Essays in Empirical Business Economics

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Introduction and Summary

This dissertation consists of four essays (labeled A to D) addressing different research questions within the broad field of business economics. These contributions have in common that they aim to understand very specific aspects of how economic actors behave and interact within their particular business environment. Moreover, all articles are mainly empirical in nature testing hypotheses derived from theoretical considerations and previous literature. While the first two essays (A and B) have been written with a co-author, I am the sole author of the last two contributions (C and D). This introductory section briefly summarizes the four essays.

Essay A, published as Rohlfing and Sturm (2011), focuses on the franchise sector and, in more detail, on the contractual and organizational design of franchise firms. In this paper, we employ a new dataset based on a sample of 123 franchise systems originating from Germany to empirically test hypotheses stemming from agency theory and capital scarcity considerations on the contractual relations and the organizational structure in franchising. We include proxies for the franchisor's capital scarcity as well as for moral hazard on the franchisee's and the franchisor's side. Furthermore, we distinguish between initial and ongoing franchisor support. Our results indicate that agency models based on double moral hazard do explain the design of franchise contracts and the organizational structure in terms of the proportion of franchised outlets. We find that the incentive component of the franchise contract (the royalty rate) is not influenced by moral hazard on the franchisee's side, but rather by moral hazard on the franchisor's side. Furthermore, the proportion franchised is strongly influenced by moral hazard on the franchisee's side. Hence, after providing incentives to outlet managers by turning them into franchisees, thereby granting them residual claimancy, the royalty rate mainly serves to ensure ongoing franchisor input. The franchisor's capital scarcity influences the fixed fee in franchise contracts and the proportion of franchised outlets, thus supporting standard capital scarcity arguments.

Essay B, forthcoming as Vetter and Sturm (2014), deals with the role of supervisory boards and the reaction of capital markets to the boards' activities, thus, picking up on the recent discussion about an efficient corporate governance system. Within this discussion, considerable attention has been paid to the supervisory board's responsibility to monitor top executives raising the question about the value relevance of supervisory board's actions (i.e., control). We conduct an event study analyzing the effect of supervisory board interventions on the value of publicly listed firms in Germany between 2000 and 2006. With our study, we are among the first to empirically test two suppositions by Hermalin and Weisbach (1998) which propose a negative stock price reaction when the CEO is fired based on private information of the supervisory board and a positive stock price reaction when the CEO is fired based on public information. Assuming that the amount of information available to the public increases with the media coverage of a company, we expect a positive (negative) stock price reaction to supervisory interventions for companies with a high (low) level of media coverage. This is confirmed by our empirical results. These results prove to be robust when controlling for company characteristics (in particular size) in a multivariate regression setting.

Essay C, published as Sturm (2013a), centers around the question whether firms (in this particular case banks) experiencing negative events such as fraud suffer from additional losses because of damages to their reputation. In order to address this question, I study the stock market reaction to the announcement of operational losses in European financial companies. Accounting for the effect of the nominal loss amount allows for an examination of the reputational damage caused by operational loss events. The analysis is based on a sample of 136 operational losses stemming from a database of the Association of German Public Sector Banks (Bundesverband öffentlicher Banken, VÖB). All operational loss events affect European financial institutions with settlements reported by the press between January 2000 and December 2009. In line with previous literature, I find a significant negative stock price reaction to the first press announcement of operational losses. Results show that the stock market also reacts negatively to the settlement announcement as losses are confirmed and the loss amount is known. Even after accounting for the nominal loss amount, cumulative abnormal returns are negative following the date of the initial news article and the settlement date indicating damages to the reputation of the firm suffering the operational loss. Multivariate regression results suggest that reputational damages are rather influenced by firm characteristics than characteristics of the operational loss event: companies with a high ratio of liabilities to total assets suffer more severe damages to reputation from operational losses than companies with more equity.

Essay D, published as Sturm (2013b), follows up on the previous article but changes the perspective from equity holders to debt holders by looking at the market for credit default swaps (CDS). More particularly, this paper examines the CDS market's reaction to operational risk events in the banking industry and thus addresses the question to what extent operational risk affects the default risk of the banks suffering the operational loss. The analysis is based on a sample of 99 operational loss events occurring at large European financial institutions between January 2004 and September 2010. Previous literature studying the market reaction to operational risk events has so far only focused on the stock and bond markets. This paper complements and extends existing literature by being the first to provide empirical evidence on the topic from the CDS market. The results shed light on the impact of operational losses on the default risk of banks, which is of great interest for creditors but also from a regulatory point of view. I find that, on average, there is a statistically significant increase in CDS spreads around the settlement date of losses in the range of 5 basis points or roughly 5 percent in relative terms. Multivariate regression results show that the CDS market's reaction to operational risk events is clearly influenced by the (relative) size of losses. Moreover, the increase in CDS spreads is more pronounced for banks with a good credit rating while internal fraud events seem to be not particularly harmful.

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Essay A:

Contractual Relations and Organizational Structure in Franchising – Empirical Evidence from Germany

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1 Introduction

In Germany, franchising began to gain importance about 30 years ago. Today, more than 900 franchise systems are registered with about 121,000 franchise outlets, employing 664,000 people and generating sales of 62.5 billion Euro (see Forum Franchise und Systeme, 2009). Thus, the franchise sector has grown to be a significant part of the German economy. The largest franchisors in Germany are TUI, McDonald's, Schülerhilfe, and Studienkreis Nachhilfe (see Deutscher Franchise Verband, 2010). A franchise relationship is usually characterized by a contractual agreement between a principal (the franchisor) who is in possession of a product or trademark and an agent (the franchisee) who pays the franchisor a fixed fee and a sales dependent royalty rate for the right to sell the product or use the trademark. The contract is defined by a linear payment structure (fixed fee and sales dependent royalty rate). Moreover, the relationship between franchisee and franchisor is associated with information asymmetries and conflicting interests. Since the franchisor is delegating decisions and tasks to the franchisee and cannot observe the franchisee's input, it has been suggested to analyze the contract design in franchising with agency-theoretic models (see, e.g., Rubin, 1978; Brickley et al., 1991; Brickley, 1999; Combs and Ketchen, 1999; Hempelmann, 2000; Blair and Lafontaine, 2005). Franchisors usually use a contract mix or dual distribution of company-owned and franchised outlets due to several reasons (see, e.g., Ehrmann and Spranger, 2005; Bürkle and Posselt, 2008). Among them, the franchisor's capital scarcity is said to be driving his decision whether to franchise or not (see, e.g., Rubin, 1978). If the franchisor desires to expand his business, but does not dispose of enough capital, he recruits franchisees who provide a significant amount of capital for opening their own outlets. Hence, arguments based on capital scarcity theory seem to be an important explanatory factor for franchising as well (see, e.g., Oxenfeldt and Kelly, 1969). Recent literature suggests that both theories are necessary to explain franchising (see Alon, 2001).

Other commonly known problems within franchise relations regard double-sided adverse selection and hold-up problems (see, e.g., Kräkel, 2010). Due to the intention to give the paper a clear focus on ex-post information asymmetries and the lack of appropriate data, we abstract from these problems in our analysis. Hence, we test hypotheses stemming from the two different theoretical perspectives, capital scarcity theory and agency theory, by empirically analyzing the contractual relations (i.e., the fixed fee and the sales dependent royalty rate) and the organizational structure (i.e., the proportion of franchised outlets) in the German franchise sector. Our research questions are: (1) How do capital scarcity arguments on the franchisor's side influence the contract design and organizational structure in franchise systems? (2) What impact do moral hazard considerations on the franchisee's and the franchisor's side have on the contractual relation and the proportion of franchised outlets?

Detailed information on a manager's compensation contract is generally only provided for the board of directors and the supervisory board of listed companies which are subject to certain disclosure requirements. In contrast, data for small and medium-sized companies is usually not publicly available. Hence, franchise contracts provide the rare opportunity to get insights into contract terms in agency settings for which data is usually unavailable.

Theoretical work on franchising has emphasized the double moral hazard relationship (e.g., Lafontaine, 1992; Kräkel, 2010) and the fact that in franchising, the franchisees own the outcome of their outlets (e.g., Lafontaine and Shaw, 2005). Hence, the variable payment component in franchise contracts (i.e., the royalty rate) might not only be intended to give incentives to the franchisee to work diligently, but can also provide the franchisor with incentives to exert effort (see, e.g., Michael, 1996). At the same time, the proportion of franchised outlets might serve as an instrument for the franchisor to increase incentives by giving outlet managers the right to own the outcome, thus turning them into franchisees. Hence, the contract terms (i.e., royalty rate and fixed fee) and the contract mix (i.e., whether the franchisor uses company-owned outlets and/or franchising) have to be considered simultaneously.

Table A.1 provides an overview of selected literature on franchising and the employed theoretical framework as well as empirical issues. Rubin (1978) was the first to conceptually develop a sharecropping argument for franchising. He investigates the capital market explanation for franchising as developed by Oxendfeldt and Kelly (1969) and Ozanne and Hunt (1971) and states that it does not explain franchising. As an alternative explanation, he proposes monitoring and control arguments following Jensen and Meckling (1976) and conceptually describes the double moral hazard problem arising from the franchisee and the franchisor both providing unobservable effort. Lal (1990) and Bhattacharyya and Lafontaine (1995) provide formal analyses of the franchise relationship. The former focuses on the royalty payments as well as the monitoring technology of a franchise contract and investigates a model with uncertain demand. He concludes that only in the double moral hazard case, the application of both, monitoring and royalties is necessary. In this case, royalties serve to provide incentives to the franchisor, while monitoring prevents franchisees from free-riding. Bhattacharyya and Lafontaine (1995) develop a revenue-sharing model based on double moral hazard and show that linear contracts can be optimal. Furthermore, they argue that the share parameter (i.e., the royalty rate in franchise contracts) is constant across franchisees, while the fixed fee varies.

