the shares it acquires in a target company during a specified period before the commencement of a tender offer.	+1
Golden parachute (gparachute)	A severance agreement/contract between a company and an executive that provides compensation to top managers for loss of job following a change of control.	+1
Poison pill (ppill)	This provision gives the target stockholders the right to purchase the target's or acquirer's stock at a steep discount, diluting the bidder's voting power, making the target financially unattractive or diluting the voting power of the potential acquirer.	+1
Supermajority required to approve a merger (supermajor)	This provision requires the approval of the holders of two-thirds or more of the outstanding shares for a merger.	+1

Table 3: Summary Statistics

This table provides summary statistics for all variables used in this study, reported separately for sued and non-sued firms. Each non-sued firm is propensity-score-matched to a sued firm based on its size and book to market ratio. The number of observations for the sued and non-sued subsamples varies because of missing observations for some variables. In the last two columns, we report p-values for a t-test and Wilcoxon test to test for the significance of differences in the means and medians between the two subsamples, respectively. P-values that indicate statistical significance at the 10% level or better are bolded. Definitions for all variables are provided in Table A1 in the Appendix.

	Sued Sample				**Non-Sued Sample**				**T-test**	**Wilcoxon Test**
Variables	**Obs.**	**Mean**	**Median**	**S.D.**	**Obs.**	**Mean**	**Median**	**S.D.**	**p-Value**	**p-Value**
Ratio of Certified Inside Directors	253	0.034	0	0.056	272	0.039	0	0.054	0.206	0.288
G Index	259	5.170	5	2.271	282	4.968	5	2.221	**0.005**	**0.046**
Board Size	266	9.282	9	2.585	271	9.474	9	2.706	**0.029**	**0.039**
Ratio of Independent Directors	266	0.715	0.75	0.174	271	0.729	0.773	0.168	0.140	0.937
Ratio of Directors Holding more than 1 Seat	266	0.561	0.444	0.507	271	0.515	0.4	0.475	**0.003**	**0.009**
Ratio of Non-Employee Block Holders	266	0.038	0	0.087	271	0.043	0	0.088	0.111	**0.058**
CEO/Chairman Duality Dummy	266	0.115	0	0.111	271	0.105	0	0.105	**0.004**	**0.003**
Ratio of Nominating Directors	266	0.313	0.333	0.201	271	0.325	0.333	0.213	**0.097**	**0.078**
Ratio of Independent Nominating Committee Members	266	0.285	0.307	0.198	271	0.299	0.333	0.210	**0.053**	**0.060**
CEO Age (Years)	266	54.054	54.981	1.151	271	55.98	55.98	1.132	**0.000**	**0.001**
CEO Tenure (Years)	266	5.370	5.995	2.372	271	5.595	5.995	2.425	0.161	0.151
CEO Voting Power (%)	266	4.612	1.1	11.518	271	4.309	1.1	11.867	0.654	0.680
CEO Stock Ownership	239	0.545	0.067	1.419	242	0.519	0.072	1.435	0.578	0.723
Number of Institutional Block Owners	858	2.123	2	1.779	771	1.153	0	1.652	**0.000**	**0.000**
Institutional Investor Ownership	858	0.474	0.477	0.297	771	0.270	0.124	0.436	**0.000**	**0.000**
Number of Institutional Owners	858	159.92	93	211.611	771	60.902	12	125.205	**0.000**	**0.000**

CEO Bonus Compensation	332	0.122	0	0.182	379	0.095	0	0.163	**0.000**	**0.000**
CEO Option Compensation	332	0.316	0.132	0.599	379	0.258	0.101	0.760	**0.090**	**0.000**
CEO Salary Compensation	332	0.318	0.220	0.283	379	0.343	0.266	0.266	**0.005**	**0.000**
CEO Long-Term Incentive Plan Compensation	332	0.028	0	0.099	379	0.034	0	0.105	0.258	0.285
Price Volatility	655	0.039	0.036	0.019	565	0.035	0.029	0.021	**0.000**	**0.000**
Stock Turnover	655	1.287	0.962	1.282	565	0.992	0.665	1.253	**0.000**	**0.000**
Buy & Hold Return	655	0.060	-0.109	1.01	565	0.130	-0.018	1.801	0.149	0.231
Intangible Assets	946	4.504	4.673	2.820	987	4.523	4.544	2.85	0.850	**0.000**
R&D Expense Ratio	946	0.125	0.069	0.293	892	0.188	0.039	0.836	**0.001**	**0.000**
ROA	1042	0.037	0.085	0.203	1040	0.040	0.074	0.186	0.420	0.585
Leverage	1041	0.739	0.466	8.517	1045	0.704	0.520	4.594	0.863	0.625
Dividend Payout Ratio	1042	0.048	0	1.259	1041	0.091	0	2.017	0.398	0.934
Analyst Coverage	913	10.06	7	9.170	746	9.042	7	8.313	**0.001**	**0.000**
Tech Dummy	1045	0.481	0	0.369	1045	0.163	0	0.499	**0.000**	**0.000**
Number of Preceding Lawsuits	1045	127.30	122	36.951	1045	112.7	109	42.338	**0.000**	**0.000**

Table 4: Logistic Regression Results: The Effects of Corporate Governance on a Firm's Litigation Risk

This table provides the results for a series of logistic regressions used to determine a firm's litigation risk. The dependent variable in each specification is equal to 1 if the firm is sued and 0 otherwise. Each column corresponds to one of our hypotheses in which we explore the determinants of a firm being sued. For each variable, we report the coefficient and the corresponding p-value (in parentheses). *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Variables	G Index Only	Board Structure	Nominating Committee Structure	CEO Characteristics	Ownership Structure	Compensation Components 1	Compensation Components 2
G Index	0.179***						
	(0.000)						
Board Size		0.056					
		(0.287)					
Ratio of Independent Directors		-1.440*					
		(0.093)					
Ratio of Directors Holding more than 1 Seat		-0.184					
		(0.461)					
Ratio of Non-Employee Block Holders		0.061					
		(0.971)					
CEO/Chairman Duality Dummy		1.884	1.612				
		(0.301)	(0.367)				
Ratio of Nominating Directors			3.402*				
			(0.053)				
Ratio of Independent Nominating Committee Members			-4.066**				
			(0.024)				
Ln (CEO Age)				0.831			
				(0.372)			
Ln (CEO Tenure)				-0.145			
				(0.289)			
CEO Voting Power				0.032*			

				(0.099)			
CEO Stock Ownership					0.031		
					(0.757)		
Number of Institutional Block Owners					-0.008		
					(0.903)		
Institutional Investor Ownership					-0.136		
					(0.823)		
Number of Institutional Owners					-0.0004		
					(0.396)		
CEO Bonus Compensation						2.291*	
						(0.089)	
CEO Option Compensation						0.022	
						(0.911)	
CEO Salary Compensation							-0.157
							(0.792)
CEO Long-Term Incentive Plan Compensation							0.338
							(0.833)
Price Volatility	6.514	12.00	11.97	24.72**	14.27	18.99	47.37***
	(0.521)	(0.275)	(0.271)	(0.035)	(0.110)	(0.156)	(0.007)
Stock Turnover	0.414***	0.981***	0.987***	0.938***	0.587***	0.605***	0.744***
	(0.006)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.007)
Buy & Hold Return	-0.544**	-0.286	-0.291	-0.218	-0.090	-0.047	0.056
	(0.011)	(0.212)	(0.203)	(0.371)	(0.502)	(0.763)	(0.845)
Intangible Assets	-0.0129	0.176**	0.166**	0.212**	0.076	0.146*	0.111
	(0.879)	(0.033)	(0.042)	(0.017)	(0.291)	(0.095)	(0.384)
R&D Expense Ratio	0.145	-1.216	-1.418	-1.809	0.568	-0.366	2.211
	(0.934)	(0.582)	(0.517)	(0.433)	(0.719)	(0.837)	(0.526)
ROA	-2.353*	-0.907	-0.824	-1.596	0.0532	-0.814	1.971
	(0.070)	(0.507)	(0.543)	(0.280)	(0.965)	(0.544)	(0.337)

Leverage	-0.793	-0.819	-0.933	-1.094*	-0.905*	-1.263**	-0.694
	(0.126)	(0.158)	(0.100)	(0.077)	(0.054)	(0.032)	(0.346)
Dividend Payout Ratio	-0.802	-0.704	-0.703	-0.647	-0.570	-0.357	-0.669
	(0.116)	(0.178)	(0.169)	(0.209)	(0.173)	(0.444)	(0.399)
Analyst Coverage	0.039***	0.007	0.007	0.011	0.014	0.028	-0.007
	(0.001)	(0.562)	(0.557)	(0.391)	(0.207)	(0.132)	(0.639)
Tech Dummy	0.142	0.290	0.286	0.151	0.152	0.011	-0.018
	(0.547)	(0.216)	(0.220)	(0.547)	(0.472)	(0.963)	(0.960)
Number of Preceding Lawsuits	0.002	0.001	0.001	0.002	0.001	0.009***	-0.002
	(0.120)	(0.240)	(0.292)	(0.118)	(0.215)	(0.001)	(0.140)
Constant	-1.336	-0.632	-1.250	-4.795	-1.908*	-2.286**	-3.735***
	(0.122)	(0.560)	(0.149)	(0.196)	(0.052)	(0.036)	(0.006)
Observations	512	541	541	474	598	414	239
$\chi 2$ Test (p-value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Table 5: IV Probit Regression Results

This table provides the results for a series of instrumental variable (IV) Probit regressions. We use the Sarbanes-Oxley Act of 2002 as an exogenous shock to the composition of many U.S. boards of directors, as it forced those boards to replace some of their internal directors with outside directors. Our instrumental variable is correlated with our endogenous variable but uncorrelated with each regression's error term. The dependent variable in each model specification is equal to one if the firm is sued and zero otherwise. We refer to inside directors with outside directorships as externally certified inside directors (CIDs). For each variable, we report the coefficient and the corresponding p-value (in parentheses). *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Variables	G Index only	Board Structure	Nominating Committee Structure	CEO Characteristics	Ownership Structure	Compensation Components1	Compensation Components2
Ratio of Certified Inside Directors	-0.842	-17.783***	-11.677***	-8.058*	-3.093	0.122	4.969
	(0.887)	(0.000)	(0.000)	(0.054)	(0.619)	(1.000)	(0.538)
G Index	0.007						
	(0.714)						
Board Size		-0.005					
		(0.595)					
Ratio of Independent Directors		-0.335**					
		(0.010)					
Ratio of Directors Holding more than 1 Seat		0.847***					
		(0.000)					
Ratio of Non-Employee Block Holders		-0.824***					
		(0.005)					
CEO/Chairman Duality Dummy		0.147	0.735***				
		(0.323)	(0.004)				
Ratio of Nominating Directors			0.282				
			(0.442)				
Ratio of Independent Nominating Committee Members			-0.299				
			(0.427)				
Ln (CEO Age)				0.514**			
				(0.034)			
Ln (CEO Tenure)				-0.033			
				(0.405)			
CEO Voting Power				0.0002			
				(0.941)			
CEO Stock Ownership					-0.010		
					(0.589)		
Number of Institutional Block Owners					0.029		
					(0.305)		
Institutional Investor Ownership					-0.088		
					(0.719)		

Number of Institutional Owners					-0.000		
					(0.718)		
CEO Bonus Compensation						0.675	
						(0.998)	
CEO Option Compensation						0.011	
						(0.999)	
CEO Salary Compensation							0.180
							(0.372)
CEO Long-Term Incentive Plan Compensation							-0.250
							(0.597)
Price Volatility	11.758***	0.664	5.597**	9.240***	10.537***	20.660	12.819**
	(0.000)	(0.814)	(0.049)	(0.002)	(0.000)	(0.995)	(0.015)
Stock Turnover	0.058	0.092**	0.110***	0.112***	0.074	0.136	0.118
	(0.212)	(0.012)	(0.004)	(0.004)	(0.114)	(0.996)	(0.172)
Buy & Hold Return	-0.161**	-0.047	-0.095*	-0.075	-0.085	-0.032	-0.208*
	(0.029)	(0.225)	(0.057)	(0.199)	(0.177)	(0.998)	(0.057)
Intangible Assets	0.063**	0.070***	0.086***	0.103***	0.068***	0.133	0.015
	(0.045)	(0.000)	(0.000)	(0.000)	(0.008)	(0.993)	(0.700)
R&D Expense Ratio	-0.070	-0.199	-0.151	-0.516	-0.469	-0.305	-1.568
	(0.922)	(0.580)	(0.779)	(0.422)	(0.535)	(0.999)	(0.150)
ROA	-0.201	-0.024	-0.012	-0.066	0.233	0.381	0.216
	(0.613)	(0.897)	(0.966)	(0.852)	(0.561)	(0.996)	(0.708)
Size	0.094**	0.004	0.092***	0.059	0.104	-0.010	0.120
	(0.039)	(0.851)	(0.002)	(0.117)	(0.224)	(0.999)	(0.214)
Leverage	-0.262	-0.028	-0.040	-0.115	-0.222	-0.490	-0.182
	(0.230)	(0.792)	(0.798)	(0.535)	(0.260)	(0.995)	(0.570)
Dividend Payout Ratio	0.000	-0.007	-0.005	-0.003	-0.001	-0.005	0.001
	(0.989)	(0.422)	(0.738)	(0.884)	(0.958)	(0.997)	(0.981)
Book to Market Ratio	-0.246**	-0.053	-0.175**	-0.196**	-0.204**	-0.251	-0.123
	(0.013)	(0.491)	(0.036)	(0.045)	(0.044)	(0.997)	(0.453)
Analyst Coverage	0.006	0.001	0.003	0.006	0.006*	0.005	0.002
	(0.142)	(0.561)	(0.260)	(0.125)	(0.086)	(0.993)	(0.754)
Tech Dummy	0.220**	0.005	0.103	0.138	0.234**	0.161	0.403***
	(0.026)	(0.946)	(0.222)	(0.142)	(0.015)	(0.998)	(0.001)
Number of Preceding Lawsuits	0.001	-0.000	0.001**	0.001***	0.001*	0.006	-0.000
	(0.151)	(0.983)	(0.019)	(0.003)	(0.094)	(0.992)	(0.433)
Constant	-3.408***	-0.673	-2.635***	-4.926***	-3.370***	-4.038	-3.477***
	(0.000)	(0.392)	(0.000)	(0.000)	(0.000)	(0.959)	(0.000)
Observations	6,876	8,138	8,138	7,081	7,682	4,756	3,221
$\chi 2$ Test (p-value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Wald test of exogeneity	(0.893)	(0.011)	(0.009)	(0.107)	(0.616)	(1.000)	(0.571)