Empirical studies on franchising have been conducted in two main streams of research (see Table A.1). The first stream investigates the conditions of franchise contracts, i.e., the royalty rate and the fixed fee. The second stream of literature analyzes the organizational structure of franchise chains in terms of the proportion franchised, i.e., the number of franchised outlets divided by total outlets. To the knowledge of the authors, Lafontaine's (1992) analysis based on a US dataset from the year 1986 has so far been the only one simultaneously examining the contract conditions and the proportion franchised. More recent work on franchising in this area might not be available since with the analyses of Lafontaine (1992) and Martin (1988) two very popular publications covered the US market.

Table A.1: Literature overview (empirical studies show data origin in parentheses)

	Agency Theory	**Capital Scarcity Theory**
Theoretical and Conceptual Work	Rubin, 1978 Lal, 1990 Bhattacharyya and Lafontaine, 1995	Oxenfeldt and Kelly, 1969 Ozanne and Hunt, 1971
	Contract Terms	**Organizational Structure**
Empirical Studies	Sen, 1993 (USA, CAN) Baucus et al., 1993 (USA) Seaton, 2003 (UK) Brickley, 2002 (USA) Lafontaine and Shaw, 1999 (USA)	Caves and Murphy, 1976 (USA) Brickley and Dark, 1987 (USA) Martin, 1988 (USA) Norton, 1988 (USA) Brickley et al., 1991 (USA) Scott, 1995 (USA) Alon, 2001 (USA) Castrogiovanni et al., 2006 (USA)
	Lafontaine, 1992 (USA)	

In Germany, empirical research on franchising has already addressed a variety of aspects. Cochet and Ehrmann (2007) investigate whether the existence of franchise councils depends on several characteristics of the franchise system, e.g., the allocation of decision rights, the level of the royalty rate, and the proportion of franchised outlets. They find that such institutions can be an efficient instrument for protecting franchisees against the franchisor's opportunistic behavior and, thus, offer a solution to the moral hazard problem on the franchisor's side. Cochet et al. (2008) focus on the franchisees' opportunistic behavior and examine the effectiveness of relational governance mechanisms for overcoming franchisee moral hazard. Grünhagen et al. (2008) compare the effectiveness of different franchisor services for the young German franchise market and the more mature US market and find that German franchisors offer more differentiated services. Finally, Windsperger (2003) offers a property rights analysis for German franchisors and finds that there exist complementary and substitutive relations between different property rights and the ownership surrogates in franchising.

We attribute the lack of research in Germany regarding the interaction of contract components and organizational structure to the fact that data was not available until recently. Cochet and Garg (2008), e.g., analyze the development of franchise contracts, however, they limit their study to three German SMEs for which they hand-collected the data.

Previous empirical studies find some inconsistencies regarding the impact of several variables related to characteristics of the franchise system and of the franchisor on the contract terms and the proportion franchised. While, e.g., Lafontaine (1992), Sen (1993), and Lafontaine and Shaw (1999) find a positive relation between the number of outlets in a franchise system and the royalty rate, Seaton (2003) identifies a negative relation. With respect to the relation between the franchise fee and the number of outlets, Sen (1993) provides evidence for a negative relation, the results of Lafontaine and Shaw (1999) suggest a positive relation, while Lafontaine (1992) cannot find a connection between franchise fee and the number of outlets at all. Finally, regarding the link between the number of outlets and the proportion of franchised outlets, Alon (2001) and Lafontaine and Shaw (1999) report a positive relation, while Lafontaine (1992) and Castrogiovanni et al. (2006) find the opposite. Regarding the franchisor's input – measured by training provided to franchisees – Sen (1993) and Lafontaine and Shaw (1999) identify a positive relation between training and the fixed fee, while Lafontaine (1992) finds no evidence for training influencing the fixed component in franchise contracts.

We contribute to the literature in several ways. First, we provide a new dataset from 2008 with a final sample of 123 German franchise systems by refining and complementing existing data sources. Second, our analysis refines the explanatory variables of existing empirical studies to reassess inconsistencies in these studies. Third, we provide the first investigation of contract terms and proportion franchised based on agency theory and capital scarcity arguments for German franchisors. Taking Germany as the country of franchisor origin, we are able to examine franchisors being active in different countries (multi-country setting), while previous studies were mainly conducted in the US market, thus focusing on national franchise activities (multi-state settings). Finally, existing empirical studies often rely on the argumentation that fixed fees and royalty rates should be negatively correlated (see, e.g., Lafontaine, 1992). However, this conjecture is not supported by empirical findings (see, e.g., Castrogiovanni et al., 2006). This questions hypotheses of previous empirical studies based on the assumption of a negative relation between both contract components. Accordingly, we develop our hypotheses without relying on the traditional line of argument based on negatively correlated fixed fees and royalty rates.

We find strong support for the hypothesis that franchisor moral hazard increases the royalty rate in franchise contracts, while we find no evidence for franchisee moral hazard influencing the variable component of the contract. Hence, our results support the theoretical consideration that in double moral hazard franchise relations, where the franchisee owns the outcome, the royalty is mainly influenced by factors associated with the franchisor's input. Furthermore, we find that the franchisor's capital scarcity increases the fixed fee paid at the beginning of the contractual relation and the proportion of franchised outlets. These findings support the traditional capital scarcity argument for franchising (see, e.g., Oxenfeldt and Kelly, 1969). The proportion of franchised outlets is furthermore positively influenced by moral hazard on the franchisee's side, thus suggesting that the proportion franchised is an additional instrument for the franchisor to manage incentives in his franchise system.

The remainder of the paper is organized as follows. In section 2, we discuss the nature of franchising, explain the basic model, and develop our hypotheses. Section 3 describes the dataset and the employed empirical methodologies. In section 4, we present our results and discuss the implications. Section 5 concludes.

2 Perspectives on franchising and hypothesis development

2.1 The nature of franchising

According to the European Franchise Federation (EFF), franchising is defined as a "contractual agreement between two independent business parties, the franchisor and the franchisee, in which the franchisor grants the franchisee, for the term of the contract, the right to buy and operate the franchisor's branded and formatted business system for a fee and according to the prescribed rules and procedures developed for the system by the franchisor" (European Franchise Federation, 2009). The contractual agreement usually stipulates that the franchisee pays the franchisor a fixed fee and a sales dependent royalty rate for the right to sell the franchisor's product and the right to use his trademarks and business format for a given location for a specified period of time (see Blair and Lafontaine, 2005) for a detailed description of a franchise agreement).

The EFF's definition emphasizes the complementary roles of the franchisor and the franchisee which implies that both contracting parties have to exert effort in order to contribute to the success of the business. Franchisee effort consists of activities concerning the commercialization of products and/or services and activities regarding the management of his outlet. Franchisor effort includes supporting activities such as providing service, operation manuals, training, and supra-regional promotion (see, e.g., Rubin, 1978; Dormann and Ehrmann, 2007). The franchise contract serves to balance the incentives of franchisee and franchisor (see, e.g., Maness, 1996) and helps to overcome moral hazard problems on both sides of the franchise contract.

A franchisee generally engages in franchising because he benefits from increased survivability during the first years of setting up a business due to the franchisor's know-how and support (see, e.g., Bates, 1998). The key motive for a franchisor to offer franchise contracts is the rapid expansion of his trademark or product, which would otherwise not be possible due to (human) capital constraints (see, e.g., Martin and Justis, 1993; Kaufmann, 1993).

2.2 Theoretical considerations and hypothesis development

The theoretical framework for explaining franchising typically relies on two main arguments: moral hazard on the franchisee's and the franchisor's side – also called *double moral hazard* (see, e.g., Rubin, 1978; Lal, 1990; Bhattacharyya and Lafontaine, 1995) – and the franchisor's capital scarcity (see Oxenfeldt and Kelly, 1969).

The franchise relationship can be generally described by a single-period Linear-Exponential-Normal-Model (LEN-model) where a risk-neutral franchisor (principal) hires a risk-averse franchisee (agent) to provide personally costly effort in return for compensation (see Holmström and Milgrom, 1987). The franchisor offers the franchisee a linear contract consisting of a variable component (royalty rate) dependent on the performance measure (e.g., sales) and a fixed component (fixed fee). Compared to the standard LEN-model established by Holmström and Milgrom (1987), the franchise relationship is different in two main aspects. First, in franchising, the principal or franchisor provides personally costly effort himself. Since neither the agent's nor the principal's effort choices are observable by the other contracting party and both effort choices contribute to the success of the system, this gives rise to the existence of a double moral hazard problem (see, e.g., Demski and Sappington, 1991). Second, the franchise contract implies payments from the franchisee to the franchisor and not from the principal to the agent. This implies that, in franchising, the agent is the owner of the outcome, e.g., the long-term outlet value (see Rohlfing, 2010). In other words, the franchisee has the residual claim on his outlet, but does not have full decision rights, i.e., the franchisor still decides on the contract terms (see, e.g., Brickley and Dark, 1987).

While the structure of the results of the LEN-model for franchising is similar to the results of the standard model, the optimal royalty rate in the franchise contract differs from the incentive rate in the standard model. The royalty rate serves two roles: First, it is set by the franchisor and influenced by his incentive to motivate the franchisee to work diligently. A lower royalty rate implies smaller payments to the franchisor and thus higher incentives for the franchisee. Second, since the royalty rate paid to the franchisor depends on sales, it provides the franchisor with incentives to exert effort. Thus, the royalty payments in franchising ensure a continuous input from the franchisor's side for the time of the contract (see Lafontaine and Shaw, 1999). Consequently, the royalty rate should be positively influenced by the franchisor's and negatively influenced by the franchisee's importance of input (see Rohlfing, 2010). The knife-edge case of a royalty rate of zero percent can be interpreted as completely leasing the outlet to the agent in return of a fixed payment. The other extreme is a royalty rate of 100 percent, which is equivalent to assuring the agent completely against any performance risk and paying him a fixed compensation in form of a negative entrance fee.

By offering a franchise contract, the franchisor influences the agent's effort choice in two ways: First, he provides agents with the right to own the outcome by turning them from store managers into franchisees. Second, he decides on the royalty rate stipulated in the contract, thereby adjusting the level of incentives for franchisees. Empirically, royalty rates average out at approximately 5 percent (see, e.g., Franchise Monitor, 2010). Thus, the right to own the outlet's proceeds provides franchisees with considerable incentives (see, e.g., Shane, 1998). Moreover, royalty rates may also be influenced by the type and extent of services provided by the franchisor (see, e.g., Michael, 1996). This suggests that residual claimancy is more important in motivating franchisees than the precise level of the royalty. Since franchise fee and royalty rate are not adjusted frequently, this leaves the mix of franchised and company-owned units as the mechanism, which can be adapted to changing market conditions (see, e.g., Scott, 1995). If turning outlet managers into franchisees (i.e., increasing the proportion franchised) is an instrument to provide them with incentives, we should observe opposite relations with (some) explanatory variables as compared to the royalty rate. The proportion franchised should be positively related to the franchisee's importance of input.

Oxenfeldt and Kelly (1969) established the capital market imperfection argument as an alternative explanation for franchising. According to them, the franchisor faces a binding capital constraint and thus needs franchising as a means to expand his business with franchisees providing some of the capital required. Several difficulties arise when applying the capital scarcity argument to franchising. First, franchisors generally provide financing to their franchisees, not only in terms of negotiation support, but also in terms of leasing agreements. Second, we should observe the tendency that with maturing franchise networks, and, consequently, decreasing capital scarcity, the franchisor starts to buy back franchise outlets. Hence, the proportion of franchised outlets should be lower in the case of mature franchise networks. However, this tendency is not observed empirically (see, e.g., Caves and Murphy, 1976; Martin, 1988). Finally, assuming that franchisees are risk-averse, they require a higher risk premium for investing in a single outlet instead of, e.g., having a claim on a portfolio of shares from all outlets in the franchise system. This, in turn, would imply that the single franchisee only marginally benefits from providing effort. Consequently, there arises a free-riding problem and each franchisee would rationally choose low effort (see Rubin, 1978). Hence, combining the capital scarcity argument with a moral hazard problem on the franchisee's side seems to contribute to the explanation of why franchising arises and persists (see Lafontaine, 1992), while the capital scarcity argument by itself is not well supported empirically. In line with these arguments, we would expect a positive relation between the franchisor's capital scarcity and the fixed fee as well as the franchisor's capital scarcity and the proportion of franchised outlets.

Based on the previous theoretical considerations we establish the following hypotheses concerning the contract terms (royalty rate and fixed fee) as well as the proportion franchised.

Hypotheses concerning the royalty rate in franchise contracts

The franchisor chooses the terms of the franchise contract with the objective to motivate the franchisee to work diligently, but also to commit himself to exerting effort (see, e.g., Agrawal and Lal, 1995). In this case, the royalty rate is the component of the franchise contract providing incentives to the franchisor and the franchisee to ensure ongoing effort from both contracting parties. Initial input by the franchisor (e.g., help in finding a location) might be paid for by the franchisee with a higher entrance fee instead of a higher royalty rate. Hence, we formulate the following hypotheses (see, e.g., Rubin, 1978; Brickley and Dark, 1987; Lafontaine, 1992; Sen, 1993):

Hypothesis 1a The royalty rate of a franchise contract is larger the more important the franchisor's ongoing input.

Hypothesis 1b The royalty rate of a franchise contract is smaller the more important the franchisee's (ongoing) input.

Franchisors usually have a major role in continuously ensuring the quality of their products or trademarks (see, e.g., Gal-Or, 1995). Since the franchisee's success depends on the franchisor's input, the franchisee is interested in giving the franchisor incentives to work for this purpose by agreeing to pay a higher sales dependent royalty rate. In other words, by setting a higher royalty rate, the franchisor commits himself to exerting higher effort. Vice versa, the franchisor is interested in motivating the franchisee to work diligently, since his input, e.g., providing local knowledge, is essential for the success of the business as well. Accordingly, the royalty rate is adjusted.

Hypothesis concerning the fixed fee in franchise contracts

If a franchisor's main consideration for engaging in franchising is to raise capital (see, e.g., Oxenfeldt and Kelly, 1969; Martin and Justis, 1993), he should demand a high fixed fee being paid at the beginning of the contractual relation. This leads to the following hypothesis (see, e.g., Sen, 1993; Lafontaine, 1992):

Hypothesis 2 The contract requires a higher fixed fee when the franchisor's capital scarcity increases.

If a franchisor's sole interest is to raise capital, he would be better off by selling shares of a portfolio consisting of all franchise outlets to potential franchisees, as long as they are risk-averse (see, e.g., Rubin, 1978). However, this would imply that the single franchisee has an incentive to free-ride, because the whole franchise system benefits from the franchisee's effort, whereas he bears the full cost of his actions. This gives rise to a moral hazard problem. To account for the moral hazard problem, the franchisor can make the single franchisee become the owner of his outlet, which implies that the franchisee benefits from his actions, but also suffers from not providing input. In consequence, when moral hazard problems are present, franchising can become more attractive for the franchisor as compared to the portfolio solution. From an empirical perspective, if the capital scarcity argument is only of relevance in combination with moral hazard considerations, the analysis should be accompanied by some empirical evidence for moral hazard on the franchisee's side.

Previous literature argues that, if we assume a competitive market for franchisees, we face binding participation constraints for them and, in consequence, the fixed fee should extract the downstream surplus given the royalty rate. This leads to the conjecture that the fixed fee and the royalty rate should be inversely related (see, e.g., Lafontaine, 1992). However, empirical studies do not find evidence for a negative correlation between royalty rate and fixed fee (see, e.g., Lafontaine, 1992; Lafontaine and Shaw, 1999; Castrogiovanni et al., 2006). This puts into question hypotheses being based on the assumption of a negative relation between both contract components. In consequence, we do not formulate any hypothesis concerning the royalty rate and the franchisor's capital scarcity.

Hypotheses concerning the proportion of franchised outlets

According to the capital scarcity argument, increased needs for funds by the franchisor go along with an increased reliance on franchising instead of company-owned outlets (see, e.g., Combs and Ketchen, 1999; Carney and Gedajlovic, 1991). Furthermore, the proportion franchised should be influenced by considerations regarding moral hazard on the franchisee's side.

Since the franchisee owns the outcome of his own outlet, while a manager of a company-owned outlet is only being paid a compensation based on his performance, a franchisee has stronger incentives than a manager to exert effort (see, e.g., Martin and Justis, 1993; Bradach, 1997). This suggests the following considerations with respect to moral hazard on the franchisee's side: If the value of local inputs by the franchisee is very high and/or monitoring is difficult due to, e.g., large geographical dispersion, the franchisor will rely more on franchising instead of operating company-owned outlets, thus increasing the proportion franchised (see, e.g., Minkler, 1990). Consequently, we formulate the following hypotheses (see, e.g., Brickley et al., 1991; Brickley and Dark, 1987; Scott, 1995; Alon, 2001; Combs and Ketchen, 2003):

Hypothesis 3a The proportion franchised is positively related to the franchisor's capital scarcity.

Hypothesis 3b The proportion franchised is positively related to the importance of the franchisee's input and monitoring costs.

Consider, for example, the educational business of tutoring centers. Here, the local conditions differ significantly from country to country and even between different regions within a country. Furthermore, we observe large geographical dispersion of tutoring centers. Hence, the franchisee's local expertise about the educational system and learning habits is very central to the success of the business, while monitoring is difficult. This coincides with the fact, that in the educational business, we find very high proportions of franchised outlets (see sectoral statistics provided in Table A.2).

3 Data description and methodology

3.1 Sources of data

The main source for the data used in this study is the *Franchise CD 2006*, sold by *FranchisePORTAL GmbH*, which also runs the corresponding web-directory *FranchisePORTAL.de*. The *Franchise CD 2006* dataset consists of a list of all franchise systems operating in Europe with the profiles of their business concept. In addition to a verbal description of the franchisor's product or service, the dataset contains detailed numerical information on the franchise systems. All information on the *Franchise CD 2006* is based on voluntary disclosure of franchisors. However, since this information is communicated to new potential franchisees, we expect that correct numbers are reported. We limit our analysis to franchisors with Germany as their home country to explore the specific characteristics of German franchise systems and to allow for a multi-country setting as opposed to the multi-state settings in previous studies. The *Franchise CD 2006* contains the profiles of 277 German franchisors with complete numerical information on the franchise contract terms (i.e., royalty rate and fixed fee).

For methodological reasons addressed in more detail in section 3.4 and the fact that information on the number of outlets was outdated or not available in many cases, up-to-date (i.e., 2008) information was gathered on the variables royalty rate, fixed fee, and, most importantly, the number of outlets. This information was collected by conducting telephone interviews during September and October 2008 with franchisor representatives and relying on public information provided by franchisors or *FranchisePORTAL GmbH*. In some cases, firms listed in the *Franchise CD 2006* directory did not offer franchising any more or did not want to provide the information needed for our analysis. Our final dataset consists of 123 detailed profiles of German franchisors providing information on the number of company-owned outlets, the number of franchised outlets, the contract terms, the minimum investment required for opening an outlet, the number of countries in which the franchisor is present, the number of years in business, the number of years since the beginning of franchising, the different types of initial management support offered to franchisees, the different types of ongoing franchisor input offered to franchisees, the different types of training offered to franchisees, the qualification requirements franchisees have to meet, whether the franchisor provides financing to franchisees, and franchisor membership in the German Franchise Association (DFV). This sample size is comparable to other German studies on Franchising (see, e.g., Cochet and Ehrmann, 2007; Grünhagen et al., 2008). Furthermore, we condensed the very detailed information provided on franchisor industry to five main sectors which are often used for industry categorization of franchise systems. Statistics regarding the German franchise sector identified “retail”, “craft business”, “hotels and restaurants”, and “services” as typical franchise sectors (see, e.g., Perlitz, 2007; Scheer, 2008). We adopted the first three categories and replaced the rather general category “services” by a more specific service category named “education and training” due to the relatively large number of systems in this sector and the particular business concept. Hence, we categorized our franchise systems in: retail, craft business, food and beverages, education and training, and other businesses (see, e.g., Brickley et al., 2006). Table A.2 shows the sectoral statistics for the 123 franchisors in our sample.