Table 6: IV Probit Regression Results, With Industry Dummies

This table provides the results for a series of instrumental variable (IV) Probit regressions, including dummies based on the Fama-French 17 industry classification in each model to control for the effect of different industries on the likelihood of a lawsuit. The dependent variable in each of model specification is equal to one if the firm is sued and zero otherwise. We refer to inside directors with outside directorship as externally certified inside directors (CIDs). For each variable, we report the coefficient and the corresponding p-value (in parentheses). *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Variables	G Index only	Board Structure	Nominating Committee	CEO Characteristics	Ownership Structure	Compensation Components1	Compensation Components2
Ratio of Certified Inside Directors	-2.273	-17.927***	-12.287***	-9.307**	-5.106	0.109	4.611
	(0.706)	(0.000)	(0.000)	(0.014)	(0.426)	(1.000)	(0.529)
G Index	0.011						
	(0.539)						
Board Size		-0.006					
		(0.505)					
Ratio of Independent Directors		-0.283**					
		(0.045)					
Ratio of Directors Holding more than 1 Seat		0.858***					
		(0.000)					
Ratio of Non-Employee Block Holders		-0.807***					
		(0.006)					
CEO/Chairman Duality Dummy		0.129	0.742***				
		(0.373)	(0.002)				
Ratio of Nominating Directors			0.180				
			(0.614)				
Ratio of Independent Nominating Committee Members			-0.162				
			(0.655)				
Ln (CEO Age)				0.514**			
				(0.029)			
Ln (CEO Tenure)				-0.023			
				(0.544)			
CEO Voting Power				-0.002			
				(0.654)			
CEO Stock Ownership					-0.0005		
					(0.995)		
Number of Institutional Block Owners					0.031		
					(0.279)		
Institutional Investor Ownership					-0.063		
					(0.798)		
Number of Institutional Owners					-0.0004		
					(0.350)		
CEO Bonus Compensation						0.542	

						(0.999)	
CEO Option Compensation						-0.010	
						(0.999)	
CEO Salary Compensation							0.169
							(0.397)
CEO Long-Term Incentive Plan Compensation							0.038
							(0.938)
Price Volatility	11.588***	0.963	5.718**	9.326***	10.905***	23.177	13.160***
	(0.000)	(0.727)	(0.040)	(0.002)	(0.000)	(0.994)	(0.007)
Stock Turnover	0.063	0.091**	0.112***	0.114***	0.077*	0.143	0.129
	(0.171)	(0.013)	(0.004)	(0.004)	(0.082)	(0.996)	(0.128)
Buy & Hold Return	-0.155**	-0.042	-0.087*	-0.066	-0.089	-0.028	-0.203*
	(0.036)	(0.261)	(0.078)	(0.250)	(0.171)	(0.998)	(0.067)
Intangible Assets	0.053*	0.059***	0.070***	0.089***	0.063**	0.110	0.012
	(0.082)	(0.001)	(0.001)	(0.000)	(0.023)	(0.994)	(0.758)
R&D Expense Ratio	0.300	-0.359	-0.102	-0.171	0.176	0.199	-0.597
	(0.627)	(0.229)	(0.819)	(0.754)	(0.772)	(0.998)	(0.529)
ROA	-0.278	-0.005	-0.023	-0.119	0.168	0.253	0.089
	(0.498)	(0.980)	(0.932)	(0.730)	(0.685)	(0.994)	(0.879)
Size	0.112**	0.018	0.112***	0.083**	0.158*	0.016	0.130
	(0.024)	(0.481)	(0.000)	(0.029)	(0.078)	(0.999)	(0.181)
Leverage	-0.381	-0.074	-0.120	-0.208	-0.407**	-0.681	-0.379
	(0.103)	(0.570)	(0.484)	(0.292)	(0.046)	(0.995)	(0.229)
Dividend Payout Ratio	-0.011	-0.009	-0.009	-0.007	-0.007	-0.007	-0.354
	(0.718)	(0.351)	(0.537)	(0.696)	(0.727)	(0.997)	(0.182)
Book to Market Ratio	-0.204**	-0.030	-0.132	-0.153	-0.184*	-0.250	-0.089
	(0.046)	(0.660)	(0.102)	(0.110)	(0.075)	(0.997)	(0.555)
Analyst Coverage	0.007*	0.002	0.005*	0.007*	0.008**	0.007	0.003
	(0.072)	(0.291)	(0.089)	(0.053)	(0.045)	(0.995)	(0.626)
Number of Preceding Lawsuits	0.001	-0.000	0.001**	0.001***	0.001*	0.006	-0.000
	(0.121)	(0.898)	(0.023)	(0.004)	(0.083)	(0.992)	(0.377)
Constant	0.476	1.033	0.786	-1.590	-0.036	-4.024	-0.001
	(0.999)	(0.995)	(0.999)	(0.996)	(1.000)	(0.882)	(1.000)
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,291	8,010	8,010	6,971	7,453	4,692	2,931
$\chi 2$ Test (p-value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Wald test of exogeneity	(0.722)	(0.007)	(0.004)	(0.050)	(0.610)	(1.000)	(0.566)

Table 7: Univariate Analysis of the Aftermath of Lawsuits: Select Corporate Governance Variables

This table compares a series of preselected corporate governance characteristics before and after the lawsuit filing. Panel A presents changes from one year prior to the lawsuit to one year after the lawsuit. Panel B presents changes from one year prior to the lawsuit to two years after the lawsuit. The last column in both panels presents the p-values for a series of t-tests in which we examine the statistical significance of differences in means between each subsample.

Panel A: Year T-1 vs. Year T+1

	Year T-1			Year T+1			
Variables	N	Mean	Std. Dev.	N	Mean	Std. Dev.	T-Test p-value
G Index	877	5.209	2.259	926	5.049	2.194	0.063
Board Size	879	9.242	2.566	622	9.207	2.456	0.790
Ratio of Independent Directors	870	0.708	0.173	622	0.717	0.164	0.314
Ratio of Directors Holding more than 1 Seat	870	0.552	0.016	622	0.574	0.019	0.414
Ratio of Non-Employee Block Holders	870	0.037	0.087	622	0.041	0.080	0.392
CEO/Chairman Duality Dummy	870	0.113	0.109	622	0.119	0.113	0.300
Ratio of Nominating Directors	870	0.318	0.202	622	0.338	0.196	0.056
Ratio of Independent Nominating Committee Members	870	0.289	0.199	622	0.308	0.196	0.068

Panel B: Year T-1 vs. Year T+2

	Year T-1			Year T+2			
Variables	N	Mean	Std. Dev.	N	Mean	Std. Dev.	T-Test p-value
G Index	928	5.176	2.261	899	5.134	2.191	0.689
Board Size	915	9.277	2.604	564	9.246	2.371	0.817
Ratio of Independent Directors	915	0.707	0.173	564	0.740	0.149	0.000
Ratio of Directors Holding more than 1 Seat	915	0.567	0.508	564	0.567	0.466	0.994
Ratio of Non-Employee Block Holders	915	0.038	0.086	564	0.038	0.076	0.959
CEO/Chairman Duality Dummy	915	0.117	0.111	564	0.114	0.117	0.605
Ratio of Nominating Directors	915	0.315	0.203	564	0.352	0.191	0.000
Ratio of Independent Nominating Committee Members	915	0.287	0.200	564	0.328	0.193	0.000

Table 8: OLS Regression Results: The Aftermath of Securities Class Action Lawsuits

This table presents results for a series of multivariate OLS regressions to examine the effects securities class action lawsuits have on the corporate governance characteristics of a firm. Panel A considers changes from one year prior to the lawsuit to one after the lawsuit (i.e., from year *t-1* to year *t+1*). Panel B considers changes from one year prior to two years after the lawsuit (i.e., from year *t-1* to year *t+2*). The dependent variable in each model is labelled in the first row. For each variable, we report the coefficient and the corresponding p-value (in parentheses). *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Changes from One Year Prior to the Lawsuit (*t-1*) to One Year after the Lawsuit (*t+1*)

Variables	(1) Δ G Index	(2) Δ Ratio of Certified Inside Directors	(3) Δ Ratio of Independent Directors	(4) Δ Ratio of Directors Holding more than 1 Seat	(5) Δ Ratio of Independent Nominating Committee Members	(6) Δ Ratio of Non-Employee Block Holders	(7) Δ CEO/Chairman Duality Dummy
Sued	-0.001	0.001	-0.013	-0.014	-0.001	0.006	-0.004
	(0.987)	(0.772)	(0.172)	(0.579)	(0.936)	(0.378)	(0.408)
Δ ROA	0.156	0.005	-0.033	0.076	-0.014	0.019	
	(0.582)	(0.760)	(0.274)	(0.354)	(0.775)	(0.382)	
Δ Price Volatility	14.65***	-0.148*	-0.352***	-0.722*	-1.025***	-0.505***	
	(0.000)	(0.070)	(0.009)	(0.052)	(0.000)	(0.000)	
Δ Intangible Assets	0.033	0.002*	0.001	0.004	0.005	-0.0001	
	(0.140)	(0.0979)	(0.442)	(0.475)	(0.139)	(0.955)	
Δ Leverage	0.188	-0.009	-0.007	-0.024	0.021	-0.014	
	(0.125)	(0.241)	(0.593)	(0.496)	(0.327)	(0.147)	
Δ Size	0.0632	0.002	-0.013**	0.039**	0.001	0.015***	
	(0.317)	(0.498)	(0.043)	(0.026)	(0.870)	(0.001)	
Δ Book to Market Ratio	0.058	-0.005**	0.004	-0.013	0.010	-0.0004	
	(0.102)	(0.015)	(0.310)	(0.234)	(0.117)	(0.875)	
Δ Board Size	0.027***	-0.001***	0.001	-0.0002	-0.015***	0.00001	
	(0.006)	(0.005)	(0.177)	(0.932)	(0.000)	(0.990)	
Δ Free Cash Flow	0.218	0.002	0.046**	0.044	0.119***	0.023	
	(0.314)	(0.869)	(0.043)	(0.479)	(0.001)	(0.179)	

Δ Ln (CEO Age)							0.113***
							(0.000)
Δ Ln (CEO Tenure)							0.013***
							(0.000)
Constant	0.033**	0.002*	-0.018***	0.033***	-0.019***	-0.009***	0.002***
	(0.038)	(0.066)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Observations	3,354	3,981	3,988	3,988	3,988	3,988	18,293
F-test (p-value)	(0.000)	(0.001)	(0.010)	(0.003)	(0.000)	(0.000)	(0.000)
Adjusted R^2	0.052	0.007	0.005	0.006	0.027	0.014	0.041

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Panel B: Changes from One Year Prior to the Lawsuit (*t-1*) to Two Years after the Lawsuit (*t+2*)

Variables	(1) 2y Δ in G Index	(2) 2y Δ Ratio of Certified Inside Directors	(3) 2y Δ Ratio of Independent Directors	(4) 2y Δ Ratio of Directors Holding more than 1 Seat	(5) 2y Δ Ratio of Independent Nominating	(6) 2y Δ Ratio of Non-Employee Block Holders	(7) 2y Δ CEO/Chairman Duality Dummy
Sued	-0.680***	0.001	-0.008	-0.028	0.010	-0.007	-0.007
	(0.000)	(0.810)	(0.507)	(0.382)	(0.604)	(0.395)	(0.191)
Δ ROA 2	0.767*	0.010	-0.123***	-0.060	-0.176***	-0.007	
	(0.079)	(0.607)	(0.000)	(0.525)	(0.001)	(0.772)	
Δ Price Volatility 2	48.25***	0.010	0.035	-0.240	-1.578***	-1.620***	
	(0.000)	(0.899)	(0.800)	(0.533)	(0.000)	(0.000)	
Δ Intangible Assets 2	0.029	0.001	0.001	-0.006	0.005	-0.00006	
	(0.344)	(0.227)	(0.588)	(0.360)	(0.208)	(0.973)	
Δ Leverage 2	-0.208	-0.008	-0.006	0.028	0.002	0.002	
	(0.202)	(0.313)	(0.650)	(0.439)	(0.899)	(0.818)	
Δ Size 2	0.149*	0.003	-0.006	0.046***	0.004	0.002	
	(0.073)	(0.398)	(0.326)	(0.008)	(0.700)	(0.680)	
Δ Book to Market Ratio 2	0.286***	-0.002	0.012**	0.010	0.024***	-0.008**	
	(0.000)	(0.421)	(0.018)	(0.436)	(0.002)	(0.016)	
Δ Board Size 2	0.050***	-0.001	0.0006	-0.010***	-0.012***	0.001	
	(0.001)	(0.148)	(0.602)	(0.002)	(0.000)	(0.235)	
Δ Free Cash Flow 2	0.269	-0.011	0.105***	0.0004	0.166***	0.019	
	(0.428)	(0.484)	(0.000)	(0.996)	(0.000)	(0.311)	
Δ Ln (CEO Age) 2							0.108***
							(0.000)
Δ Ln (CEO Tenure) 2							0.014***
							(0.000)

Constant	-0.759***	0.001	-0.035***	0.040***	-0.032***	0.010***	0.009***
	(0.000)	(0.263)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	2,798	3,259	3,266	3,266	3,266	3,266	16,186
F-test (p-value)	(0.405)	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)	(0.000)
Adjusted R^2	0.284	0.003	0.009	0.006	0.030	0.098	0.044

Table 9: Two-Stage Least Squares (2SLS) IV Regressions Results: Changes in ROA Following Lawsuits

This table presents results for the second stage of two 2-stage least squares (2SLS) IV regressions in which we examine the effects of shareholder class action lawsuits on the profitability of firms. Our dependent variable is the change in the return on assets (ROA) from one year prior to the lawsuit to one year (two years) after the lawsuit, respectively. The change in ROA (ΔROA) is defined as $ROA_{t+1} - ROA_{t-1}$ in column 1 and as $ROA_{t+2} - ROA_{t-1}$ in column 2. For each variable, we report the coefficient and the corresponding p-value (in parentheses). *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Variables	(1) One-Year ΔROA	(2) Two-Year ΔROA
Ratio of Certified Inside Directors	-1.056***	-1.080***
	(0.000)	(0.000)
Sued	-0.024***	-0.030***
	(0.008)	(0.003)
Δ G Index	-0.002	
	(0.291)	
Δ Price Volatility	-0.113	
	(0.515)	
Δ Intangible Assets	-0.001	
	(0.432)	
Δ Leverage	-0.026**	
	(0.015)	
Δ Size	0.025***	
	(0.000)	
Δ Free cash flow	0.515***	
	(0)	
Δ G Index 2		-0.002*
		(0.075)
Δ Price Volatility 2		-0.318***
		(0.008)
Δ Intangible Assets 2		0.0001
		(0.934)
Δ Size 2		0.009*
		(0.081)
Δ Leverage 2		-0.014
		(0.162)
Δ Free Cash Flow 2		0.537***
		(0.000)
Constant	-0.042***	-0.043***
	(0.000)	(0.000)
Observations	3,872	3,322
Wald test of exogeneity	(0.000)	(0.000)

Appendix:

Table A1: Variable Definitions

This table defines the variables used in the study, along with their sources and descriptions.