Table A.2: Sectoral statistics for 123 franchisors

Sector	Number of franchisors	Number of outlets Mean	Number of outlets Median	Proportion franchised (%) Mean	Proportion franchised (%) Standard Dev	Royalty 2008 (%) Mean	Royalty 2008 (%) Standard Dev	Fixed fee 2008 (in thousand Euro) Mean	Fixed fee 2008 (in thousand Euro) Standard Dev
Retail	37	134.0	31.0	74.32	27.13	3.97	2.61	10.49	9.58
Craft business	13	189.8	36.0	90.31	22.94	4.38	1.80	10.46	7.53
Food and beverages	26	82.4	32.0	78.69	27.63	4.83	1.68	10.10	4.74
Education and training	12	150.7	40.5	89.50	17.66	8.71	4.50	7.93	6.83
Other	35	35.7	19.0	81.71	27.31	5.99	3.15	11.68	10.39
Total	123	102.6	27.0	80.52	26.31	5.23	3.07	10.49	8.52

About 30 percent of the franchisors in our sample can be classified as retail businesses, 11 percent as craft businesses, and 21 percent originate from the food and beverages industry. These figures are quite comparable to contemporary statistics of the German franchise sector (see Franchise Monitor, 2010) which makes us confident that our sample is representative for Germany. The median values of the number of outlets show that the majority of our franchise systems is smaller than the mean. In other words, our sample includes a large number of small franchise systems and a small number of large franchise systems.

3.2 Variable measurement

Since the general concept of franchise contracts is very well known, the interpretation of the variables we use should be fairly straightforward. However, some of the variables in our analysis might not be self-explanatory. Therefore, we will briefly describe the variables (or the proxies we use to measure them) and the associated theoretical considerations.

Dependent variables: contract terms and proportion franchised

As mentioned above, our analysis focuses on both, the contract terms and the contract mix (i.e., the organizational structure). Therefore, the dependent variables of our model are, on the one hand, the franchisor's contract terms (i.e., the royalty rate and the fixed fee of franchise contracts) and, on the other hand, the franchisor's propensity to franchise (i.e., the decision whether to manage stores as company-owned outlets or to run them via franchise contracts). The variable *royalty* is a royalty on sales (expressed as a percentage of sales) paid by the franchisee to the franchisor, often on a monthly basis. The variable *fixed fee* is a (fixed) payment paid at the beginning of the contract by the franchisee to the franchisor. We observe that most franchisors operate some of their stores as company-owned and others as franchised outlets. This phenomenon raises the question what influences their decision about the contract mix. In order to analyze this decision we use *proportion franchised*, i.e., the number of franchised outlets compared to the total number of outlets, as the dependent variable, which can be interpreted as the extent to which franchisors make use of franchising.

Independent variables concerning franchisor's capital scarcity

Franchisor's capital scarcity depends on two factors: the franchisor's access to capital and the franchisor's need for capital. *Log(number of outlets)* is the natural log of the total number of outlets in a franchise system. Previous empirical studies often classified the number of outlets as a proxy for franchisee moral hazard and found mixed empirical results (see, e.g., Lafontaine, 1992; Sen, 1993; Lafontaine and Shaw, 1999). We follow the convincing line of argumentation that the number of outlets is an indicator for the franchisor's access to capital, because the franchisor's access to capital will be better the more established and the more present the business concept is in the market (see, e.g., Baucus et al., 1993). For example, applying for a bank loan might be more promising if the franchisor is well established on the market. At the same time, the number of outlets is an indicator for the franchisor's capital needs, since small, young, and growing franchise systems are generally subject to higher capital needs than large franchise systems. In consequence, we expect that the number of outlets has a negative impact on *fixed fee 2008*. However, the size of the franchise system has conflicting effects on *proportion franchised* (see, e.g., Shane, 1998). In early growth stages, franchising is favored over company-owned outlets, because the franchisor needs the human and financial capital provided by franchisees. When franchise systems become very large, the franchisor's capital scarcity is reduced and he can buy back profitable outlets to completely absorb their rents. In consequence, we expect an inverse U-shaped relation between the size of the franchise system and the proportion of franchised outlets. *Franchisor financing* is a dummy variable indicating whether or not the franchisor is offering financing to his franchisees (one if yes, zero otherwise). Clearly, the franchisor can only offer financing to his franchisees, if he has access to capital. Hence, *franchisor financing* is used as an additional indicator for the franchisor's access to capital (see, e.g., Lafontaine, 1992; Pfister et al., 2006). *Minimum investment* is the minimum amount the franchisee is required to invest when starting his business. The amount required to open a new outlet is a measure of the franchisor's need for capital (see, e.g., Lafontaine, 1992).

Independent variables concerning franchisee moral hazard

Franchisee moral hazard is typically measured in two different ways: The first one is the importance of the franchisee's input and the second is the cost of monitoring these inputs. The *FranchiseCD 2006* provides detailed information on the qualification the franchisor expects from franchisees, which we use as a proxy to measure the importance of the franchisee's input. *Qualification of franchisee* is a standardized variable which can take on values between 0 and 11 counting the different qualification requirements of franchisors which franchisees have to meet, e.g., professional skills, industry knowledge, technical knowledge, and team spirit. This approach is close to the one employed in Ehrmann and Dormann (2008). We use *number of countries* as an indicator for the franchisor's cost of monitoring the franchisee's input. This indicator is typically used as a measure of geographical dispersion, which is assumed to increase monitoring cost (see, e.g., Norton, 1988; Carney and Gedajlovic, 1991; Combs and Ketchen, 1999). The further away an outlet is located from the franchisor, the more difficult and the more costly is the monitoring of this outlet. First, monitoring costs increase because of the distance the monitor needs to travel to the outlets under consideration. Second, absent knowledge about the peculiarities of foreign countries makes it difficult to monitor the activities of the outlet manager or franchisee. Both aspects are incorporated in the variable *number of countries*.

Independent variables concerning franchisor moral hazard

The different ways the franchisor provides input in a franchise agreement can be categorized in assistance to franchisees and system development. For the latter, we use *% time not franchising*, i.e., the number of years the franchisor has not been franchising as a percentage of the total number of years the franchisor has been in business. This is a proxy indicating how much time and effort it took to set up the franchise system (see, e.g., Lafontaine, 1992; Pénard et al., 2003). We expect that a franchise system which was difficult to establish and whose development took a long time requires a high franchisor input at any time, i.e., even after the business has been turned into a franchise system. Hence, a long *% time not franchising* is considered to be an indicator for the importance of the franchisor's input. As for assistance to the franchisee, we have three different indicators: initial management support, ongoing management support, and training to the franchisee. Initial management support comprises a detailed manual of the business concept, assistance in finding a location for the outlet, analysis of outlet location, and planning of outlet equipment. The standardized variable *management support initial* is the number of these different types of support offered and can take on values between 0 and 4 (i.e., the sum of the various support types). The franchisor's time and effort expenditures regarding these four management support indicators was assumed to be comparable. In consequence, we assigned the same weights to the four indicators (see, e.g., Ehrmann and Dormann, 2008). Since ongoing management support (e.g., accounting services, information technology, and market analysis) and training to the franchisee (e.g., training in marketing techniques, administration, or quality control) are both measures of ongoing franchisor input, we condense this information by adding the number of different types of ongoing management support and the number of different types of training, constructing the standardized variable *ongoing franchisor input* (see, e.g., Sen, 1993). In pursuing that all training and ongoing management support indicators require similar input from the franchisor, we excluded one indicator (information letters) from the training indicators, since we suspect the other indicators to require more time and effort from the franchisor. All other indicators were assigned the same weights (see Grünhagen et al., 2008; Ehrmann and Dormann, 2008). Ongoing management support and training to the franchisee have the same implications with respect to our hypotheses, because they are both a measure of ongoing franchisor input. Moreover, they are positively correlated. Therefore, including them in a regression equation as two different independent variables is not without problems. Previous studies include only training, and in some cases only the initial training provided by the franchisor, as proxies for franchisor moral hazard, but report inconsistent empirical results (see, e.g., Sen, 1993; Lafontaine and Shaw, 1999; Lafontaine, 1992). From separating into initial and ongoing franchisor input we expect the results to become clearer. There are 7 different types of training a franchisor might offer to his franchisees and 11 types of ongoing management support. Therefore, the standardized variable *ongoing franchisor input* can take on values between 0 and 18.

Control variables

Member of DFV is a dummy variable indicating whether or not the franchisor is a member of the German Franchise Association (one if yes, zero otherwise). Membership is typically seen as a sign of reliability and quality, thus reducing the risk for the franchisee. The German Franchise Association claims to check the business format of its members on a regular basis. Since we believe this might influence contract terms, we include this dummy as a control variable.

Years in business is the number of years since the franchisor has started his operations, regardless of whether the business was initially established as a franchise business or not. It is used as a variable to control for the potential influence of the age of the franchise system and as a signal for the unknown quality of a franchisee (similar to *member of DFV*). Especially regarding the proportion franchised there are several arguments predicting a positive or negative relation with age. Based on capital scarcity theory, it is argued that the proportion of franchised outlets decreases with the age of the franchise system due to lower needs for and better access to capital (see, e.g., Caves and Murphy, 1976; Lafontaine, 1992). However, empirical results often suggest the opposite. Other researchers (Pfister et al., 2006) predict a larger proportion franchised for older franchise systems, because franchisors expand their business by means of franchising or find it easier to franchise due to reduced costs and obstacles. For example, a business with a long tradition might signal good reputation and quality to potential franchisees. As the franchisor contracts with more franchisees over the years, the proportion franchised increases with the age of the franchise system. Finally, life-cycle theory predicts an inverse U-shaped relation between the proportion franchised and the age of the franchise system (see, e.g., Shane, 1998; Martin, 1988).

We use a set of indicator variables to control for potential industry effects (see, e.g., Castrogiovanni et al., 2006). Indicator variables are included for the following four industries: (1) *craft business*, (2) *food and beverages*, (3) *education and training*, and (4) *other*. The indicator variables equal 1 if the franchisor belongs to the industry category and zero otherwise. *Retail* is the industry category excluded for the regressions.

3.3 Descriptive statistics and correlation matrix

Interestingly, our descriptive statistics (see Table A.3) for dependent variables are generally comparable to the results of previous studies, even though they stem from different markets and decades. Lafontaine (1992) reports values for the *proportion franchised*, the *royalty*, and the *fixed fee* of 82.75 percent, 6.54 percent, and 21,490 USD, respectively. Those values correspond to our dataset with respective values of 80.52 percent, 5.23 percent, and 10,490 Euro. Similar values are observed in Brickley (2002), Sen (1993), Lafontaine and Shaw (1999), Scott (1995), and Castrogiovanni et al. (2006). Moreover, compared to previous studies conducted in

Germany, our sample shows similar mean values for the *royalty*, the *years in business*, and the *proportion franchised*, as well as an increased *number of outlets* which is due to the growing characteristics of the German franchise sector (see, e.g., Cochet and Ehrmann, 2007).

Table A.3: Descriptive statistics for 123 franchisors

Variable	Mean	Standard Deviation	Minimum	Maximum
Proportion franchised (%)	80.52	26.31	0.00	100.00
Royalty 2008 (%)	5.23	3.07	0.00	20.00
Fixed fee 2008 (in thousand Euro)	10.49	8.52	0.00	50.00
Royalty 2006 (%)	5.15	3.07	1.00	20.00
Number of outlets	102.63	202.63	1.00	1092.00
Franchisor financing (yes/no)	0.79	0.41	0.00	1.00
Minimum investment (in thousand Euro)	76.66	101.28	0.50	620.00
Qualification of franchisee	5.79	1.90	1.00	11.00
Number of countries	2.12	2.34	1.00	15.00
% time not franchising	25.07	25.00	0.00	96.00
Management support initial	3.37	0.97	0.00	4.00
Management support ongoing	7.62	2.08	2.00	11.00
Training	6.57	0.85	2.00	7.00
Ongoing franchisor input	14.19	2.62	5.00	18.00
Member of DFV (yes/no)	0.40	0.49	0.00	1.00
Years in business	20.21	26.60	2.00	260.00

For the royalty rate, two variables (royalty 2008 and royalty 2006) are reported, since 2008 values are used in case the variable enters the regression model on the left hand side, while 2006 values are used in case the variable enters the model on the right hand side.

Table A.4 shows the correlation matrix for our dependent and independent variables. Nearly all correlation values are below 0.5, except for the high correlation between the *royalty 2008* and the *royalty 2006* as well as the correlation between *ongoing franchisor input* and *management support initial*. It is not surprising that these two variables measuring the franchisor's input are correlated. A franchisor offering a wide range of initial support is also likely to offer high support during the contractual relation.

Table A.4: Correlation matrix for dependent and independent variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
(1) Royalty 2006	1.00																		
(2) Royalty 2008	0.97	1.00																	
(3) Fee 2008	0.03	0.01	1.00																
(4) Proportion franchised	0.04	0.03	0.12	1.00															
(5) Number of outlets	-0.02	-0.02	-0.13	-0.10	1.00														
(6) Franchisor financing	-0.14	-0.12	0.04	-0.08	-0.03	1.00													
(7) Minimum investment	-0.24	-0.24	0.35	0.00	0.11	0.15	1.00												
(8) Qualification franchisee	-0.01	0.01	0.12	-0.09	0.13	0.22	0.11	1.00											
(9) Number of countries	-0.04	-0.04	0.23	0.20	0.31	-0.05	0.18	0.10	1.00										
(10) % time not franchising	0.06	0.04	0.02	-0.32	-0.11	0.13	0.09	0.14	-0.03	1.00									
(11) Mgmt support initial	-0.14	-0.14	0.10	-0.10	0.10	0.26	0.29	0.19	-0.02	0.19	1.00								
(12) Ong. franchisor input	0.01	0.01	0.15	-0.09	0.07	0.31	0.30	0.35	0.02	0.10	0.55	1.00							
(13) Member of DFV	0.04	0.01	0.12	0.06	0.27	-0.03	0.27	0.18	0.22	0.07	0.26	0.26	1.00						
(14) Years in business	-0.02	-0.04	-0.06	-0.14	0.28	0.07	0.14	0.08	0.06	0.43	0.15	0.10	0.26	1.00					
(15) Retail	-0.28	-0.27	0.00	-0.16	0.10	0.04	0.20	0.06	0.02	0.06	0.27	0.27	0.15	0.16	1.00				
(16) Craft business	-0.09	-0.10	0.00	0.13	0.15	0.11	-0.12	0.22	0.08	-0.12	-0.21	-0.10	0.04	-0.02	-0.23	1.00			
(17) Food and beverages	-0.06	-0.07	-0.02	-0.04	-0.05	0.07	0.11	-0.13	-0.07	0.00	0.20	0.12	0.07	-0.08	-0.34	-0.18	1.00		
(18) Education and training	0.39	0.37	-0.10	0.11	0.08	-0.23	-0.20	0.01	0.02	-0.04	-0.24	-0.24	0.01	-0.02	-0.22	-0.11	-0.17	1.00	
(19) Other	0.14	0.16	0.09	0.03	-0.21	-0.03	-0.10	-0.10	-0.03	0.05	-0.15	-0.16	-0.26	-0.07	-0.41	-0.22	-0.33	-0.21	1.00

3.4 Methodological issues

We analyze our data using OLS and Tobit regression models. The circumstance that our dependent variables are censored suggests using a Tobit model in order to account for this characteristic. However, since only very few observations are in fact limit observations, this problem is not very pronounced. Therefore, we estimate our equations using OLS and provide results from a Tobit model as a robustness check where limit observations are considerable. In fact, there are only two franchisors in our dataset with a *royalty* of zero percent and six franchisors with a *fixed fee* of 0 Euro. However, there are 37 franchisors franchising all their outlets (i.e., a *proportion franchised* of 100 percent) and two franchisors owning all their outlets (i.e., a *proportion franchised* of zero percent).

All OLS regressions are estimated with Eicker-Huber-White robust standard errors. Similar to the problems discussed in Lafontaine (1992) some of the proxies used as explanatory variables in our regression models might suffer from endogeneity. The management support offered to franchisees might, for example, depend on the proportion of franchised outlets. We address this issue by using 2008 information for the explained variable and past values for all explanatory variables except for the *number of outlets*, the *years in business*, and the proportion of time the firm has not been franchising (*% time not franchising*).

4 Results and discussion

The results obtained from our regression analyses are reported in Table A.5. Column A displays the results for the OLS regression of *royalty 2008* on the independent variables, column B shows the OLS regression results for *fixed fee 2008*. Finally, column C provides the OLS regression results for *proportion franchised*.

Table A.5: OLS regression results – reduced form

	Dependent variables		
	A	B	C
Independent variables	Royalty 2008	Fixed fee 2008	Proportion franchised
Log(number of outlets)	0.38 *	-1,944.07 ***	1.02
	(1.67)	(-2.73)	(0.43)
Log(number of outlets)^2			-2.69 ***
			(-2.71)
Franchisor financing	-0.42	-387.11	-1.68
	(-0.49)	(-0.21)	(-0.36)
Minimum investment	-0.01 ***	26.60 **	0.02
	(-2.81)	(2.41)	(1.09)
Qualification of franchisee	-0.05	312.67	-1.48
	(-0.33)	(0.77)	(-1.11)
Number of countries	-0.11	955.04 **	2.40 ***
	(-0.91)	(2.63)	(3.53)
% time not franchising	0.02	-32.16	-0.29 **
	(1.32)	(-0.80)	(-2.42)
Management support initial	-0.46	537.41	1.09
	(-1.20)	(0.65)	0.39
Ongoing franchisor input	0.31 ***	292.23	-0.35
	(3.04)	(0.92)	(-0.35)
Member of DFV	0.43	1,555.33	1.91
	(0.93)	(1.19)	(0.30)
Years in business	-0.01	2.12	0.01
	(-1.38)	(0.08)	(0.14)
Craft Business	0.26	2,517.25	16.41 *
	(0.31)	(1.11)	(1.88)
Food and beverages	0.88	151.20	2.19
	(1.65)	(0.10)	(0.33)
Education and training	4.45 ***	1,723.82	12.92 *
	(3.30)	(0.79)	(1.85)
Other	2.17 ***	2,972.23	4.90
	(3.09)	(1.36)	(0.85)
Constant	0.76	4,415.55	92.96 ***
	(0.46)	(1.06)	(5.20)
R^2	0.30	0.26	0.27
Adj. R^2	0.21	0.17	0.16
Prob > F	0.00	0.00	0.00

***,**, and * indicate significance at the 1%, 5%, and 10%-level, respectively. Asymptotic t-values are given in parentheses. The variables log(number of outlets), log(number of outlets)^2, franchisor financing, and minimum investment measure the franchisor's capital scarcity. Qualification of franchisee and number of countries are indicators for franchisee moral hazard, while % time not franchising, management support initial and ongoing franchisor input are measures of the franchisor's moral hazard. Member of DFV is a risk control variable, years in business controls for the age and reputation of the franchise system. Craft business, food and beverages, education and training, and other are sector dummy variables. When entering the regression analysis together with log(number of outlets)^2, the variable log(number of outlets) was centered in order to avoid structural multicollinearity due to the quadratic term (see, e.g., Cohen et al., 2003).

4.1 Royalty rate

With respect to our hypothesis of franchisor moral hazard influencing *royalty 2008* (H1a), the coefficient of the variable *ongoing franchisor input* is clearly significant with a positive sign (Table A.5, column A). Hence, we cannot reject our hypothesis H1a. This finding is similar to Sen (1993) who identifies a positive relation between the royalty rate and central data processing as a franchisor service. However, he does not provide evidence for a broader spectrum of franchisor services influencing the royalty rate. Lafontaine and Shaw (1999) find that initial training provided by the franchisor has a positive impact on the royalty rate. This result is, however, limited to the case where sector dummies are included in their analysis. As a robustness check, we also tested the specification for the royalty rate without industry dummies. We find that the positive impact of *ongoing franchisor input* on *royalty 2008* also holds when not including industry dummies.