Variable	Definition	Source
Corporate governance variables		
1. G Index, based on: • Blank check for preferred stock (blankcheck) • Classified board/Staggered board (cboard) • Limits to the ability to call a special meeting (lspmt) • Limits to the ability to act by written consent (lwcnst) • Cumulative voting (cumvote) • Confidential voting / secret ballots (confvote) • Limits to the ability to amend the bylaws (labylw) • Limits to the ability to amend the charter (lachtr) • Unequal voting rights (uneqvote) • Fair price (fairprice) • Golden parachute (goldenparachute) • Poison pill (ppill) • Supermajority required to approve a merger (supermajor)	We calculate the G Index as the sum of 13 indicators of governance quality. Following Hazarika et al. (2012), we fill in the ISS Governance data for missing years by projecting them forward from the most recent ISS data. For example, the ISS Governance data from 1995 are used for 1996 and 1997 (which are missing in the database). We recode variables that have characters or numbers instead of a binary format and replace them with values in a dichotomous format. For example, if an observation for the variable *supermajor* is recorded with a value above 66.7%, we replace it with 1. For variables that have missing values, but for which the ISS database contains complementary variables that have the same meaning but are reported in a different format, we fill in the missing observations using the complementary variables. For instance, if the variable *labylw* (limits to the ability to amend the bylaws) has missing values, then we examine the variable "*Law-amend-votepcnt*" and assign a value to 0 to *labylw* if *Law-amend-votepcnt* is below 66.7%.	ISS Governance database
2. Board Size	Number of directors on the board	ISS Directors database
3. Ratio of Independent Directors	Number of independent directors / Total directors on the board	ISS Directors database
4. Ratio of Directors Holding more than 1 Seat	Number of directors sitting on other boards / Total directors on the board	ISS Directors database

5.	***Ratio of Non-Employee Block Holders***	Number of non-employee block holders (anyone holding more than 1% voting power) / Total directors on the board (see also Masulis and Mobs, 2011)	ISS Directors database
6.	***CEO/Chairman Duality Dummy***	Dummy variable indicating whether or not the CEO is also the chairman of the board; equals one if yes and zero otherwise	ISS Directors database
7.	***Ratio of Nominating Directors***	The proportion of the members of the board of directors that is responsible for nominating candidates for board seats, defined as: Number of nominating committee members / Total directors on the board	ISS Directors database
8.	***Ratio of Independent Nominating Committee Members***	Number of independent directors who are also members of the nominating committee / Total directors on the board	ISS Directors database
9.	***Ln (CEO Age)***	Natural logarithm of the CEO's age	ISS Directors database
10.	***Ln (CEO Tenure)***	Natural logarithm of (1 + the CEO's tenure)	ISS Directors database
11.	***CEO Voting Power***	Percentage voting power held by the CEO at the end of the fiscal year (see also Masulis and Mobs, 2011)	ISS Directors database
12.	***Ratio of Certified Inside Directors***	Number of insiders with independent outside directorships / Total directors on the board (see also Masulis and Mobs, 2011)	ISS Directors database
13.	***CEO Stock Ownership***	Percentage of outstanding shares owned by the CEO at the end of the fiscal year	Execucomp
14.	***Number of Institutional Block Owners***	Number of institutional block owners (with ownership > 5%) at the end of the fiscal year	13-F Thomson Reuters
15.	***Institutional Investor Ownership***	Total institutional ownership, as a percentage of shares outstanding at the end of the fiscal year	13-FThomson Reuters
16.	***Number of Institutional Owners***	Number of 13-F institutional owners at the end of the fiscal year	13-F Thomson Reuters
17.	***CEO Bonus Compensation***	Dollar value of CEO bonuses during the fiscal year / Total CEO compensation during the same year	Execucomp
18.	***CEO Options Compensation***	Dollar value of CEO stock options during the fiscal year / Total CEO compensation during the same year	Execucomp
19.	***CEO Salary Compensation***	Dollar value of the CEO's base salary during the fiscal year / Total CEO compensation during the same year	Execucomp

20. CEO Long-Term Incentive Plan Compensation	Dollar value of the CEO's long-term incentive programs during the fiscal year / Total CEO compensation during the same year	Execucomp
Control variables		
21. Price Volatility	Annualized standard deviation of daily stock returns during the fiscal year	CRSP
22. Stock Turnover	Average daily trading volume during the fiscal year / Number of shares outstanding at the end of the fiscal year	CRSP
23. Buy & Hold Return	One-year buy-and-hold return less the average annual return for the corresponding size and book-to market matched portfolio	CRSP
24. Intangible Assets	Natural log of the firm's intangible assets	COMPUSTAT
25. R&D Expense Ratio	R&D expenses / Total assets	COMPUSTAT
26. ROA	Net income / Total assets	COMPUSTAT
27. Size	Natural log of the firm's total assets	COMPUSTAT
28. Leverage	Total debt / Total assets	COMPUSTAT
29. Dividend Payout Ratio	Total dividends paid / Earnings before interest and taxes	COMPUSTAT
30. Book to Market Ratio	Book value of equity / Market value of equity	COMPUSTAT
31. Analyst Coverage	Number of analysts covering the firm on a given date	IBES
32. Tech Dummy	Dummy variable indicating whether or not the firm is classified as a technology firm based on its SIC code; we employ the classification by Kile and Phillips (2009) who consider firms with the following SIC codes as technology firms: 2833-2836, 3825- 3827, 7370-7375, 7377-7379, 3571, 3572, 3575, 3577, 3578, 3661, 3663, 3669, 3674, 3812, 3823, 3829, 3841, 3845, 4812, 4813, 4899	IBES
33. Number of Preceding Lawsuits	Number of lawsuits during the 365-day period prior to a given date	Securities Class Action Clearinghouse

Corporate governance and safety in the aviation industry

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Abstract

The purpose of this study is to examine whether airlines with poor corporate governance characteristics exhibit poorer safety performance after controlling for a series of firm-level and country-level variables that characterize the airline and the country it is headquartered in. Specifically, we regress the number of accidents of each airline on various corporate governance variables along with six firm-level financial variables and seven country-level variables during the period 1990 to 2016. We find a negative relationship between an airline's corporate governance quality and its accident rate. Specifically, our results suggest that airlines with less qualified, older, and busier directors, as well as airlines with a higher risk of director succession, exhibit more frequent accidents. Moreover, the longer the CEO's tenure in an airline, the lower the number of accidents. The study also examines whether a country's macroeconomic and institutional environment affects the safety of airlines that are headquartered there. As expected, the results suggest that airlines based in countries with more stringent legal regulations, stronger law enforcement, and better air transport infrastructure have better safety performance.

1. Introduction

You are sitting on a plane next to your significant other holding hands, enjoying the view above the clouds, and suddenly the plane runs into an area of severe turbulence. Ding! Buckle Up!! Your brain says: "Wait, what if the plane crashes." At one point or another, thoughts like these cross almost every air passenger's mind. Based on information provided by the Aviation Safety Network[1], there have been over 12,000 fatalities from plane crashes in North America alone since 1946.

Although that figure places flying among the safest modes of transportation, a single accident can be catastrophic and frequently leads to substantial news coverage. Based on information provided by planecrashinfo.com, pilot errors and mechanical failures are arguably responsible for 73% of all accidents, yet both are, to some extent, preventable because they are related to the way in which an airline company is directed and managed. For instance, the amount of money an airline spends on the renewal and maintenance of its air fleet, or how much it spends on training its pilots are discretionary expenses under the airline management's control.

Prior studies have investigated various possible determinants of safety in the aviation industry. Snow (1975), Michel and Shaked (1984), and Rhoades and Waguespack (1999) examine the effectiveness of the industry's regulations in preventing accidents as well as the potential impact of regulations on the economic and financial performance of the airline industry. Relatedly, many studies examine the financial performance of airlines in the aftermath of a disaster or terrorist attack and demonstrate that such events often affect the whole industry (e.g., Walker et al., 2005).

Another strand of the literature examines the relationship between competition in the industry and aviation safety. Abeyratne (2000) examines the consequences of strategic airline alliances on aviation safety and finds that although such alliances tend to foster growth and increase route coverage, they may reduce safety due to increased traffic volume; therefore, safety measures should grow in parallel to ensure the safe passage of the thousands of airplanes in the sky. Rhoades and Waguespack (1999) test the relationship between service and safety quality in the U.S. after industry deregulation that gave way to fierce competition. They note that service quality is a poor indicator of safety in their sample of air carriers. In a similar study, Jou et al. (2008) investigate the effect of service quality, price, and safety on passengers' choice behavior,

[1] See: https://aviation-safety.net

taking into consideration international airline competition. They find that safety, convenience, and service quality are major determinants of the booking decisions of air passengers.

The airline industry is a sector that is highly prone not only to external shocks as evidenced, e.g., by the current COVID-19 crisis but is also heavily dependent upon the economic, institutional, and political environment of a given country (Morrell, 2011; Pagliari & Voltes-Dorta, 2012; Walker et al., 2014). Apart from such external factors, many internal factors may affect the probability of airline accidents. Examples of these include the number of hours of training that pilots receive, pilot performance, the privatization of airlines, and the age of air fleets (Sagers, 1992; Gudmundsson, 2004; Walker et al., 2005; Wang et al., 2013; Ahmed and Ochieng, 2014; Asker and Kiraci, 2016). In addition, several previous papers (e.g., Rose, 1990; Li et al., 2004; Walker et al., 2020) examine the relationship between an airline's finances and its safety record. Their shared assumption is that financial constraints may cause air carriers to reduce maintenance and training expenses and to keep outdated airplanes in service. However, in practice, the situation appears to be more complex, as airline management may either sacrifice safety-enhancing investments in an effort to generate greater profits or may offset the high costs associated with safety investments by saving elsewhere. Therefore, empirical results on whether the financial status of an airline has any meaningful effect on its safety record are mixed. Furthermore, the findings in earlier studies are of limited value as they utilize shorter time-spans and only include cross-sectional data from one country such as the U.S.

The Airline Deregulation Act (ADA) of 1978 has changed the aviation industry in the United States. It eliminates government control over many aspects of this industry. Other countries took similar steps to liberalize aviation industry services. Although they do not affect aviation safety rules directly, airline managers may take advantage of this freedom in the market and act on their interest, cutting down certain expenses such as pilot training, maintenance expenses, etc., hence posing a potential threat to an airline's safety.

Deregulation increases the importance of managerial practices in a firm, including changes in operations, marketing, M&A activities and executive compensation (Cooper, 1999; Moritz, 2001; Manuela, 2011). In addition, deregulations increase the costs of monitoring managerial performance and the intensity of potential agency problems. The extant literature suggests many changes in the governance mechanisms of airlines post-deregulation (cf., Kole and Lehn, 1996). Similarly, Lee et al. (2011) examine earnings management dynamics in the aviation industry

following the Airline Deregulation Act and find that earnings management significantly increased post-deregulation. Because industry deregulation generally increases managerial discretion, it is possible, if not expected, that airline managers take advantage of this freedom and sacrifice safety-enhancing investments for their own benefit.

We are only away of few studies that have investigated the relationship between an airline's governance structure and its safety performance. Moreover, the existing research in this area is often regionally or temporally limited or has other drawbacks. For example, Li and Yang (2014) examine the governance characteristics of airlines and their potential impact on airline safety performance, but their data is limited to Chinese airlines. Other researchers have studied the effect of an airline's governance practices on various other aspects of performance (other than its safety record). These studies have linked corporate governance to such factors as an airline's profitability, professional development, sustainability, and marketing efficiency (Mileski and Nwabueze, 2007; Goll et al., 2008; Lu et al., 2010; Rammal and Hermann, 2010; Callahan and Davis, 2012). Recently, Suhardjanto et al. (2017) examine the effect of ownership structure on airlines' financial performance using airlines in Asia and Australia and document a positive relation between foreign and government ownership and the financial performance of airlines. In a similar study, Vermooten (2018) tests options for the restructuring of state-owned airlines in South Africa and finds that the share issue privatization method of privatization is suited to resolve the capitalization of South African Airways (SAA) and subject SAA to market and regulatory disciplines. Most recently, Manda and Polisetty (2019) explore India's leading airline's boardroom battles that were triggered by alleged rights abuses by one of its co-founders. They find that although the airline (IndiGo) managed to stay profitable and keep its brand visibility, certain irregularities in IndiGo's corporate governance have raised shareholder concerns.

One of the difficulties in obtaining consistent findings in this area is the rarity of airline accidents, together with the small sample size used in most studies. A comprehensive international sample is, therefore, needed to obtain more accurate results. In addition, a further limitation of earlier studies is that they were carried out before the industry was deregulated in most countries, as a result of which it became increasingly competitive.

The primary contribution of this study is that it is the first to investigate the influence of an airline's corporate governance characteristics on its safety performance in a broad cross-country context, along with other variables that have already been shown to affect aviation safety, in particular, the

financial health of the airline. In addition, our study is the first to explore how the institutional and macroeconomic environment of a given country affect the safety performance of airlines headquartered there. As such, our study adds to the literature pertaining to the link between the management of airlines in diverse environments and their safety.

The benefits of a comprehensive analysis of this nature are manifold. First, North American airlines are more heavily regulated and are subject to more stringent safety regulations than airlines in many other countries around the world. As such, even in light of poor financial performance and poor governance practices, they may not be able to significantly reduce their safety spending (and thereby heighten their accident susceptibility), making a relationship between accident rates, corporate governance characteristics and financial performance more difficult to identify. Moreover, given that accidents are rare, a large sample is required to separate accidents that occur due to pure bad luck from accidents that are truly the airline's fault. Finally, by employing a sample of airlines around the world, we are able to consider critical country-level factors (e.g., macroeconomic, regulatory, legal, and infrastructure-related variables) that cannot be examined in a single country context, but are of considerable interest when exploring the determinants of an airline's safety performance.

Regarding the governance structure, we expect that board members holding multiple director positions in different airlines or a less diverse board of directors are less inclined to invest in new airplanes, pilot training, etc., resulting in a poorer safety record. Similarly, we expect that CEOs who also serve as chairmen of their companies' boards of directors are less monitored, and many thus shirk on important safety investments. We answer questions such as: What kind of directors should oversee the CEOs of airlines while they are making important decisions? What characteristics of directors strengthen their monitoring role on the board of an airline? What country characteristics help improve safety in the aviation industry?

2. Data

2.1 Sample description

This study provides empirical evidence drawn from both North American and international sources. The sample consists of 372 airlines from 70 countries from 1990 to 2016. Due to the entry

and exit of several air carriers during that timeframe, as well as instances of missing data, the dataset is not fully balanced.[2]

We retrieve our data from the following sources:

1. The International Civil Aviation Organization offers several databases, including the three modules entitled Air Carrier Finances, Air Carrier Fleet, and Air Carrier Personnel, from which we retrieved data for all airlines.

2. Data about governance characteristics of airlines are accessible through the BoardEx database, in particular, the "Organizational Summary" section.

We manually reference and cross-check each airline from the ICAO database in BoardEx to ensure that we find exact matches and increase the matched sample size. In case we cannot find an exact match in the BoardEx database, we use the data of its parent airline instead of the airline subsidiary.[3] We define our dependent variable as the number of accidents experienced by an airline in a particular year. Our independent variables consist of governance characteristics, financial measures, and a set of macro-level control variables. Similar to the previous literature, we estimate a series of Poisson regressions because ordinary least squares regressions used in combination with ratio data (e.g., accident ratios) as the dependent variable might lead to incorrect or misleading inferences (cf., Walker et al., 2020).

We investigate airlines headquartered in different countries that are at various levels of development. These countries vary with respect to their economic strength, demographics, geography, infrastructure, and institutional environment. As such, our sample provides a comprehensive representation of the worldwide aviation industry.

We obtain data on global aviation disasters from the National Transportation Safety Board (NTSB) and two online databases: aviation-safety.net and planecrashinfo.com. To ensure the accuracy and reliability of these databases, we compare the details of every overlapping record among the databases. In addition, we cross-reference the data to airline accident reports listed on Wikipedia. No inconsistencies or spurious data entries were found during these cross-checks.

Based on the classification scheme provided by the International Civil Aviation Organization (ICAO), accidents differ from incidents in several aspects. Accidents include occurrences in which

[2] The authors are delighted to provide, on request, a list of the airlines included in the dataset together with their operating periods and all major accidents.

[3] Our results remain qualitatively and quantitatively similar if we remove these airlines from our sample.

a person is fatally or seriously injured, the aircraft sustains damage or structural failure, or the aircraft is missing or is completely inaccessible.[4] Accidents of this nature are frequently considered to be due to air carrier deficiencies such as pilot errors, inadequate training, or aircraft maintenance problems. In contrast, aviation incidents tend to be less severe and are frequently attributed to air traffic control failures or unusual natural events. We follow Rose (1989) who employs airline accidents as a proxy for safety, arguing that they are more appropriate than airline incidents to investigate air carrier safety as opposed to air system safety.