With respect to moral hazard on the franchisee's side (H1b), our regression results suggest the following: The coefficients of the variables *qualification of franchisee* and *number of countries* are not significant. Hence, we find no support for franchisee moral hazard having an impact on the choice of *royalty 2008* leading us to reject H1b. This result is different from, e.g., Lafontaine (1992) who reports a significant relation between the royalty rate and variables measuring franchisee moral hazard. Nonetheless, our results confirm the considerations based on the double moral hazard model: The royalty rate is used by the franchisor to commit himself to provide the input needed for the success of the franchise system, while the proportion franchised is used to incentivize outlet managers by turning them into franchisees (see section 4.3).

We find that the variables *minimum investment* and *log(number of outlets)* are also significantly influencing the royalty rate. For *minimum investment*, the economic effect is small. With respect to the hypothesis of a negative correlation between royalty rate and fixed fee, the negative sign of the coefficient for *minimum investment* and the positive sign of the coefficient for *log(number of outlets)* would support a hypothesis based on capital scarcity. A franchisor with higher need for capital – measured by *minimum investment* – would then demand high initial fees and low royalty rates. On the other hand, a franchisor with better access to capital and lower needs for capital – measured by *log(number of outlets)* – would demand low initial fees and high royalty rates. However, our sample – in line with other studies – does not provide evidence for a negative correlation between fixed fee and royalty rate. A possible explanation for the negative impact of *minimum investment* on the royalty rate might relate to the fact that the franchisor wants to compensate the franchisee with lower payments if the franchisee is already required to take large initial investments. Of course, this type of compensation is not possible via the fixed fee if the franchisor is subject to capital scarcity, which is apparently the case in our sample (see the positive relation between *minimum investment* and *fixed fee 2008* in Table A.5, column B). Hence, with capital scarcity problems being present, the compensation cannot occur via the fixed fee. However, the franchisor could offer lower royalties which reduce the (future) payments in order to compensate franchisees for high initial investments, if capital scarcity impedes compensation at the beginning of the contractual relation via the fixed fee. The positive impact of *log(number of outlets)* on the royalty rate might be explained by the conjecture that a larger franchisor is able to generally charge higher royalties from his franchisees.

Finally, we find that royalty rates differ significantly among various industries (see, e.g., Baucus et al., 1993). As suggested by sectoral statistics (Table A.2), we observe higher royalty rates for all sectors compared to the *retail* sector. The strongest impact can be observed for the *education and training* sector as well as for *other* industries, which is also confirmed by our regression results. Furthermore, supporting the compensation argument, we find significantly negative correlation between the *education and training* variable and the variable *minimum investment* (-0.20, see Table A.4) as well as a positive correlation between the *royalty 2008* and *education and training* (0.39, see Table A.4).

4.2 Fixed fee

With respect to *fixed fee 2008*, the coefficient of the variable *minimum investment* is significant and shows the expected positive sign (Table A.5, column B). This result is consistent with the findings of, e.g., Lafontaine (1992). A franchisor with higher need for capital demands a higher fixed fee at the beginning of the contractual relationship. Furthermore, the coefficient of the variable *log(number of outlets)* shows the expected negative sign and is highly significant, which is consistent with the findings of Sen (1993). However, Sen (1993) uses the variable as channel control, while we follow the argument of Baucus et al. (1993): A larger franchise system has a higher market representation and thus the franchisor's capital needs are lower and his access to capital is better than for small, still rapidly expanding franchise systems. Hence, franchisors with an already established large network demand lower fixed fees. Both variables suggest that we cannot reject H2. As outlined in section 2, the capital scarcity argument is not very convincing without evidence of a moral hazard problem on the franchisee's side. We provide the respective evidence with the results for the proportion franchised (see section 4.3).

Furthermore, we find that the coefficient of the variable *number of countries* is positive, thus suggesting that franchisors who have outlets in more than one country generally demand higher fixed fees. This result is comparable to Lafontaine and Shaw (1999), but is the opposite of Lafontaine (1992). However, both studies take the number of states in which a franchisor operates and thus measure national inter-state effects and not inter-country effects. A franchisor can follow several strategies when expanding his franchise system. Among them, two seem to be particularly plausible. First, the franchisor can flood the national market with a high number of outlets. In this case, the variable *number of countries* takes on a low value (equal to one), while *number of outlets* is high. Second, the franchisor can enter various countries with a single (master) franchise outlet. In this case, *number of countries* is high, while *number of outlets* is rather small. The general idea illustrated by these two extreme scenarios is supported by our data as the two variables are not highly correlated (see Table A.4). Furthermore, both variables capture different theoretical ideas. While the variable *number of outlets* is an indicator for the franchisor's capital scarcity, *number of countries* measures franchisee moral hazard in terms of monitoring difficulties due to large geographical dispersion. However, we did not formulate a hypothesis on the relation of *number of countries* and *fixed fee*, since we do not expect the fixed component of the franchise contract being associated with incentive considerations. Nevertheless, a plausible line of reasoning could be that a franchisor with a higher market representation in various countries is in the position to demand high fixed fees from his franchisees. This line of argumentation has also been emphasized by Baucus et al. (1993), however, empirical tests of market power in franchising are very difficult (see Norton, 1988).

We tested the specification for *fixed fee 2008* based on two regression models, one including *royalty 2006*, thus considering it exogenous (full specification), and the second without the royalty (reduced form). While in Table A.5 the results for the reduced form are displayed, Table A.6 reports the corresponding OLS regression results for *fixed fee 2008* including *royalty 2006* (column D). Note that the results do not significantly change dependent on whether the royalty rate is included in the regression or not. The results in Table A.6 also show that there is no negative correlation between the fixed fee and the royalty which corresponds to the findings of, e.g., Lafontaine (1992), Lafontaine and Shaw (1999), and Castrogiovanni et al. (2006). In contrast, our sample shows a positive and weakly significant relation between *fixed fee 2008* and *royalty 2006*. This questions hypotheses based on the assumption of a negative relation between both contract components. An alternative explanation for the positive relation between fixed fee and royalty rate has been found by Kaufmann and Dant (2001) who state that both components could reflect the level of the franchisor's investment into the system.

Table A.6: OLS regression results – full model

	Dependent variables	
	D	E
Independent variables	Fixed fee 2008	Proportion franchised
Log(number of outlets)	-2,074.39 ***	1.05
	(-2.90)	(0.44)
Log(number of outlets)^2		-2.69 ***
		(-2.70)
Franchisor financing	-136.81	-1.73
	(-0.07)	(-0.38)
Minimum investment	29.06 **	0.02
	(2.60)	(1.00)
Qualification of franchisee	358.38	-1.49
	(0.90)	(-1.11)
Number of countries	996.41 ***	2.39 ***
	(2.83)	(3.48)
% time not franchising	-41.04	-0.29 **
	(-1.00)	(-2.37)
Management support initial	748.02	1.05
	(0.88)	(0.36)
Ongoing franchisor input	138.74	-0.32
	(0.43)	(-0.30)
Member of DFV	1,270.82	1.96
	(0.96)	(0.31)
Years in business	6.72	0.01
	(0.24)	(0.13)
Royalty 2006	442.70 *	-0.09
	(1.72)	(-0.11)
Craft Business	2,296.21	16.46 *
	(1.03)	(1.86)
Food and beverages	-280.21	2.28
	(-0.19)	(0.34)
Education and training	-386.56	13.36
	(-0.14)	(1.63)
Other	1,991.44	5.10
	(0.88)	(0.79)
Constant	4,151.95	93.13 ***
	(0.99)	(5.20)
R^2	0.28	0.27
Adj. R^2	0.18	0.16
Prob > F	0.00	0.00

***,**, and * indicate significance at the 1%, 5%, and 10%-level, respectively. Asymptotic t-values are given in parentheses. The variables log(number of outlets), log(number of outlets)^2, franchisor financing, and minimum investment measure the franchisor's capital scarcity. Qualification of franchisee and number of countries are indicators for franchisee moral hazard, while % time not franchising, management support initial and ongoing franchisor input are measures of the franchisor's moral hazard. Member of DFV is a risk control variable, years in business controls for the age and reputation of the franchise system. Craft business, food and beverages, education and training, and other are sector dummy variables. When entering the regression analysis together with log(number of outlets)^2, the variable log(number of outlets) was centered in order to avoid structural multicollinearity due to the quadratic term (see, e.g., Cohen et al., 2003).

4.3 Proportion franchised

Regarding the OLS regression for *proportion franchised* (Table A.5, column C), the coefficient of the variable *log(number of outlets)*^{2} is negative and significant. This finding corresponds to the results of Shane (1998). The fact that the quadratic term is significant can explain the differing results in previous studies when *number of outlets* enters the regression linearly. Lafontaine (1992) and Castrogiovanni et al. (2006) find a significant negative relation between size and the proportion of franchised outlets, while Alon (2001) and Lafontaine and Shaw (1999) find the opposite. Our results suggest that the relation between the size of the franchise system and the proportion of franchised outlets is inversely U-shaped. If franchising is a means of raising funds, small but growing franchise systems will increase their proportion franchised. In contrast, franchisors of large and mature franchise systems may even start to buy back outlets from franchisees, thus decreasing the proportion franchised (see Oxenfeldt and Kelly, 1969). Hence, these findings impede to reject our hypothesis H3a.

Furthermore, the coefficient of the variable *number of countries* is highly significant with a positive sign. If a franchisor operates in more countries, he is also increasing the proportion of franchised outlets. This result is supported by the findings of Brickley and Dark (1987) who state that franchised units are usually located further away from headquarters than company-owned units. Castrogiovanni et al. (2006) find that a multinational scope of the franchisor is also positively associated with the proportion franchised. Finally, Lafontaine (1992) reports a positive relation between the number of states in which a franchisor operates and the proportion of franchised outlets. If a larger geographical dispersion leads to an increased reliance on franchising, this supports the argumentation that the franchisor uses the proportion franchised as an instrument to counter moral hazard problems. Providing agents with the right to own the outcome of their units increases their incentives to provide input, thus alleviating monitoring problems. Hence, we cannot reject our hypothesis H3b.

We find that the variable *% time not franchising* has a significant negative impact on *proportion franchised*. This variable is used for measuring the franchisor's input – in this case the input which has been put to the development of the franchise system (in contrast to ongoing franchisor input). Hence, the more input was needed to develop the system, the lower is the reliance on franchising after the business has been turned into a franchise system. Our finding corresponds to, e.g., Lafontaine (1992). She states that the proportion franchised decreases with measures of the importance of the franchisor's role. We extend this argumentation since in our opinion, the terms of the franchise contract and the contract mix are chosen to ensure ongoing input (and not initial as measured by *% time not franchising*) of both contracting parties.

Finally, we find a positive and significant coefficient for the variable *craft business* indicating a higher proportion franchised compared to the base category *retail*. This corresponds to the observation that in this sector we find the largest proportion of franchised outlets compared to the other industries in the sample (see sectoral statistics in Table A.2).

Analogously to *number of outlets*, we tested a quadratic term for the age of the franchise system (i.e., *years in business*) and its impact on the proportion of franchised outlets. However, we could not find any evidence for an inverse U-shaped relation between *years in business* and the proportion of franchised outlets.

Similar to *fixed fee 2008*, we test *proportion franchised* with the reduced form and the full specification including *royalty 2006*. The corresponding regression results for the full specification are reported in Table A.6, column E. The results are not affected by including *royalty 2006* in the regression model.

Furthermore, due to the circumstances that the dependent variable *proportion franchised* is censored and that we find a considerable number of limit observations (39 out of 123), we estimate the equations using a Tobit model as robustness check. Results can be found in Table A.7. Column F reports the Tobit results for the reduced form, column G the Tobit results for the full specification. Note that OLS and Tobit both produce almost identical results in terms of significance. Likewise, results are very similar comparing the full and reduced form specifications of OLS and Tobit models.

In the Tobit model, we find our industry dummy *education and training* having a significant positive impact on the proportion of franchised outlets. This corresponds to the fact that in the education and training sector we find the second-highest proportion of franchised outlets (see sectoral statistics in Table A.2).

Two words of caution have to be brought forward regarding the Tobit results. First, when including *royalty 2006* into the Tobit model for *proportion franchised*, we find that the coefficient for the variable *qualification of franchisee* is significant and does not show the expected sign. We suppose that the monitoring argument regarding moral hazard on the franchisee's side is the key driver for the proportion of franchised outlets while the franchisee's qualification is of less importance. Second, the McFadden Pseudo R^2 is relatively low (0.04).

Summarizing, we find support for the franchisor's capital scarcity influencing the fixed fee and the proportion of franchised outlets. Hence, our findings support the traditional conjecture that capital scarcity is one main reason for a franchisor to engage in franchising rather than expanding his system by company-owned outlets (see, e.g., Oxenfeldt and Kelly, 1969), however, only in combination with a moral hazard problem on the franchisee's side (see Lafontaine, 1992).

Franchisor moral hazard has an impact on the royalty rate. This supports theoretical considerations where the royalty rate in double moral hazard franchise relations is mainly influenced by factors being associated with the franchisor's input.

Moral hazard on the franchisee's side has an impact on the proportion franchised, but we do not find evidence for its impact on the royalty rate. At first sight, the rejection of H1b might seem counterintuitive, since we assumed the royalty rate to be a component of the contract the franchisor uses to motivate the franchisee to work diligently. However, our results on H1a and H3b indicate that the royalty rate is mainly used as an instrument to ensure the continuous input of the franchisor, while the franchisee is not motivated to exert effort by paying lower royalties, but rather by owning the outcome of his outlet. Consequently, the proportion franchised is evidently influenced by moral hazard on the franchisee's side and is the stronger instrument for the franchisor to increase incentives.

Table A.7: Tobit regression results

	Dependent variables	
	D	E
Independent variables	Proportion franchised	Proportion franchised
Log(number of outlets)	2.20	2.37
	(0.88)	(0.94)
Log(number of outlets)^2	-3.04 ***	-3.06 ***
	(-2.97)	(-2.99)
Franchisor financing	-2.76	-2.99
	(-0.35)	(-0.38)
Minimum investment	0.01	0.01
	(0.42)	(0.32)
Qualification of franchisee	-2.95	-3.02 *
	(-1.66)	(-1.69)
Number of countries	3.55 **	3.49 **
	(2.35)	(2.31)
% time not franchising	-0.34 **	-0.32 **
	(-2.36)	(-2.25)
Management support initial	3.00	2.71
	(0.78)	(0.70)
Ongoing franchisor input	-0.49	-0.31
	(-0.34)	(-0.21)
Member of DFV	2.19	2.55
	(0.32)	(0.37)
Years in business	0.02	0.02
	(0.18)	(0.15)
Royalty 2006		-0.53
		(-0.48)
Craft Business	32.07 ***	32.29 ***
	(2.65)	(2.66)
Food and beverages	4.00	4.43
	(0.50)	(0.55)
Education and training	19.79 *	22.38 *
	(1.67)	(1.71)
Other	8.45	9.53
	(1.05)	(1.14)
Constant	100.29 ***	101.50 ***
	(4.82)	(4.84)
Pseudo R^2	0.04	0.04
Prob > χ^2	0.00	0.00
Censored observations	39	39
Uncensored observations	84	84

***,**, and * indicate significance at the 1%, 5%, and 10%-level, respectively. Asymptotic t-values are given in parentheses. The variables log(number of outlets), log(number of outlets)^2, franchisor financing, and minimum investment measure the franchisor's capital scarcity. Qualification of franchisee and number of countries are indicators for franchisee moral hazard, while % time not franchising, management support initial and ongoing franchisor input are measures of the franchisor's moral hazard. Member of DFV is a risk control variable, years in business controls for the age and reputation of the franchise system. Craft business, food and beverages, education and training, and other are sector dummy variables. When entering the regression analysis together with log(number of outlets)^2, the variable log(number of outlets) was centered in order to avoid structural multicollinearity due to the quadratic term (see, e.g., Cohen et al., 2003).

5 Concluding remarks

In this paper, we empirically test hypotheses stemming from agency theory and capital scarcity considerations about the franchise contract components (fixed fee and royalty rate) as well as the organizational structure (in form of the proportion franchised) with a new dataset based on a sample of 123 German franchisors. Our analysis includes proxies for the franchisor's capital scarcity, moral hazard on the franchisee's and the franchisor's side, as well as control variables for risk, age and reputation of the franchise system, as well as for the franchisor's industry.

While descriptive statistics for our dependent variables do not significantly differ from US-based datasets, our regression analysis yields some new and interesting results for the German franchise sector. By investigating German franchisors and taking the number of countries in which they operate as a measure for geographical dispersion, we are able to analyze inter-country effects as opposed to inter-state effects in US-based studies. We further distinguish between initial and ongoing support provided by the franchisor. We expect the royalty rate to be the compensation for ongoing franchisor input, but not for initial input.

Our findings confirm the argumentation that capital scarcity is a factor for a franchisor to choose franchising instead of company-owned outlets. A higher capital scarcity thus increases the proportion of franchised outlets and the fixed fee paid at the beginning of the contractual relation. With respect to agency considerations, our results support arguments based on double moral hazard. Franchisor moral hazard impacts the royalty rate, while franchisee moral hazard does not. Instead, franchisee moral hazard has an influence on the proportion of franchised outlets. This suggests that of the two instruments the franchisor has on hand to manage incentives in his franchise system, increasing the proportion franchised is the stronger one, while the royalty rate mainly serves as a means to ensure ongoing input on the franchisor's side. This also coincides with the argument found in the literature on franchising that a franchisee is generally more motivated than a manager.

Our findings have several implications. First, the capital scarcity argument established by Oxenfeldt and Kelly (1969) seems to be valid for the German franchise sector as well. A comparison of descriptive statistics of the variable *minimum investment* with the comparable variable *capital required* in Lafontaine (1992) further suggests that our sample is not very different in terms of the capital intensity of the franchisors' businesses.

Second, the level of the royalty rate does not seem to serve as an instrument for the franchisor to provide incentives to franchisees. In contrast, it is used to ensure ongoing franchisor input. Since the franchisor is the one who decides on the contract terms, this result seems counterintuitive at first sight, as he offers take-it-or-leave-it contracts to potential franchisees and does not negotiate on the contract terms. However, with a high royalty rate, the franchisor commits himself to contributing to the success of the franchise system, thus signaling credible commitment to franchisees.

Third, we do not find a negative correlation between the royalty rate and the fixed fee, which is an argument on which hypotheses in previous studies have been based (see, e.g., Lafontaine, 1992). This suggests, on the one hand, that hypotheses should be formulated without relying on a negative correlation of fees and royalties, because it is not supported empirically. On the other hand, this suggests an alternative explanation for the relation of the two contract terms. One reason might be that attractive franchisors can charge franchisees higher fixed fees and higher royalty rates ignoring any incentive considerations. Our finding with respect to *log(number of outlets)* positively influencing the *royalty 2008* provides some support for this argument. Hence, royalty rate and fixed fee do not work as substitutes, but rather as complementary elements. It also follows that, ceteris paribus, the participation constraint for franchisees is not binding, opposed to the argumentation found in previous literature.

Our analysis suggests some interesting directions for future research. First, it might be of interest to see whether the contract conditions of a single franchisor change over time. The data on *royalty 2008* and *royalty 2006* suggest that on average, the contract conditions did not change considerably over these two years. However, a closer look at the data reveals that about 20 percent of the franchisors in our dataset changed their royalty rates from 2006 to 2008.

Second, it seems quite surprising that franchisors use linear contract schemes for their franchisees, because existing work on agency theory regularly criticizes the rather stringent assumption of linear contracts in agency models. Hence, it might be informative to ask franchisors for their reasons (except for simplicity) of choosing a linear contract against the background of the formulated weaknesses.

Finally, franchisors offer their contracts as take-it-or-leave-it offers to all potential franchisees. Hence, they do not distinguish between the franchisees' preferences. On the one hand, this is detrimental because it leads to inefficient contracts. On the other hand, the costs of designing individual contracts might exceed the loss incurred by non-efficient identical contracts. This cost-benefit relation thus requires some further investigation.

The explanation of the contract design in franchising and the franchisor's decision about the contract mix still demands more research. Looking at panel data on franchisors could provide more insights on how franchisors decide on contracts terms and contract mix and how relations evolve over time, e.g., how franchise systems react to shocks such as an economic crisis.