2.2 Accident causes

The website Planecrashinfo.com breaks down accident causes into five categories: (1) pilot error, (2) mechanical failure, (3) weather-related, (4) criminal activity, and (5) other. Because many accidents are attributed to more than one such cause, we focus our analysis on the primary cause listed in the accident description.

*** Insert Table 1 About Here ***

Table 1 provides information on the primary causes of fatal accidents that occurred in each decade since 1950. Accidents involving aircraft with 18 or fewer passengers aboard, military aircraft, private aircraft, and helicopters are excluded. Consistent with the findings in the literature (Wiegmann et al., 2001; Shappell et al., 2004) that identify pilot errors as the primary cause of aircraft accidents, the table shows that, on average, pilot errors account for 49 percent of all accidents. Pilot errors can be attributed to a range of organizational influences, including inadequate supervision, inappropriate planning of flights, inadequate training (Johnson and Holloway, 2004), willful violation of rules, and corruption to bypass regulatory oversight (Wiegmann et al., 2001). The second most prominent culprit is mechanical failures, which are responsible for 23 percent of all accidents. Prior academic studies (Sexton et al., 2000; Baker et al., 2001; Wiegmann et al., 2001) show that ground crews' lack of experience and aircraft manufacturer miscalculations are the main reasons for mechanical failures. The third and fourth most frequent causes of accidents include adverse weather and other causes, respectively, each accounting for approximately ten percent of all accidents. Weather-related accidents include poor visibility, severe turbulence, severe winds, icing, thunderstorms, lightning strike, etc. (Knecht and

[4] Specifically, ICAO defines an accident as "an occurrence associated with the operation of an aircraft that takes place between the time any person boards the aircraft with the intention of flight and all such persons have disembarked, and in which any person suffers death or serious injury, or in which the aircraft sustains damage or structual failure, or in which the aircraft is missing or is completely inaccessible" (see http://www.icao.int/Pages/default.aspx).

Lenz, 2010). However, Knecht and Lenz (2010) report that weather alone is rarely the sole culprit, and they point out that the lack of weather-related training and experience of pilots and poor-quality equipment are contributing factors of aviation accidents in this category. Finally, the last category is criminal activities, accounting for approximately eight percent of all accidents. This category includes accidents caused by hijackings, shoot-downs, explosive devices aboard, and pilot suicides. Following Walker et al. (2020), we eliminate accidents in this latter category (i.e., criminal occurrence) as well as accidents caused by wildlife hits from our subsequent analysis, as those accidents do not reflect poor safety practices by the airline.

3. Methodology

We estimate the Poisson regression models as follows:

$$Log(N(Accidents)) = \beta_0 + \beta_1 (Corporate\ Governance\ Characteristics) + \beta_2 (Financial\ Variables) + \beta_3 (Institutional\ \&\ Macroeconomic\ Variables) + \varepsilon$$

The main focus is on the corporate governance characteristics of airlines in the Poisson regression. We also include financial variables in our model to control for the financial health of airlines. The dependent variable is the number of accidents in the Poisson regression as a proxy for safety performance. Table 2 provides detailed definitions for all variables used in our study.

*** Insert Table 2 About Here ***

Our first group of variables is related to the corporate governance characteristics of airlines. The variables pertain to two categories: (1) board characteristics, and (2) CEO characteristics. In terms of board characteristics, we utilize various variables from BoardEx in our regression analysis, including the *succession factor*, the *gender ratio,* the *board size*, an *independent director ratio*, a *"busy board"* measure*,* the *standard deviation of the busy board,* the *average number of professional qualifications* held by the board members*,* the *standard deviation of the age of directors,* a ratio that captures the *nationality mix* among the board members*,* and the *average directors' time to retire.* The *succession factor* measures the clustering of directors around their retirement age, with a lower number presenting a higher risk of succession. We argue that airlines with a higher risk of succession will have a higher number of less-engaged board members and thus face a higher risk of accidents. Horner (2016) examines the clustering effect and finds that clustered boards with a large proportion of ready-to-retire directors shirk on their monitoring responsibilities.

The *average number of professional qualifications* held by board members is a proxy for how qualified directors are to make decisions for the company. We expect that boards with more qualified directors will better direct their CEOs to steer the airlines toward success, including safer operations. By using machine learning algorithms, Erel et al. (2018) find that male directors who hold more directorships and have fewer qualifications tend to be less desirable and provide poorer internal oversight. Similarly, Fich and Shivdastani (2006) report that firms with busy boards are associated with weak corporate governance. Our *busy board* variable captures the number of other directorships held by each director of the firm. We expect that directors with directorships at other firms will have less time to allocate to each firm they serve on, and that they provide poorer monitoring. As a result, airlines with busier boards of directors will have a larger number of accidents. The variables measuring the *standard deviation of the age of directors* and the *average directors' time to retire* capture the age diversity within a business environment. Similarly, the *nationality mix* and the *gender ratio* capture the cultural and gender diversity within a firm. Diversity among the board members is frequently viewed as having a positive influence on the monitoring quality of a board. For instance, Louch (2000) measures the age-related distance between directors on the board and shows that a higher age difference reduces the probability of established connections among individuals. In another study, Chidambaran et al. (2018) find that age, ethnicity, and gender diversity explain both director turnover and director promotions to more influential positions on boards. We anticipate that airlines with younger directors and a wider age range among the directors have a lower number of accidents because the directors have fewer established connections and can settle conflicts more objectively and efficiently. In addition, we expect that airlines with a more diverse board of directors benefit from improved internal monitoring and thus have fewer accidents.

To capture the impact of CEO characteristics on a carrier's safety performance, we include *CEO tenure*, *CEO age*, and a *CEO duality dummy* in our analysis. Fich and Shivdastani (2007) explain the impact of CEO duality in a litigation context and report that fraudulent firms are more likely to exhibit CEO duality. In another study, Miller and Shamsie (2001) report that CEO tenure exhibits an inverse U-shaped relationship with firm performance: their experience grows which, in general, has a positive influence on firm performance, but their willingness to take on risks declines when they approach retirement. Similalrly, Baker and Mueller (2002) examine how CEO characteristics affect R&D spending and report that CEOs with longer tenure tend to act more in

their own interest, which results in weaker corporate governance practices and poorer performance.

We use an essential control variable throughout all models: the *average utilization factor*, which captures the airline's accident risk in terms of total hours flown over total days available. In addition, we use four categories of financial ratios that are frequently used in the literature to evaluate a firm's performance and financial health: (1) the *current ratio*, a liquidity proxy, (2) *total asset turnover*, an activity ratio, and (3) *the growth ratio,* recognizing that sustainable growth is an important lever of business success. The fourth category includes two *profitability ratios*, which aim to capture an airline's current and expected future profitability and financial health: the *net profit margin*, and the *Z Score*.[5]

The Altman Z Score model has been successfully used to predict firm failures in various industries as early as the 1980s. More recently, scholars employed this variable to predict the bankruptcy of carries in the aviation industry (Gritta et al. 2011; Stepanyan, 2014).

We define two additional control variables, namely (1) the *maintenance ratio* to control for the effect of direct maintenance expenditures on safety, and (2) the operating revenue to control for the effect of airline size on safety. The maintenance ratio is defined as an airline's expenditures on flight equipment maintenance and overhaul divided by its total revenue. We use this variable to control for the overall attempt of an airline to update and maintain its air fleet, thereby keeping it secure and safe. The operating revenue is defined as an airline's annual operating revenue reported in billions of dollars. We employ this variable in all models to capture the natural tendency for larger airlines to have more accidents.

The airlines in this study are headquartered across various countries around the globe and it is reasonable to assume that the level of development and infrastructure of a given country affect the safety performance of airlines headquartered there. In an attempt to control for such country-level determinants of airline safety, we consider a series of variables that proxy for the level of

[5] We calculate the Z Score using the formula for US and foreign firms because we study the global aviation industry. Specifically, we follow Altman et al. (2014) and consider Z Scores below 1.1 as representative of a firm's distress zone, and above 2.6 as indicative of its safe zone (after discounting 3.25 from the score). The Z Score itself is calculated as:
$Z = 6.56X1 + 3.26X2 + 6.72X3 + 1.05X4 + 3.25$, where
X1 = Working capital / Total assets, where X_1 measures liquid assets in relation to the size of the company.
X2 = Retained earnings / Total assets, where X_2 measures profitability that reflects the company's age and earning power.
X3 = Earnings before interest and taxes / Total assets, where X_3 measures operating efficiency apart from tax and leveraging factors. It recognizes operating earnings as being important to long-term viability.
X4 = Book value of equity / Book value of total liabilities. This variable adds a market dimension that highlights security price fluctuations as a possible red flag.

corruption, the quality of law enforcement, the legal environment, and the quality of air transport infrastructure in a given country, as well as the state of a country's economy. Our research is one of the first study in which we control for macro variables in the finance/aviation literature. We argue that the accident propensity of airlines is higher in countries with a higher level of corruption, poorer law enforcement, and a less developed legal environment, due to a lack of consistent regulatory policies and the laxer enforcement of those policies. In addition, we expect airlines in countries whose economies are in poor health, whose technical infrastructure is antiquated, and/or whose aviation sector is underdeveloped to incur a higher accident risk.

The country-level variables used in the study are: (1) *registered carrier departures* (*Departures*), which capture the number of domestic and international takeoffs of air carriers registered in the country and reflect air transportation usage in the country. We argue that the higher the flight volume in a given country, the higher the number of accidents, and (2) a country's *unemployment rate,* which is widely recognized as a key indicator of a country's economic well-being. Moreover, following La Porta et al. (1998), we employ proxies for the quality of law and order in each country and consider (3) the *efficiency of the judicial system*, (4) the *rule of law*, and (5) the level of *corruption*. These measures are compiled by private credit risk agencies to assess differences in the institutional environment across countries. These three institutional environment measures are scored from zero to ten, with lower scores representing a lower quality institutional environment. Moreover, we employ an additional macro-level control variable, i.e., (6) the *quality of air transport infrastructure.* The quality of a country's air transport infrastructure is defined as the quality (extensiveness and condition) of air transport in a given country in a given year. The quality of air transport infrastructure information is retrieved from the Global Competitiveness Index Dataset provided by the World Economic Forum. The variable originally ranges from one to seven. We adjust the scale from (underdeveloped) to ten (most developed) to increase the variable's comparability with the institutional variables mentioned above. Finally, we employ (7) *an English legal origin dummy* to identify whether the legal system of a given country originates from English common law. The variable equals one if the origin is English common law and zero otherwise. There is a vast literature which shows that common law countries have more effective institutions and policies than countries with legal systems that originate from civil law. For example, common law countries grant more freedom to the entry of new businesses (Djankov et al., 2002) and provide a better quality of contract enforcement and more reliable protection of

private property (Djankov et al., 2003). They are also associated with more highly developed financial systems (La Porta et al., 1997; Djankov et al., 2008) and less corruption (Treisman, 2000).

4. Empirical Results

4.1 Descriptive Statistics and Univariate Tests

We commence our empirical analysis with a series of univariate tests (see Table 3) in which we split our sample into two subsamples, a sample of airlines (firm-year observations) with accidents and one without accidents. For each subsample, we then report the mean and median for each variable. In the last two columns, we test for the equality of means and medians between the two subsamples and report the p-values for both a t-test for the difference in means and a Wilcoxon median test.

*** Insert Table 3 About Here ***

We see that the mean and median of the busy board variable are significantly higher for the sample with accidents than the sample without accidents, showing that airlines that have accidents also have busier boards of directors. As expected, the succession factor exhibits higher mean and median values for the sample without accidents than the sample with accidents implying that airlines that have accidents also have a higher risk of succession. Another interesting observation is that the mean and median board size is significantly higher for the sample with accidents than the sample without accidents, suggesting that airlines that have accidents also have larger boards of directors. This finding is in line with the literature that suggests that boards that are too large are less efficient and provide lower-quality monitoring. Moreover, we observe that airlines with accidents have older CEOs than airlines without accidents. Contrary to our expectations, the independent director ratio exhibits higher mean and median values for the sample with accidents than the sample without accidents. This may be due to potential endogeneity (which we will address in our multivariate setup) or may be due to the fact that airlines with accidents have larger boards than airlines without accidents, which may also affect their composition. From a financial perspective, airlines in the sample without accidents have a higher current ratio, greater asset turnover, and larger Z Scores compared to airlines in the sample with accidents, with all differences being statistically significant.

In Panel C, we divide our sample into a series of subsamples, with each pair of subsamples formed around the median of our continuous or categorical independent variables (the below-

median vs. above-median). For binary variables, we define the subsamples based directly on the underlying variable values (zero or one subsamples). For each subsample, we report the number of observations (N), as well as the mean and median of the number of accidents. We employ a series of t-tests and Wilcoxon tests to test for the equality of mean and median accidents between the subsample pairs.

Our univariate tests provide initial support for our main hypotheses, suggesting that both an airline's corporate governance as well as its home country's institutional environment affect its safety performance. The mean and median accidents for airlines with a low (below-median) *succession factor* are higher than the accident rates for the above-median subsample. The differences are statistically significant, indicating (as expected) that airlines with a higher risk of succession have more accidents than airlines with a lower risk of succession. Similarly, the mean and median accidents are significantly higher for airlines with undiversified boards (boards with a smaller *gender ratio*), airlines with larger boards (*board size* >11 members), boards whose directors are about to retire sooner (*average director time to retire* ≤ 10.5 years), and airlines with older CEOs (*CEO age* > 60 years). Airlines with busier boards (*busy board* >2) and airlines with CEOs who also serve as chairmen of the board of directors (CEO duality = 1) also exhibit higher number of accidents. The subsample differences for the latter two variables are only significant in the median (not the mean), however. Somewhat surprisingly, the subsample differences suggest that boards with a higher proportion of independent directors (*independent director ratio* > 0.863) have higher accident rates. The difference becomes insignificant in our multivariate analysis, however.

The subsample differences for other firm-level variables are also as expected: airlines with higher utilization factors (*average airline utilization factor* > 7.1), less liquid assets (*current ratio* ≤ 0.905), lower asset turnover (*total asset turnover* ≤ 1.139), and lower Z scores (*Z score* ≤ 3.683) are more prone to accidents. The *maintenance ratio* also exhibits the expected differences, airlines with a lower maintenance ratio (*maintenance ratio* ≤ 0.106) have poorer safety performance, but the subsamples only differ in the mean, not the median.

Finally, on a country level, airlines appear to have poorer safety performance if they are headquartered in countries with a higher flight volume (*ln(departures)* > 12.335). Contrary to our expectations, airlines from countries with a lower quality institutional environment and poorer enforcement of the law have fewer accidents. This contradiction may be due to the fact that we do

not control for the number of departures in each country in our univariate analysis. In our multivariate analysis, these variables reverse their signs and support our initial expectations.

4.2 Correlation Analysis

Before we estimate our regressions, we calculate the Pearson correlation coefficients between each variable pair. The correlations are reported in Table 4. We mark in bold the correlation coefficients that exceed a threshold of 0.5 in absolute terms. In our subsequent analysis, we include these variables separately in our regressions to mitigate any multicollinearity concerns.[6]

*** Insert Table 4 About Here ***

4.3 Poisson Regression Analysis

We first focus on the interpretation of variables related to an airline's corporate governance characteristics and their financial condition. In Models 1 to 5 of Table 5 (Panel A), we employ various combinations of our corporate governance variables while controlling for country-level influences. Model 1 provides the results for several board characteristic variables including the *average number of qualifications* of directors on the board, the *succession factor*, the *gender ratio*, and the *board size*. The coefficient of the *average number of qualifications* is negative and statistically significant at the 5% level indicating that airlines in which directors are more qualified have fewer accidents; increasing the average number of qualifications of directors by one unit causes a decrease in the log of the number of accidents by 1.12 units. The *succession factor* exhibits a negative (albeit insignificant) coefficient, suggesting that airlines with a lower risk of succession also have fewer accidents.[7] The *board size* variable exhibits a negative coefficient that is insignificant, however.

In all models, we include the *average airline utilization factor* which captures the airline's accident risk in terms of total hours flown over total days available. The variable exhibits a positive coefficient (that is only marginally significant in one model, however), providing a weak indication that airlines that employ their air fleet to a fuller extent (with possibly less time for maintenance between flights) are more prone to accidents.

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[6] Due to the high correlation between the *efficiency of the judicial system*, *corruption*, the *rule of law,* and the *quality of air transport infrastructure*, reported in Table 4, we only include the rule of law (together with other country-level controls) in all models in Panel A. In un-tabulated tests, we re-run the tests using the other variables (the *efficiency of the judicial system*, *corruption*, and the *quality of air transport infrastructure*) and we find similar results. We explore the individual effects of each country level variable in Panel B.

[7] Note that the *succession factor* becomes significant in two subsequent model specifications in Table 5.

*** Insert Table 5 About Here ***

In Models 2 and 3, we keep the *average number of qualifications* and the *succession factor* and add the *nationality mix* (Model 2) and the *standard deviation of the age of directors* and the *independent director ratio* (Model 3), while dropping *board size* and the *gender ratio*, respectively. Both the *succession factor* and the *average number of qualifications* retain their signs from Model 1, with the *average number of qualifications* remaining statistically significant in these models. The coefficient of the *nationality mix* is negative but insignificant, providing at best weak support for the notion that that airlines with more diverse boards also have fewer accidents. Similarly, the *standard deviation of the age of directors* exhibits a positive (albeit insignificant) coefficient. The variable remains positive with mixed significance levels in subsequent tables (Tables 6 to 8), offering weak support for our expectation that airlines with directors from a wider age range also have more accidents. This is probably due to the fact that directors from the same age group behave more homogeneously, and have fewer conflicts compared to boards with directors who are more diverse in terms of their age.

In Model 4, we replace the corporate governance variables in Model 3 (other than the *average number of qualifications*) with the variables *busy board*, the *standard deviation of the busy board*, and the *average directors' time to retire*. The busy board variable exhibits a statistically significant positive coefficient, indicating that airlines with busier directors on the board have more accidents. This is as expected as busy directors are less likely to fulfill their monitoring role in an airline, which could lead to the CEO exploiting the airline's resources or shirking on his/her efforts, thereby increasing the likelihood of an accident. Also, the standard deviation of the *busy board* exhibits a negative coefficient, which is statistically significant, suggesting that the higher the *standard deviation of the busy board* variable, the lower the number of accidents. Intuitively, when there are less busy directors on a board (which increases the *standard deviation of the busy board* variable), it may cancel the adverse effects of busy directors on the number of accidents. Moreover, the *average directors' time to retire* also shows a negative, but insignificant coefficient. The coefficient remains negative and becomes borderline significant in subsequent tables, providing weak support for the notion that an airline with a younger board of directors will have fewer accidents. This provides partial evidence for our expectation that directors who are at earlier stages of their career and further from retirement are better monitors and are less likely to take on additional risk at the expense of the shareholders.

In Model 5, we test the effects of CEO characteristics, including *CEO tenure*, *CEO age*, and *CEO duality* on an airline's safety performance. Our results show that CEO tenure has a negative coefficient. Again, the variable is insignificant here, but gains significance in some of our later tables, indicating that the longer the CEO's tenure in an airline, the lower the number of accidents. A common-sense interpretation for this finding is that, although the CEO's tenure may influence his/her risk-taking behavior and consequently the firm's performance adversely, the CEO's insights that come with experience may cancel the negative effects of a seasoned CEO's risk-adversity. Finally, as expected, CEO duality exhibits a positive coefficient, which is not statistically significant, however.

In Models 6 and 7, we exclusively focus our attention on financial variables to examine whether our results confirm or contradict previous findings in the literature (see, e.g., Walker et al., 2020). The results for Model 6 indicate that the *current ratio* and *total asset turnover* have negative coefficients (although only the *total asset turnover is statistically significant)*, suggesting that more liquid and particularly more efficient airlines have fewer accidents, as would be expected. Similarly, in Model 7, the *Z Score* exhibits a statistically significant negative coefficient, indicating that airlines with lower bankruptcy risk experience fewer accidents. Moreover, following our expectations, the coefficient of the *maintenance ratio* is negative, suggesting that when airlines increase their maintenance and overhaul expenses, they have fewer accidents. Similarly, the net profit margin exhibits statically significant negative coefficients in Models 2 to 5, confirming our expectation that more profitable airlines have a lower accident risk. In all models, we control for an airline's size by including the *operating revenue* of each airline. As would be expected, the variable consistently exhibits positive and statistically significant coefficients, suggesting that larger airlines experience more frequent accidents. In the last column, we include all variables used in the previous columns to examine whether or not our findings still hold in a fully specified model. Other than the *net profit margin*, all variables retain their signs and significance levels. In addition, the coefficient of the *standard deviation of the age of directors* becomes statistically significant at the 5% level, confirming our hypothesis that directors from the same age group behave more homogeneously and have fewer conflicts compared to boards with directors who are more diverse in terms of their age.

The institutional and macroeconomic variables exhibit consistent signs and significance levels throughout most models. Somewhat surprisingly, the unemployment rate is significantly

negatively related to accident frequency, suggesting that airlines in countries with higher unemployment experience fewer accidents. The rule of law variable also exhibits a negative coefficient in all models showing, as expected, that airlines from countries with stronger tradition of law and order have fewer accidents.

To address the potential multicollinearity between several of our (highly correlated) country-level variables, we excluded three of them in Panel A. In Panel B, we exclusively focus on our institutional and macroeconomic variables and explore how each of them affects aviation safety when viewed alone. We employ the country-wide departures variable in all models to control for the size of the overall aviation sector in a given country. In Model 9, we find the coefficient of the *unemployment rate* to be positively, albeit insignificantly, associated with the number of accidents. We initially expected airlines in countries with higher unemployment rates (and weaker economies) to have poorer safety performance but, as noted earlier, found contrary results in Panel A and now inconclusive results in Panel B. In Model 10, we explore the effect of country-wide *departures* (as a proxy for the size of the country's aviation sector). Our results show a significant positive coefficient for *Ln (Departures)*, suggesting that airlines in countries with a large volume of flights experience more accidents – as would be expected. Next, we estimate four models designed to examine the effect of our institutional environment and law enforcement variables. The results are provided in Models 11 to 14 of Panel B. As mentioned above (see Section 3), other than the *common law dummy*, these measures (the *efficiency of the judicial system*, *corruption*, and the *rule of law)* are scored from zero to ten, with lower scores representing a lower quality institutional environment and/or poorer enforcement of the law. Except for the *common law dummy*, all variables exhibit significant negative coefficients. This confirms our hypothesis that airlines in countries with less efficient judicial systems, poorer law enforcement, and higher levels of corruption are likely to have poorer safety performance.

In Model 15, we examine how the *quality of a country's air transport infrastructure* affects the accident risk of airlines operating in that country. As expected, we observe a significant negative coefficient for the variable, suggesting that airlines in countries with better aviation infrastructures are less likely to have accidents.

Finally, in the last column, we estimate a fully specified model in which we include all country-level variables. The joint inclusion of the variables reduces the significance of some. Each variable retains its expected sign, however.

5. Robustness Checks

5.1 Reverse Causality

One concern is that our results may be subject to reverse causality, i.e., that accidents cause declines in an airline's profitability and possibly a different board structure, and not vice versa. To address this possibility, we follow Rose (1990), Marcus et al. (1990), Dionne et al. (1997), and Wang et al. (2013), and re-run our Poisson regression using lagged independent variables. By employing lagged financial and board characteristics variables, we eliminate the possibility that accidents drive a firm's financial performance and governance characteristics and may thereby bias our results. Table 6 summarizes the results. Overall, in both Panels A and B, the results remain qualitatively and quantitatively similar to our original findings in Table 5.

*** Insert Table 6 About Here ***

Interestingly, once we employ lagged variables, the coefficients of *board size*, the *standard deviation of the age of directors,* and *nationality mix* become statistically significant compared to our findings in Table 5. The lagged *standard deviation of the age of directors* variable has a significant positive coefficient indicating that an increase in the *standard deviation of the age of directors* by one unit causes an increase in the log number of accidents by 0.229 units. Moreover, the lagged *board size* variable exhibits a significant positive coefficient in our full model specification suggesting that airlines have more accidents when they have more directors on their board – possibly because boards that become too large are less efficient and provide poorer monitoring than smaller boards.[8]

5.2 Zero Inflated Regression

Because our dependent variable has an excess of zero counts (aviation accidents are – fortunately – rare), we perform a robustness test in which we employ the zero-inflated regression variant of the Poisson model. The zero-inflated Poisson model allows for over-dispersion in the data. The results of our zero-inflated Poisson regressions are summarized in Table 7. In both Panel A and Panel B, the coefficients of our variables retain the same signs and significance levels as our results in Table 5, thus confirming our earlier findings.

*** Insert Table 7 About Here ***

[8] Note that the literature examining the optimal board size suggests that boards should neither be too large nor too small with boards consisting of approximately six members often considered to be ideal.

5.3 Potentially Omitted Variables

In a third set of robustness tests, we address the concern that potentially omitted variables may bias our result. This problem is common in studies of this kind. Following the literature in the area (O'Connell, 2007; Wooldridge, 2010; Amir et al., 2016), we perform a robustness test in which we control for random effects in our multivariate empirical analysis. Before doing so, we ran a Hausman specification test to choose the appropriate model (a random-effects model rather than a fixed-effects model). In addition, we evaluated the log-transformed over-dispersion parameter (lnalpha). This statistic assesses the extent to which the use of random effects enhances the fit of our model (compared to just using a pooled Poisson estimation). It confirmed that the random-effects model is the appropriate option to control for firm-fixed effects in our empirical analysis and to address the potential omitted variable problem. The results, reported in Table 8, again remain qualitatively consistent with those reported in Table 5.

*** Insert Table 8 About Here ***

5.4 Cox Proportional Hazards Model

One of the disadvantages of the Poisson regression model is that the failure rate (the accident rate in our study) is assumed to be constant throughout the period of investigation. Given the technological progress during our sample period, it is likely that this assumption is violated. The Cox Proportional Hazards Model relaxes this assumption and leaves the failure rate unspecified. Moreover, in contrast to the Poisson regression model, it does not make any assumptions regarding the shape and distribution of the dependent variable. Therefore, estimates are likely to be more robust under the Cox model. Many scholars have used the Cox Proportional Hazards Model in their analysis (Allen and Rose, 2006; Chen et al., 2012; Gupta et al., 2018). We follow prior studies that conduct survival analyses and perform a robustness test using the Cox model (see Table 9).[9] For consistency with our previous tables and to aid the interpretation of our results, we report positive-negative coefficients instead of hazard ratios. Most of the results reported in Table 9 remain consistent with our original findings in Table 5.

*** Insert Table 9 About Here ***

[9] We do not estimate the full model in Panel A of Table 9 to avoid over-specification that may result from the reduced sample size in our Table 9 regressions.

6. Conclusions

The purpose of this study is to examine whether airlines with poor corporate governance characteristics exhibit poorer safety performance after controlling for each airline's financial condition and a series of country-level variables. To address this question, we regress the number of accidents of our sample airlines on various firm-level corporate governance variables along with eight firm-level and seven country-level control variables during the period from 1990 to 2016. Overall, we find a negative relationship between an airline's corporate governance quality and its accident propensity. We find that the more qualified the directors on the board of an airline, the fewer accidents the airline will have. In addition, we find that airlines with a lower level of age-clustering among the directors have fewer accidents. Although gender and national diversity among the board members exhibit negative signs, they are not significant. We further find that airlines with busier directors on the board have more accidents. Arguably, busy directors are less likely to fulfill their monitoring responsibilities in an airline, which can lead to the CEO exploiting the airline's resources or reducing his/her efforts, thereby increasing the likelihood of an accident. Although the coefficients of *busy board* variable are not statistically significant in all models, it is the case for most models and in the summary statistics section, and moreover the coefficients may lose their significance level because of the methodology used. Furthermore, our findings show that an airline with a younger board of directors tends to have fewer accidents. Finally, the longer the CEO's tenure in an airline, the lower the number of accidents. Although CEO duality exhibits a positive coefficient, it is not statistically significant.

In a series of robustness tests, we employ Zero Inflated Poisson regressions instead of regular Poisson regressions to assess whether the excess of zeros in our dependent variable generates any incorrect inferences. We also add the utilization factor variable to all of our models to control for an airline's exposure to the risk of an accident. In almost all models, the results from the robustness tests are consistent with the main regressions. In another robustness test, we re-run our main Poisson regression models with lagged variables to address any potential reverse causality problems. Also, in an attempt to address any biases caused by potentially omitted variables, we perform a robustness test in which we control for random effects in our multivariate empirical analysis. Finally, we employ the Cox Proportional Hazards Model in another robustness test to find whether or not our results are consistent regardless of the specification of our regression models.

This study further examines whether a country's macroeconomic and institutional environment, as well as its infrastructure, affect the safety of airlines which are headquartered in that country. As expected, the results suggest that airlines based in countries with stronger law enforcement, more stringent legal regulations, and better air transport infrastructure have better safety performance. Although, the coefficient of the *quality of air-transport infrastructure* variable changes its sign in the last models, it may be due to multicollinearity in the last equation.

The results of this study have important policy implications for both the airline industry and regulators. To allocate resources more efficiently, regulators may find it beneficial to focus their supervision on airlines with poor governance practices. Moreover, as noted earlier, pilot errors remain the most frequent cause of aviation accidents. Thus, developing and refining policies that reduce accidents caused by pilot errors should be a prime goal for regulators. Given the association between poor corporate governance characteristics and accident rates observed in this study, it is reasonable to conclude that pilots of airlines with poor corporate governance practices are more likely to experience such issues as inadequate training, unfavorable working conditions, unreasonable flight schedules, etc. In addition, it is possible that airlines in financial distress and airlines with weak corporate governance practices have lower hiring standards, such as requiring fewer hours of flight experience. The strategies employed by regulators should, therefore, take account of the higher risks attached to airlines that exhibit poor corporate governance practices or are in a weak financial state, particularly insofar as these may affect the selection, training, and management of pilots.

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Table 1: Causes of Fatal Accidents by Decade

This table provides information on the causes of fatal accidents that occurred worldwide from January 1950 to December 2009 based on information provided by PlaneCrashInfo.com. For accidents with multiple causes, the most prominent cause is used.

Cause	1950s	1960s	1970s	1980s	1990s	2000s	2010s	Average
Pilot Error	50%	53%	49%	42%	49%	50%	57%	50%
Mechanical Failure	26%	27%	19%	22%	22%	23%	21%	23%
Weather-Related	15%	7%	10%	14%	7%	8%	10%	10%
Criminal Activities	4%	4%	9%	12%	8%	9%	8%	8%
Other	5%	9%	13%	10%	14%	10%	4%	10%

Table 2: Definitions of Variables

This table provides an overview of the explanatory variables used in our subsequent analysis. Panel A provides sources and definitions for the firm-level explanatory variables. Panel B provides sources and descriptions for the country-level explanatory variables.

Panel A: Firm-level Explanatory Variables

Variable	Source	Description
Avg. Number of Qualifications	BoardEx	Average number of professional and academic qualifications of directors on the board
Succession Factor	BoardEx	Measurement of the clustering of directors around retirement age on a given date; a lower number represents a higher risk of succession
Gender Ratio	BoardEx	Male directors / Total directors
Board Size	BoardEx	Number of directors on the board
Nationality Mix	BoardEx	Proportion of directors from other (non-domestic) countries
Std. Dev. of Age of Directors	BoardEx	Standard deviation of the ages of directors for all the directors on a given date
Independent Director Ratio	BoardEx	Number of outside or supervisory directors / Board size
Busy Board	BoardEx	Number of other directorships held by each director of the firm (Average across all directors on the board)
Std. Dev. of Busy Board	BoardEx	Standard deviation of Busy Board
Avg. Dir. Time to Retire	BoardEx	Average time to retirement for all directors on a given date, assuming a retirement age of 70
Ln (CEO Tenure)	BoardEx	Natural logarithm of the airline CEO's tenure on a given date
Ln (CEO Age)	BoardEx	Natural logarithm of the airline CEO' age on a given date
CEO Duality Dummy	BoardEx	Dummy variable indicating whether or not the CEO is also the chairman of the board. Equals one if yes and zero otherwise
Avg. Airline Utilization Factor	ICAO database	Average of total hours flown / Total days available for each airline's air fleet
Net Profit Margin	ICAO database	Net income / Total revenue
Maintenance Ratio	ICAO database	Flight equipment maintenance and overhaul expense / Total revenue
Current Ratio	ICAO database	Current assets / Current liabilities

Total Asset Turnover	ICAO database	Sales / Total assets
Growth Rate	ICAO database	ROE * Retention ratio / (1- ROE * Retention ratio)
Z Score	ICAO database	Z = 6.56X1 + 3.26X2 + 6.72X3 + 1.05X4 + 3.25, where X1 = Working capital / Total assets, X2 = Retained earnings / Total assets, X3 = Earnings before interest and taxes / Total assets, X4 = Book value of equity / Book value of total liabilities.
Operating Revenue	ICAO database	Total operating revenue, in billions of dollars

Panel B: Country-level Explanatory Variables

Variable	Source	Description
Ln (Departures)	World Bank database	Natural logarithm of the number of domestic and international airplane takeoffs per year in a given country
Unemployment	World Bank database	Unemployment rate (in %)
Efficiency of the Judicial System	La Porta et al. (1998)	Assessment of the efficiency and integrity of the legal environment as it affects business. Scale from zero to ten, with lower scores representing
Rule of Law	La Porta et al. (1998)	Assessment of the law and order tradition in a given country. Scale from zero to ten, with lower scores for a weaker tradition of law and order
Corruption	La Porta et al. (1998)	Assessment of the corruption in government. Lower scores indicate that high government officials are likely to demand special payments and illegal payments are generally expected throughout lower levels of government.
English Origin Dummy	Reynolds and Flores (1989)	Dummy variable that identifies whether or not the legal system of a given country originates from English common law (1=yes, 0=no)
Quality of Air-Transport Infrastructure	The World Economic Forum (WEF)	Assessment of the quality of airports in a given country based on data from the WEF Executive Opinion Survey. The individual responses are aggregated to produce a country score. Scale from zero (underdeveloped) to ten (most developed). (We adjusted the scale form its original range which

Table 3: Summary Statistics and Univariate Tests

Panel A provides summary statistics for all variables used in our study. Panel B reports the mean and median firm-and country-level characteristics for our subsamples of airlines with and without accidents during our 1990-2016 sample period. The last two columns of Panel B report p-values for t-tests of differences in means and Wilcoxon tests of differences in medians between each subsample. Panel C forms subsamples around the median of each continuous or categorical independent variable and compares the accident rate (i.e., the number of accidents per $ billion in revenue) in the below-median vs. above-median subsamples. For binary variables, the subsamples are based directly on the underlying variable values (zero or one).

Panel A: Summary Statistics

Variable	Airlines	Mean	Median	Std. Dev.	Min	Max
Accident	701	0.038	0	0.226	0	5
Avg. Number of Qualifications	107	1.951	2	0.527	0.4	4
Succession Factor	107	0.367	0.3	0.171	0	1
Gender Ratio	107	0.870	0.889	0.110	0.4	1
Board Size	107	11.514	11	4.791	3	27
Nationality Mix	107	0.204	0.2	0.217	0	0.8
Std. Dev. of Age of Directors	107	7.297	7.2	2.079	0	14.8
Independent Director Ratio	107	0.822	0.863	0.134	0	1
Busy Board	107	2.143	2	0.752	1	4.5
Std. Dev. of Busy Board	107	1.241	1.2	0.689	0	4.7
Avg. Dir. Time to Retire (Years)	107	10.913	10.5	4.091	2.377	28.5
CEO Tenure (Years)	107	5.747	4.5	4.491	1.1	26.6
CEO Age (Years)	107	58.818	60	6.452	40	79.5
CEO Duality Dummy	107	0.445	0	0.497	0	1
Avg. Airline Utilization Factor	602	7.073	7.1	4.652	0.166	29.4
Net Profit Margin	701	0.005	0.010	0.078	-0.234	0.271
Maintenance Ratio	701	0.116	0.106	0.066	0	0.375
Current Ratio	680	1.133	0.905	0.997	0.044	7.211
Total Asset Turnover	679	1.631	1.139	1.571	0.211	10.588
Growth Ratio	651	0.154	0.018	1.362	-3.109	6.968
Z Score	635	3.691	3.683	2.142	-1.616	10.746
Operating Revenue ($ Billion)	658	0.766	0.241	1.266	0.001	7.39
Unemployment Rate (%)	701	7.771	6.7	4.526	0.16	39.3
Ln (Departures)	701	12.335	12.333	2.173	4.394	16.127
English Origin Dummy	701	0.387	0	0.487	0	1
Efficiency of the Judicial System	701	5.889	5.92	1.515	1	8.9
Corruption	701	6.540	6.32	2.339	1.08	10
Rule of Law	701	7.219	8.33	2.084	1.58	10
Qual. of Air Tran. Infrastructure	701	7.303	7.85	1.398	2.86	9.77

Panel B: Univariate Tests – Characteristics of Firms With/Without Accidents

	Airlines with Accidents (Firm-Year Observations)			Airlines without Accidents (Firm-Year Observations)			T-Test	Wilcoxon Test
Variable	**Obs.**	**Mean**	**Median**	**Obs.**	**Mean**	**Median**	**p-Value**	**p-Value**
Avg. Number of Qualifications	96	1.937	1.941	890	1.953	2	0.717	0.734
Succession Factor	95	0.305	0.3	865	0.374	0.3	**0.000**	**0.000**
Gender Ratio	94	0.854	0.846	867	0.872	0.889	**0.071**	**0.010**
Board Size	93	12.568	12	881	11.405	10	**0.012**	**0.000**
Nationality Mix	92	0.170	0.15	851	0.207	0.2	**0.074**	0.252
Std. Dev. of Age of Directors	96	6.976	7.1	898	7.332	7.2	**0.032**	0.298
Independent Director Ratio	95	0.849	0.9	877	0.819	0.857	**0.056**	**0.000**
Busy Board	95	2.234	2.071	894	2.133	2	**0.090**	**0.083**
Std. Dev. of Busy Board	94	1.223	1.2	887	1.243	1.2	0.703	0.534
Avg. Dir. Time to Retire (Years)	96	9.478	8.722	911	11.065	10.65	**0.000**	**0.000**
CEO Tenure (Years)	96	5.478	3.75	986	5.775	4.5	0.537	0.231
CEO Age (Years)	96	61.253	61.55	910	59.666	59.6	**0.021**	**0.018**
CEO Duality Dummy	93	0.569	1	839	0.431	0	**0.012**	**0.010**
Avg. Airline Utilization Factor	131	8.776	8.853	3,578	7.011	7	**0.000**	**0.000**
Net Profit Margin	211	-0.002	0.012	5,924	0.0008	0.009	0.538	1.000
Maintenance Ratio	211	0.1167	0.102	6,217	0.1166	0.106	0.998	0.906
Current Ratio	204	0.979	0.795	5,979	1.138	0.909	**0.025**	**0.025**
Total Asset Turnover	207	1.205	0.932	6,001	1.646	1.148	**0.000**	**0.000**
Growth Ratio	170	0.137	0.030	4,830	0.155	0.017	0.857	1.000
Z Score	197	3.274	3.305	5,402	3.707	3.699	**0.005**	**0.002**
Operating Revenue ($ Billion)	204	0.979	0.795	5,758	0.736	0.228	**0.000**	**0.000**
Unemployment Rate (%)	264	6.944	6.17	6,138	7.807	6.7	**0.000**	**0.031**
Ln (Departures)	270	13.572	13.396	8,136	12.294	12.295	**0.000**	**0.000**
English Origin Dummy	266	0.530	1	8,089	0.382	0	**0.000**	**0.000**
Efficiency of the Judicial System	266	6.059	6.745	8,090	5.884	5.92	**0.064**	**0.182**
Corruption	266	7.069	8.52	8,090	6.522	6.32	**0.000**	**0.001**
Rule of Law	266	7.492	8.57	8,089	7.210	7.8	**0.029**	**0.001**
Qual of Air Tran. Infrastructure	266	7.614	8.26	8,090	7.292	7.85	**0.000**	**0.001**

Panel C: Univariate Test – The Number of Accidents for Subsamples Based on Different Firm- and Country-Level Characteristics

Subsample 1: Below Median	N, Mean, Median	Subsample 2: Above Median	N, Mean, Median	Tests of differences Means (p-Value) Medians (p-Value)
Avg. Number of Qualifications ≤ 2	492	Avg. Number of Qualifications > 2	437	
	0.123		0.116	0.793
	0		0	0.846
Succession Factor ≤ 0.3	194	Succession Factor > 0.3	403	
	0.154		0.066	**0.006**
	0		0	**0.018**
Gender Ratio ≤ 0.889	458	Gender Ratio > 0.889	445	
	0.165		0.083	**0.004**
	0		0	**0.001**
Board Size ≤ 11	470	Board Size > 11	400	
	0.072		0.170	**0.000**
	0		0	**0.000**
Nationality Mix ≤ 0.2	441	Nationality Mix > 0.2	360	
	0.138		0.097	0.179
	0		0	0.230
Std. Dev. of Age of Directors ≤ 7.2	486	Std. Dev. of Age of Directors > 7.2	484	
	0.117		0.115	0.952
	0		0	0.542
Independent Director Ratio ≤ 0.863	485	Independent Director Ratio > 0.863	486	
	0.078		0.164	**0.001**
	0		0	**0.000**
Busy Board ≤ 2	468	Busy Board > 2	457	
	0.091		0.135	0.106
	0		0	**0.052**
Std. Dev. of Busy Board ≤ 1.2	484	Std. Dev. of Busy Board > 1.2	410	
	0.113		0.102	0.662
	0		0	0.841
Avg. Dir. Time to Retire ≤ 10.5 Years	502	Avg. Dir. Time to Retire > 10.5 Years	503	
	0.173		0.063	**0.000**
	0		0	**0.000**

CEO Tenure ≤ 4.5 Years	498	CEO Tenure > 4.5 Years	485	
	0.122		0.115	0.793
	0		0	0.228
CEO Age ≤ 60 Years	501	CEO Age > 60 Years	504	
	0.091		0.114	**0.044**
	0		0	**0.013**
CEO Duality Dummy = 0	516	CEO Duality Dummy = 1	415	
	0.108		0.144	0.203
	0		0	**0.009**
Avg. Airline Utilization Factor ≤ 7.1	1,856	Avg. Airline Utilization Factor > 7.1	1,853	
	0.015		0.063	**0.000**
	0		0	**0.000**
Net Profit Margin ≤ 0.010	2,741	Net Profit Margin > 0.010	2,662	
	0.050		0.055	0.774
	0		0	0.815
Maintenance Ratio ≤ 0.106	3,199	Maintenance Ratio > 0.106	3,229	
	0.043		0.032	**0.052**
	0		0	0.156
Current Ratio ≤ 0.905	3,083	Current Ratio > 0.905	3,100	
	0.044		0.030	**0.013**
	0		0	**0.001**
Total Asset Turnover ≤ 1.139	3,103	Total Asset Turnover > 1.139	3,105	
	0.054		0.021	**0.000**
	0		0	**0.000**
Growth Ratio ≤ 0.018	2,500	Growth Ratio > 0.018	2,499	
	0.038		0.039	0.947
	0		0	0.933
Z Score ≤ 3.683	2,799	Z Score > 3.683	2,799	
	0.050		0.029	**0.000**
	0		0	**0.002**
Unemployment Rate ≤ 6.7%	3,316	Unemployment Rate > 6.7%	3,223	
	0.053		0.044	0.167
	0		0	0.118
Ln (Departures) ≤ 12.335	4,204	Ln (Departures) > 12.335	4,201	
	0.019		0.055	**0.000**
	0		0	**0.000**
English Origin Dummy = 0	5,117	English Origin Dummy = 1	3,238	
	0.026		0.054	**0.000**
	0		0	**0.001**

Efficiency of the Judicial System ≤	3,982	Efficiency of the Judicial System >	4,374	
5.92	0.031	5.92	0.042	**0.023**
	0		0	**0.082**
Corruption ≤ 6.32	3,882	Corruption > 6.32	4,474	
	0.029		0.044	**0.002**
	0		0	**0.004**
Rule of Law ≤ 8.33	4,653	Rule of Law > 8.33	3,702	
	0.029		0.047	**0.000**
	0		0	**0.001**
Quality of Air Tran. Infrastructure	4,324	Qual. of Air Tran. Infrastructure >	4,173	
≤ 7.85	0.028	7.85	0.047	**0.000**
	0		0	**0.000**

Table 4: Correlation Matrix

This table reports Pearson correlation coefficients for all pairwise combinations of the independent variables used in our analysis. Correlation coefficients that exceed a threshold of 0.5 in absolute terms are marked in bold.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)
(1) Avg. Number of Qualifications	1.00																											
(2) Succession Factor	0.10	1.00																										
(3) Gender Ratio	-0.08	0.07	1.00																									
(4) Board Size	-0.35	-0.19	0.10	1.00																								
(5) Nationality Mix	-0.18	0.19	-0.01	0.06	1.00																							
(6) Std. Dev. of Age of Directors	-0.17	0.60	0.24	-0.12	0.04	1.00																						
(7) Independent Director Ratio	0.29	0.05	-0.08	-0.003	-0.19	-0.05	1.00																					
(8) Busy Board	0.18	-0.33	0.06	0.24	-0.01	-0.29	0.09	1.00																				
(9) Std. Dev. of Busy Board	0.25	-0.21	0.18	0.29	0.005	-0.18	0.04	**0.79**	1.00																			
(10) Avg. Dir. Time to Retire	0.17	**0.70**	-0.06	-0.13	0.22	0.01	0.07	-0.26	-0.18	1.00																		
(11) Ln (CEO Tenure)	0.11	0.11	0.09	-0.09	-0.12	0.03	0.26	-0.08	-0.05	0.12	1.00																	
(12) Ln (CEO Age)	0.05	-0.23	0.14	0.14	-0.12	-0.05	-0.03	0.24	0.23	-0.37	0.20	1.00																
(13) CEO Duality Dummy	-0.07	-0.24	0.06	0.37	-0.44	-0.23	0.15	0.14	0.04	-0.06	0.28	0.19	1.00															
(14) Avg. Airline Utilization Factor	0.15	0.07	0.01	0.06	0.23	-0.11	-0.01	-0.03	0.12	0.20	-0.002	-0.02	-0.07	1.00														
(15) Net Profit Margin	0.05	0.15	0.10	-0.01	0.01	0.11	-0.04	-0.08	-0.02	0.04	0.10	-0.17	-0.06	0.09	1.00													
(16) Maintenance Ratio	-0.03	-0.29	0.07	0.03	-0.22	-0.19	0.07	0.04	-0.07	-0.19	-0.02	0.13	0.25	-0.32	-0.14	1.00												
(17) Current Ratio	0.16	0.16	0.16	-0.21	0.08	0.16	0.01	-0.15	-0.09	0.08	0.24	0.05	-0.18	0.01	-0.01	-0.05	1.00											
(18) Total Asset Turnover	0.21	-0.07	0.02	-0.01	-0.01	-0.03	0.10	0.07	0.26	-0.12	-0.07	0.02	-0.17	0.25	0.01	-0.04	-0.06	1.00										
(19) Growth Ratio	-0.04	0.03	-0.09	0.13	0.06	-0.06	-0.01	-0.03	0.001	0.10	0.08	-0.14	-0.02	0.16	0.29	-0.11	0.09	-0.10	1.00									
(20) Z Score	0.15	0.23	0.14	-0.08	0.22	0.12	-0.11	-0.13	-0.03	0.14	0.18	-0.05	-0.26	0.18	0.42	-0.20	**0.60**	-0.01	0.43	1.00								

(21) Operating Revenue	-0.06	-0.04	-0.12	0.25	0.16	-0.03	-0.08	-0.04	-0.02	-0.07	-0.17	0.06	0.08	0.06	0.08	-0.17	-0.15	-0.28	0.11	-0.004	1.00								
(22) Unemployment Rate	0.10	-0.21	-0.11	-0.22	-0.09	-0.12	-0.04	-0.08	-0.09	-0.19	-0.01	0.06	-0.04	-0.02	0.06	0.11	0.05	0.01	-0.05	-0.07	0.13	1.00							
(23) Ln (Departures)	0.33	-0.32	0.08	-0.33	-0.44	-0.09	0.05	0.08	0.01	-0.24	0.04	0.06	0.21	-0.20	-0.03	0.37	0.07	-0.03	-0.19	-0.07	-0.14	0.18	1.00						
(24) English Origin Dummy	0.21	-0.20	0.11	-0.38	-0.16	-0.05	-0.22	0.11	0.05	-0.14	0.01	0.01	-0.05	-0.26	0.02	0.17	0.11	-0.12	-0.14	-0.04	-0.19	0.18	**0.76**	1.00					
(25) Efficiency of Judicial System	-0.23	0.04	-0.01	0.40	0.34	-0.05	-0.22	0.05	0.09	0.11	-0.03	0.04	-0.17	0.16	0.04	-0.12	-0.06	0.07	0.12	0.09	-0.03	-0.31	**-0.54**	-0.29	1.00				
(26) Corruption	-0.21	0.07	-0.05	**0.50**	0.27	-0.04	0.01	-0.004	0.04	0.10	-0.05	0.07	-0.004	0.28	-0.02	-0.09	-0.13	0.14	0.10	0.05	0.12	-0.30	**-0.67**	**-0.74**	**0.80**	1.00			
(27) Rule of Law	-0.02	0.22	-0.09	0.20	0.03	0.12	0.41	-0.07	-0.02	0.15	0.17	-0.15	0.04	0.20	0.11	-0.10	-0.04	0.10	0.23	0.12	0.06	-0.34	-0.42	**-0.68**	0.26	**0.55**	1.00		
(28) Qual. of Air Tran. Infrastructure	0.16	-0.06	-0.12	0.21	-0.29	-0.05	0.36	-0.01	-0.02	-0.003	0.08	-0.01	0.24	0.13	0.03	0.18	-0.07	0.16	0.02	0.03	-0.06	-0.18	0.06	-0.40	0.27	**0.52**	**0.57**	1.00	

Table 5: Poisson Regression Results

This table provides regression results for models in which the log of an airline's number of accidents is regressed on various firm-level corporate governance variables, financial variables, and country-level variables during our sample period from 1990 to 2016. Panel A reports the regression results for a series of models that consider both our firm- and country-level variables. Models 1 to 5 focus on different governance characteristics. Models 6 and 7 focus on firm-level financial variables. In the last column, Model 8, we include all variables together. Panel B reports the regression results related to the macroeconomic, institutional, and infrastructure environment of a given country. Each country variable is included separately to observe its individual effect. The results are reported in Models 9 to 16 in Panel B. For each variable, we report the coefficient and the corresponding p-value (in parentheses). In the last two rows, we report the number of observations as well as the p-value for a Chi-square (χ^2) test for each regression. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Firm-and Country-Level Results (DV=Number of Accidents)

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Avg. Number of Qualifications	-1.120**	-1.074*	-0.307	-0.892				-1.297**
	(0.045)	(0.064)	(0.626)	(0.203)				(0.043)
Succession Factor	-0.719	-0.342	-3.708*					-10.380**
	(0.536)	(0.799)	(0.099)					(0.019)
Gender Ratio	-0.959	-0.836						-1.906
	(0.571)	(0.646)						(0.445)
Board Size	-0.008							-0.046
	(0.837)							(0.568)
Nationality Mix		-0.246						-1.232
		(0.844)						(0.447)
Std. Dev. of Age of Directors			0.149					0.600**
			(0.182)					(0.030)
Independent Director Ratio			-3.047					4.391
			(0.116)					(0.115)
Busy Board				0.762**				0.852**
				(0.042)				(0.035)
Std. Dev. of Busy Board				-1.065**				-1.299**
				(0.016)				(0.032)
Avg. Dir. Time to Retire				-0.051				0.180
				(0.417)				(0.182)

Ln (CEO Tenure)					-0.245			-0.184
					(0.409)			(0.641)
Ln (CEO Age)					-0.295			-0.885
					(0.907)			(0.803)
CEO Duality Dummy					0.493			0.608
					(0.240)			(0.424)
Avg. Airline Utilization Factor	0.003	0.037	0.054	0.057	-0.027	0.007	0.007	0.111*
	(0.953)	(0.502)	(0.301)	(0.295)	(0.570)	(0.816)	(0.780)	(0.096)
Net Profit Margin		-2.320**	-2.084**	-1.829*	-2.265**			-2.186
		(0.024)	(0.038)	(0.065)	(0.021)			(0.289)
Maintenance Ratio		-4.305	-4.999*	-4.886			-0.139	-8.371***
		(0.219)	(0.067)	(0.146)			(0.938)	(0.005)
Current Ratio						-0.187		-0.195
						(0.377)		(0.673)
Total Asset Turnover						-0.203**		-0.967
						(0.031)		(0.174)
Growth Ratio						-0.116		-0.133
						(0.281)		(0.425)
Z Score						-0.017	-0.090*	0.239
						(0.870)	(0.078)	(0.387)
Operating Revenue	0.239**	0.285***	0.239**	0.335***	0.198*	0.237***	0.270***	0.381**
	(0.018)	(0.003)	(0.026)	(0.001)	(0.095)	(0.001)	(0.000)	(0.019)
Unemployment Rate	-0.334*	-0.353**	-0.257**	-0.360**	-0.176	-0.042	-0.020	-0.591**
	(0.061)	(0.042)	(0.044)	(0.030)	(0.278)	(0.214)	(0.496)	(0.013)
Ln (Departures)	0.338	0.284	0.377	0.177	0.145	0.223***	0.212**	-0.546
	(0.223)	(0.333)	(0.224)	(0.555)	(0.472)	(0.008)	(0.012)	(0.242)
English Origin Dummy	-1.514	-1.418	-2.025*	-1.223	-1.078	-0.019	-0.203	0.197
	(0.144)	(0.177)	(0.080)	(0.242)	(0.194)	(0.965)	(0.631)	(0.870)
Rule of Law	-0.979**	-1.179***	-0.953**	-1.070***	-0.747	-0.172**	-0.155**	-2.091***

	(0.021)	(0.006)	(0.028)	(0.008)	(0.105)	(0.048)	(0.043)	(0.000)
Constant	6.903	8.206	4.991	7.256	4.879	-4.377***	-4.790***	26.477
	(0.212)	(0.141)	(0.228)	(0.118)	(0.626)	(0.000)	(0.000)	(0.143)
Observations	416	407	415	431	411	1,417	1,855	273
$\chi 2$ Test (p-value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

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Panel B: Country-Level Results (DV=Number of Accidents)

VARIABLES	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14	Model 15	Model 16
Unemployment Rate	0.005							-0.024
	(0.820)							(0.406)
Ln (Departures)	0.259***	0.303***	0.318***	0.361***	0.342***	0.364***	0.337***	0.257***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
English Origin Dummy			-0.109					0.343
			(0.552)					(0.155)
Efficiency of the Judicial System				-0.173***				-0.370***
				(0.000)				(0.000)
Corruption					-0.086**			0.086
					(0.016)			(0.291)
Rule of Law						-0.118***		-0.180**
						(0.003)		(0.020)
Qual. of Air Tran. Infrastructure							-0.098*	0.329***
							(0.076)	(0.004)
Constant	-6.440***	-7.239***	-7.369***	-6.949***	-7.163***	-7.151***	-6.952***	-5.849***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	6,222	8,475	8,355	8,356	8,356	8,355	8,469	6,218
$\chi 2$ Test (p-value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)	(0.002)	(0.000)	(0.000)

Table 6: Poisson Regression Results with Lagged Independent Variables

To address any endogeneity concerns related to our empirical modelling and to clarify the direction of causality, we re-estimate our Poisson regression using lagged independent firm-level variables. Panel A reports the regression results for a series of models that consider both our firm- and country-level variables. Models 1 to 5 focus on different governance characteristics. Models 6 and 7 focus on firm-level financial variables. In the last column, Model 8, we include all variables together. Panel B reports the regression results related to the macroeconomic, institutional, and infrastructure environment of a given country. Each country variable is included separately to observe its individual effect. The results are reported in Models 9 to 16 in Panel B. For each variable, we report the coefficient and the corresponding p-value (in parentheses). In the last two rows, we report the number of observations as well as the p-value for a Chi-square ($\chi 2$) test for each regression. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Firm- and Country-Level Results (DV=Number of Accidents)

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Avg. Number of Qualifications Lagged	-0.821	-0.698	-0.813	-0.396				0.062
	(0.181)	(0.191)	(0.213)	(0.476)				(0.925)
Succession Factor Lagged	-0.167	-0.125	-2.694					-7.072
	(0.905)	(0.931)	(0.209)					(0.222)
Gender Ratio Lagged	-0.160	-0.354						-2.159
	(0.914)	(0.818)						(0.225)
Board Size Lagged	0.036							0.114**
	(0.320)							(0.045)
Nationality Mix Lagged		-1.658						-3.509**
		(0.238)						(0.023)
Std. Dev. of Age of Directors Lagged			0.229**					0.308
			(0.017)					(0.292)
Independent Director Ratio Lagged			1.404					-0.240
			(0.346)					(0.907)
Busy Board Lagged				-0.069				0.040
				(0.871)				(0.933)
Std. Dev. of Busy Board Lagged				-0.275				-0.367
				(0.547)				(0.512)
Avg. Dir. Time to Retire Lagged				-0.135*				0.186

				(0.088)				(0.246)
Ln (CEO Tenure) Lagged					-0.231			-0.900**
					(0.547)			(0.035)
Ln (CEO Age) Lagged					2.004			1.942
					(0.484)			(0.508)
CEO Duality Dummy Lagged					-0.218			-0.392
					(0.655)			(0.506)
Avg. Airline Utilization Factor Lagged	0.008	0.028	0.035	0.034	-0.030	-0.012	-0.014	-0.006
	(0.862)	(0.539)	(0.497)	(0.464)	(0.511)	(0.569)	(0.487)	(0.931)
Net Profit Margin Lagged		-0.344	-0.065	-0.137	0.023			1.505
		(0.796)	(0.964)	(0.913)	(0.985)			(0.394)
Maintenance Ratio Lagged		-1.793	-2.754	-2.356			-0.960	-1.575
		(0.601)	(0.393)	(0.461)			(0.549)	(0.720)
Current Ratio Lagged						-0.064		0.096
						(0.762)		(0.738)
Total Asset Turnover Lagged						-0.230**		-1.573
						(0.030)		(0.152)
Growth Ratio Lagged						0.050		-0.034
						(0.608)		(0.847)
Z Score Lagged						-0.066	-0.044	0.138
						(0.490)	(0.327)	(0.513)
Operating Revenue Lagged	0.241**	0.290***	0.287***	0.256**	0.236**	0.248***	0.302***	0.027
	(0.030)	(0.004)	(0.003)	(0.015)	(0.018)	(0.000)	(0.000)	(0.874)
Unemployment Rate Lagged	-0.009	-0.040	-0.070	-0.084	-0.042	0.038	0.032	-0.230
	(0.947)	(0.742)	(0.496)	(0.382)	(0.709)	(0.345)	(0.403)	(0.121)
Ln (Departures) Lagged	0.207	0.015	0.032	-0.013	0.093	0.170*	0.186**	-0.289
	(0.429)	(0.948)	(0.881)	(0.960)	(0.668)	(0.055)	(0.022)	(0.548)
English Origin Dummy	-0.510	-0.442	-0.300	-0.356	-0.753	0.089	0.040	-1.339
	(0.531)	(0.618)	(0.693)	(0.666)	(0.358)	(0.854)	(0.929)	(0.368)

Rule of Law	-0.308	-0.377	-0.492	-0.369	-0.238	-0.151*	-0.171**	-1.881***
	(0.509)	(0.429)	(0.245)	(0.356)	(0.552)	(0.083)	(0.034)	(0.009)
Constant	-1.857	1.851	0.246	3.064	-9.125	-4.195***	-4.655***	14.756
	(0.767)	(0.755)	(0.963)	(0.548)	(0.493)	(0.001)	(0.000)	(0.375)
Observations	383	380	380	380	381	1,247	1,604	264
$\chi 2$ Test (p-value)	(0.013)	(0.027)	(0.003)	(0.004)	(0.039)	(0.000)	(0.000)	(0.000)

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Panel B: Summary of Country-Level Results (DV=Number of Accidents)

VARIABLES	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14	Model 15	Model 16
Unemployment Rate Lagged	0.031							-0.002
	(0.153)							(0.933)
Ln (Departures) Lagged	0.272***	0.304***	0.327***	0.364***	0.342***	0.378***	0.326***	0.261***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
English Origin Dummy			-0.153					0.310
			(0.435)					(0.249)
Efficiency of the Judicial System				-0.184***				-0.388***
				(0.000)				(0.000)
Corruption					-0.088**			0.118
					(0.028)			(0.141)
Rule of Law						-0.140***		-0.226***
						(0.000)		(0.001)
Qual. of Air Tran. Infrastructure							-0.077	0.402***
							(0.178)	(0.000)
Constant	-6.669***	-7.124***	-7.354***	-6.813***	-7.039***	-7.058***	-6.835***	-6.239***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	4,853	6,611	6,561	6,562	6,562	6,561	6,605	4,804
$\chi 2$ Test (p-value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Table 7: Zero-inflated Poisson Regression Results

To address the fact that aviation accidents are rare (i.e., our accident dummy registers a large number of zeros), we re-estimate our Poisson regression as a zero-inflated Poisson regression. Panel A reports the regression results for a series of models that consider both our firm- and country-level variables. Models 1 to 5 focus on different governance characteristics. Models 6 and 7 focus on firm-level financial variables. In the last column, Model 8, we include all variables together. Panel B reports the regression results related to the macroeconomic, institutional, and infrastructure environment of a given country. Each country variable is included separately to observe its individual effect. The results are reported in Models 9 to 16 in Panel B. For each variable, we report the coefficient and the corresponding p-value (in parentheses). In the last two rows, we report the number of observations as well as the p-value for a Chi-square (χ^2) test for each regression. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Firm- and Country-Level Results (DV=Number of Accidents)

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Avg. Number of Qualifications	-1.124**	-1.080*	-0.332	-0.906				-1.320**
	(0.044)	(0.063)	(0.591)	(0.197)				(0.042)
Succession Factor	-0.703	-0.330	-3.746*					-10.495**
	(0.546)	(0.806)	(0.092)					(0.017)
Gender Ratio	-0.944	-0.821						-1.888
	(0.576)	(0.650)						(0.442)
Board Size	-0.007							-0.046
	(0.847)							(0.561)
Nationality Mix		-0.227						-1.213
		(0.854)						(0.446)
Std. Dev. of Age of Directors			0.158					0.601**
			(0.156)					(0.028)
Independent Director Ratio			-2.841					4.416
			(0.114)					(0.115)
Busy Board				0.766**				0.860**
				(0.042)				(0.035)
Std. Dev. of Busy Board				-1.061**				-1.302**
				(0.016)				(0.033)
Avg. Dir. Time to Retire				-0.050				0.186

				(0.431)				(0.164)
Ln (CEO Tenure)					-0.245			-0.174
					(0.471)			(0.661)
Ln (CEO Age)					-0.300			-0.846
					(0.905)			(0.810)
CEO Duality Dummy					0.481			0.590
					(0.263)			(0.443)
Avg. Airline Utilization Factor	0.002	0.036	0.057	0.055	-0.025	0.015	0.010	0.105
	(0.963)	(0.520)	(0.280)	(0.306)	(0.595)	(0.690)	(0.699)	(0.109)
Net Profit Margin		-2.320**	-2.085**	-1.836*	-2.285**			-2.168
		(0.023)	(0.040)	(0.064)	(0.022)			(0.291)
Maintenance Ratio		-4.237	-5.192*	-4.798			-0.183	-8.247***
		(0.226)	(0.062)	(0.154)			(0.918)	(0.006)
Current Ratio						-0.198		-0.208
						(0.358)		(0.652)
Total Asset Turnover						-0.205**		-0.959
						(0.027)		(0.170)
Growth Ratio						-0.139		-0.138
						(0.235)		(0.414)
Z Score						-0.017	-0.094*	0.244
						(0.872)	(0.065)	(0.375)
Operating Revenue	0.239**	0.284***	0.243**	0.334***	0.202*	0.259***	0.282***	0.375**
	(0.017)	(0.003)	(0.022)	(0.001)	(0.084)	(0.001)	(0.000)	(0.019)
Unemployment Rate	-0.313*	-0.330**	-0.300**	-0.337**	-0.223	-0.043	-0.022	-0.552**
	(0.065)	(0.045)	(0.030)	(0.032)	(0.131)	(0.199)	(0.478)	(0.012)
Ln (Departures)	0.334	0.280	0.376	0.175	0.159	0.240***	0.222***	-0.539
	(0.228)	(0.338)	(0.223)	(0.559)	(0.442)	(0.005)	(0.010)	(0.241)
English Origin Dummy	-1.474	-1.381	-2.034*	-1.193	-1.144	-0.043	-0.226	0.191
	(0.152)	(0.186)	(0.078)	(0.251)	(0.199)	(0.918)	(0.586)	(0.873)

Rule of Law	-0.936**	-1.126***	-1.067**	-1.020***	-0.841*	-0.184**	-0.162**	-2.025***
	(0.023)	(0.006)	(0.014)	(0.010)	(0.064)	(0.038)	(0.040)	(0.000)
Constant	6.421	7.643	6.064	6.701	5.938	-3.808***	-4.250***	25.441
	(0.224)	(0.152)	(0.135)	(0.134)	(0.564)	(0.001)	(0.001)	(0.149)
Observations	416	407	415	431	411	1,417	1,855	273
$\chi 2$ Test (p-value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.004)	(0.000)	(0.000)	(0.000)

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Panel B: Country-Level Results (DV=Number of Accidents)

VARIABLES	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14	Model 15	Model 16
Unemployment Rate	0.003							-0.017
	(0.902)							(0.556)
Ln (Departures)	0.258***	0.302***	0.311***	0.363***	0.348***	0.365***	0.342***	0.261***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
English Origin Dummy			-0.071					0.347
			(0.705)					(0.114)
Efficiency of the Judicial System				-0.176***				-0.337***
				(0.000)				(0.002)
Corruption					-0.095**			0.076
					(0.013)			(0.370)
Rule of Law						-0.119***		-0.158**
						(0.003)		(0.048)
Qual. of Air Tran. Infrastructure							-0.111*	0.279**
							(0.051)	(0.013)
Constant	-4.733***	-5.373***	-5.446***	-5.126***	-5.342***	-5.317***	-5.054***	-4.285***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	6,222	8,475	8,355	8,356	8,356	8,355	8,469	6,218
$\chi 2$ Test (p-value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Table 8: Random-effects Panel Poisson Regression Results

To address any potentially omitted variable concerns related to our empirical modelling, we re-run our Poisson regression using a random-effects panel Poisson regression. Panel A reports the regression results for a series of models that consider both our firm- and country-level variables. Models 1 to 5 focus on different governance characteristics. Models 6 and 7 focus on firm-level financial variables. In the last column, Model 8, we include all variables together. Panel B reports the regression results related to the macroeconomic, institutional, and infrastructure environment of a given country. Each country variable is included separately to observe its individual effect. The results are reported in Models 9 to 16 in Panel B. For each variable, we report the coefficient and the corresponding p-value (in parentheses). In the last three rows, we report the number of observations, the number of airlines used in each panel as well as the p-value for a Chi-square (χ^2) test for each regression. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Firm- and Country-Level Results (DV=Number of Accidents)

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Avg. Number of Qualifications	-1.124**	-1.081*	-0.368	-0.906				-1.320
	(0.043)	(0.063)	(0.513)	(0.174)				(0.124)
Succession Factor	-0.703	-0.327	-3.495					-10.495*
	(0.675)	(0.861)	(0.142)					(0.067)
Gender Ratio	-0.944	-0.818						-1.888
	(0.664)	(0.728)						(0.541)
Board Size	-0.007							-0.046
	(0.888)							(0.594)
Nationality Mix		-0.224						-1.213
		(0.882)						(0.505)
Std. Dev. ff Age of Directors			0.165					0.601*
			(0.225)					(0.058)
Independent Director Ratio			-3.027**					4.416
			(0.025)					(0.229)
Busy Board				0.766				0.860
				(0.126)				(0.197)
Std. Dev. of Busy Board				-1.061				-1.302
				(0.136)				(0.194)
Avg. Dir. Time to Retire				-0.050				0.186

				(0.467)				(0.296)
Ln (CEO Tenure)					-0.238			-0.174
					(0.432)			(0.711)
Ln (CEO Age)					-0.291			-0.846
					(0.888)			(0.789)
CEO Duality Dummy					0.483			0.590
					(0.284)			(0.466)
Avg. Airline Utilization Factor	0.002	0.036	0.052	0.055	-0.025	0.010	0.010	0.105
	(0.973)	(0.624)	(0.479)	(0.428)	(0.721)	(0.776)	(0.771)	(0.254)
Net Profit Margin		-2.320	-2.070	-1.836	-2.283			-2.168
		(0.133)	(0.175)	(0.214)	(0.111)			(0.392)
Maintenance Ratio		-4.245	-5.661	-4.798			-0.881	-8.247*
		(0.273)	(0.110)	(0.188)			(0.707)	(0.073)
Current Ratio						-0.123		-0.208
						(0.642)		(0.669)
Total Asset Turnover						-0.204		-0.959
						(0.198)		(0.150)
Growth Ratio						-0.110		-0.138
						(0.429)		(0.604)
Z Score						-0.016	-0.081	0.244
						(0.869)	(0.162)	(0.367)
Operating Revenue	0.239**	0.284**	0.255*	0.334***	0.202*	0.233***	0.261***	0.375*
	(0.045)	(0.020)	(0.050)	(0.005)	(0.082)	(0.004)	(0.000)	(0.057)
Unemployment Rate	-0.313*	-0.330*	-0.319*	-0.337**	-0.224	-0.055	-0.040	-0.552**
	(0.063)	(0.056)	(0.052)	(0.048)	(0.120)	(0.226)	(0.302)	(0.029)
Ln (Departures)	0.334	0.280	0.398	0.175	0.160	0.240**	0.228**	-0.539
	(0.176)	(0.308)	(0.162)	(0.501)	(0.483)	(0.030)	(0.027)	(0.273)
English Origin Dummy	-1.474	-1.380	-2.084*	-1.193	-1.165	-0.158	-0.316	0.191
	(0.124)	(0.162)	(0.064)	(0.218)	(0.227)	(0.709)	(0.426)	(0.910)

Rule of Law	-0.936	-1.127*	-1.179*	-1.020*	-0.849*	-0.176*	-0.170**	-2.025**
	(0.107)	(0.070)	(0.079)	(0.068)	(0.086)	(0.054)	(0.049)	(0.026)
Constant Accident	6.423	7.644	6.916	6.701	5.876	-4.567***	-4.874***	25.441
	(0.351)	(0.322)	(0.299)	(0.290)	(0.567)	(0.000)	(0.000)	(0.160)
Observations	416	407	415	431	411	1,417	1,855	273
Number of Panel ID Variables	62	62	62	62	62	285	317	52
$\chi 2$ Test (p-value)	(0.033)	(0.027)	(0.024)	(0.013)	(0.053)	(0.001)	(0.001)	(0.200)

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Panel B: Country-Level Results (DV=Number of Accidents)

VARIABLES	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14	Model 15	Model 16
Unemployment Rate	0.005							0.002
	(0.852)							(0.943)
Ln (Departures)	0.280***	0.374***	0.429***	0.477***	0.487***	0.469***	0.487***	0.338***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
English Origin Dummy			-0.359					0.146
			(0.136)					(0.596)
Efficiency of Judicial System				-0.266***				-0.122
				(0.002)				(0.402)
Corruption					-0.194***			-0.021
					(0.001)			(0.839)
Rule of Law						-0.179***		-0.079
						(0.002)		(0.363)
Qual. of Air Tran. Infrastructure							-0.289***	0.042
							(0.001)	(0.761)
Constant Accident	-7.001***	-8.454***	-8.997***	-8.211***	-8.658***	-8.370***	-7.796***	-6.678***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	6,222	8,475	8,355	8,356	8,356	8,355	8,469	6,218
Number of Panel ID Variables	927	1,035	1,035	1,035	1,035	1,035	1,031	923
$\chi 2$ Test (p-value)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Table 9: Cox Proportional Hazards Model Regression Results

To further address any methodology-related biasedness and to confirm our original findings in Table 5, we re-run our analysis using a series of Cox Proportional Hazards Model regression. Panel A reports the regression results for a series of models that consider both our firm- and country-level variables. Models 1 to 5 focus on different governance characteristics. Models 6 and 7 focus on firm-level financial variables. Panel B reports the regression results related to the macroeconomic, institutional, and infrastructure environment of a given country. Each country variable is included separately to observe its individual effect. The results are reported in Models 8 to 15 in Panel B. For each variable, we report the coefficient and the corresponding p-value (in parentheses). In the last two rows, we report the number of observations as well as the p-value for a Chi-square (χ^2) test for each regression. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Firm- and Country-Level Results (DV=Number of Accidents)

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Avg. Number of Qualifications	-0.309	-0.417	-0.353	-0.712			
	(0.680)	(0.603)	(0.645)	(0.533)			
Succession Factor	1.659	2.445	2.875				
	(0.563)	(0.495)	(0.415)				
Gender Ratio	3.333	1.800					
	(0.459)	(0.728)					
Board Size	0.013						
	(0.883)						
Nationality Mix		1.195					
		(0.537)					
Std. Dev. of Age of Directors			-0.151				
			(0.536)				
Independent Director Ratio			-1.690				
			(0.440)				
Busy Board				1.417			
				(0.200)			
Std. Dev. of Busy Board				-1.373			
				(0.325)			
Avg. Dir. Time to Retire				0.081			

				(0.482)			
Ln (CEO Tenure)					0.255		
					(0.588)		
Ln (CEO Age)					2.133		
					(0.506)		
CEO Duality Dummy					0.040		
					(0.959)		
Avg. Airline Utilization Factor	0.048	0.126	0.139	0.161	0.058	0.027	0.016
	(0.660)	(0.358)	(0.239)	(0.192)	(0.646)	(0.527)	(0.658)
Net Profit Margin		-6.219**	-6.291**	-6.176**	-4.680**		
		(0.021)	(0.016)	(0.026)	(0.029)		
Maintenance Ratio		-9.587	-10.524	-6.974			-0.482
		(0.212)	(0.138)	(0.376)			(0.866)
Current Ratio						0.059	
						(0.854)	
Total Asset Turnover						-0.149	
						(0.362)	
Growth Ratio						-0.066	
						(0.687)	
Z Score						-0.115	-0.104
						(0.395)	(0.190)
Operating Revenue	0.627***	0.813***	0.693***	0.811***	0.561***	0.295**	0.351***
	(0.007)	(0.002)	(0.003)	(0.001)	(0.004)	(0.028)	(0.001)
Unemployment Rate	-0.174	-0.215	-0.267	-0.412	-0.376	-0.021	-0.008
	(0.600)	(0.535)	(0.421)	(0.154)	(0.294)	(0.744)	(0.879)
Ln (Departures)	0.494	0.439	0.553	0.455	0.657	0.377**	0.304**

	(0.318)	(0.433)	(0.290)	(0.422)	(0.208)	(0.017)	(0.018)
English Origin Dummy	-2.801	-2.746	-3.523*	-2.722	-3.476*	-0.695	-0.567
	(0.123)	(0.157)	(0.056)	(0.164)	(0.080)	(0.288)	(0.311)
Rule of Law	-1.243	-1.543	-1.720	-1.853	-2.260*	0.073	0.008
	(0.312)	(0.249)	(0.194)	(0.174)	(0.090)	(0.602)	(0.946)
Observations	300	292	299	310	297	1,125	1,489
$\chi 2$ Test (p-value)	(0.181)	(0.072)	(0.055)	(0.051)	(0.064)	(0.011)	(0.003)

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Panel B: Country-Level Results (DV=Number of Accidents)

VARIABLES	Model 8	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14	Model 15
Unemployment Rate	0.019							0.010
	(0.544)							(0.778)
Ln (Departures)	0.184***	0.201***	0.132**	0.166***	0.151***	0.191***	0.192***	0.129**
	(0.000)	(0.000)	(0.018)	(0.002)	(0.005)	(0.000)	(0.000)	(0.040)
English Origin Dummy			0.395*					0.317
			(0.091)					(0.249)
Efficiency of the Judicial System				0.052				-0.088
				(0.497)				(0.558)
Corruption					0.067			0.193*
					(0.188)			(0.057)
Rule of Law						-0.016		-0.183*
						(0.774)		(0.053)
Qual. of Air Tran. Infrastructure							0.005	0.045
							(0.949)	(0.751)
Observations	5,308	7,505	7,418	7,419	7,419	7,418	7,499	5,304
$\chi 2$ Test (p-value)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.004)