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Essay B:

Stock Price Reaction to Supervisory Board Interventions: Empirical Evidence from Germany

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1 Introduction

Since the turn of the century, the discussion about the efficiency of different corporate governance systems around the world has been spurred by scandals of big corporations in many countries. Within this context, supervisory boards as internal controlling bodies have been subject to particular scrutiny because of accusations claiming they are not fulfilling their controlling obligations (see Köhler, 2010).

While several studies focus on this issue by investigating the intervening actions (see Vetter and Weber, 2012; Grothe, 2006; Vogel, 1980; Pelke, 1972) used by supervisory boards to control the management, it remains unclear how stock prices react to these interventions. For example, previous empirical studies provide mixed evidence for the stock price reaction to forced executive turnover (see for an overview Cools and van Praag, 2007 and section 2.2). Theoretical considerations by Hermalin and

Weisbach (1998) offer an explanation for these inconsistent findings as they suggest that the stock price reaction depends on whether the information for the board's decisions is private or public.

With our study we are among the first to empirically test these propositions by Hermalin and Weisbach (1998)[1] by addressing the following questions: What information is contained in news about intervention activities of the supervisory board for the stock market? Do the observed effects vary for different groups of companies depending on the amount of information available to the public? To answer these questions, we examine the news about intervention activities of supervisory boards of German listed companies in the indices DAX, MDAX, SDAX and TecDAX within the time period of 2000 to 2006 and analyze the stock price reaction to these interventions. On the basis of the number of relevant news items for each company in the Frankfurter Allgemeine Zeitung (FAZ), one of Germany's major newspapers, we use the media coverage of the firms to measure the information available to the public. Applying standard event study methodology we are able to test hypotheses derived from Hermalin and Weisbach (1998).

The main contribution of this paper is to empirically test two (related) propositions of Hermalin and Weisbach (1998) regarding the stock market reaction to dismissals of CEOs. In order to do so, we proxy for the information available to the public by measuring the media coverage of the respective firms. While the number of news items is well established as a measure of media coverage (see Fang and Peress, 2009), we propose this figure as a proxy for the amount of information available to the public. The results of our empirical analysis are in line with the predictions of Hermalin and Weisbach (1998). Furthermore, our results contribute to the explanation of inconsistent findings in previous studies examining the effect of forced top executive departures on firm value. Last but not least, we contribute to the research on corporate governance and the ongoing discussion with our analysis in different ways: We present recent empirical evidence on supervisory board interventions in Germany. Moreover, we do not only analyze forced top executive departures but look at the whole legally provided range of intervention measures of which dismissals of top executives are only one part of.

1 To the knowledge of the authors, only Höppe and Moers (2008) test the same propositions so far. However, their approach is different since their study is mainly based on bonus contract information.

In more detail, our results show that news about intervention activities by the supervisory board contains relevant information for the capital market. Consequently, it has significant effects on stock prices. Moreover, these effects vary for groups of companies with different levels of media coverage: We observe insignificant abnormal returns around the time of intervention for companies with high media coverage.[2] However, when cumulated over several days, including the days preceding the date of intervention, abnormal returns for high media coverage companies are positive and statistically significant. When looking at companies with low media coverage, we find a negative and significant stock price reaction to interventions indicating that the information effect (bad news about management performance) outweighs the real effect (good news about the board) which we attribute to lower media coverage on (management) performance before the intervention. For companies with low media coverage, we also observe stronger negative reactions to more severe measures of interventions relative to weaker measures and stronger negative reactions to dismissals of CEOs compared to dismissals of other members of management; however, the differences in the means of these sub-groups are not statistically significant. Our results prove to be robust when including variables controlling for company characteristics (especially size) in multivariate regressions.

The remainder of this paper proceeds as follows: Section 2 takes a look at the regulatory framework of supervisory boards and reviews prior literature. The theoretical background for our analysis is provided in section 3 before section 4 presents the empirical analysis including the results. Section 5 concludes.

2 Regulatory framework and literature review

2.1 Duties, responsibilities and possibilities of intervention of the supervisory board

The main characteristic of the German corporate governance system is the division between the management as executive body and the supervisory board as controlling

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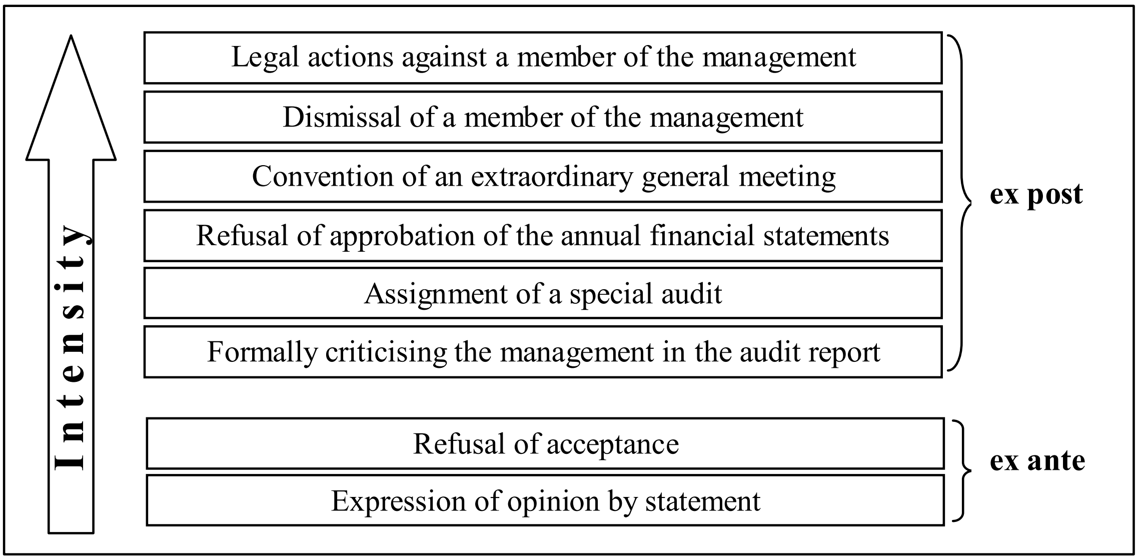
[2] Note that inconclusive results might be due to two competing effects (positive real effect and opposing information effect (see Warner et al., 1988, p. 466 and Cools and van Praag, 2007, p. 725). The positive real effect results from the boards monitoring (good information about the board), the opposing information effect occurs due to negative news about firm performance (bad news about the management).

body (see Bleicher et al., 1989, p. 44; Schmidt et al., 2002, p. 31). While, according to national law, the management conducts all business on it's own authority, the supervisor board has the duty to monitor the management. Simultaneous affiliations to both, the management and the supervisory board are strictly prohibited to avoid possible conflicts of interest and to ensure the independence of members of the supervisory board. Beside the task of monitoring the management, the supervisory board also has the duty of appointing, reappointing and withdrawing members of the management and is in charge of designing their employment contracts.

As controlling body, the power of the supervisory board heavily depends on the extent of possibilities to take corrective action against the company's management. In order to do so, the supervisory board has a set of interventions of gradually increasing intensity at hand which enable it to exert influence on the management with different degrees of power. Figure B.1 outlines the existing legitimate possibilities of intervention based on the categorization of Vetter and Weber (2012) following Vogel (1980) and Westerburg (2002). They are categorized by their intensity and by the time of intervention relative to the disputed issue (ex ante or ex post). The first *ex ante* possibility of action, the *expression of opinion by statement* to the management, applies to all facts that have to be reported to the supervisory board by the management and are thus subject to the audit of the supervisory board (see sec. 90 AktG).

Figure B.1: Legal possibilities of supervisory board intervention by intensity[3]



[3] Based on the illustration of Vetter and Weber (2012) following Vogel (1980) and Westerburg (2002).

The supervisory board reports its views to the management in form of a statement after auditing; the management, however, is not obliged to obey the expressed comments. The supervisory board's second ex ante possibility of action is the right to *submit certain kinds of affairs to its approbation* (see sec. 111 subs. 4 sent. 2 AktG) and thereby limits the autonomous authority of the management to act. This right strengthens the supervisory board's position against the management enormously since it allows an early exercise of influence on the business policy.

Within the context of *ex post* control, the mildest measure of intervention by the supervisory board is *formally criticizing the management in its audit report* at the annual general meeting (see sec. 171 subs. 2 AktG). This possibility allows the board to inform the stockholders about problems in the management at an early stage. In case it questions the legality of the management's actions, the supervisory board can furthermore *assign a special audit* to let already completed business transactions be re-assessed (see sec. 142 subs. 1 AktG). Therewith, the controlling body expresses clearly its distrust against the management. The *refusal of approbation of the annual financial statements* is another possibility of imposing an ex post sanction against the management (see sec. 171 subs. 2 AktG). In case the members of the supervisory board have objections against the management's decisions concerning accounting policies, the supervisory board can refuse its acceptance of the annual statement and thereby defer the decision to the annual general meeting (see sec. 173 subs. 1 AktG). Another measure of ex post intervention is *convening an extraordinary general meeting*. The supervisory board is obliged to apply this measure when the well-being of the company renders this necessary (see sec. 111 subs. 3 sent. 1 AktG). The stockholders are informed about possible failures of the management and can hereupon deprive the management of its trust at an early stage. With this action, the stock holders can give the supervisory board an important reason for the dismissal of one or more members of the management according to sec. 84 subs. 3 sent. 2 AktG (see Lutter and Krieger, 2002, p. 49).

Aside from legal actions for damages, the *dismissal of one or more members of the management* is the strongest instrument of sanction for malpractice. An important reason must be on hand which according to sec. 84 subs. 3 sent. 2 AktG must consist of a serious violation of obligations (e.g., by damaging the company), the inability of proper management (e.g., because of missing qualifications) or the withdrawal of confidence for an important cause by the general meeting (see Lutter and Krieger, 2002, p. 146 et seq.). Insurmountable differences concerning the business policy of the company between the two bodies can furthermore be a reason for dismissal (see Lutter and Krieger, 2002, p. 146 et seq.). Finally, the supervisory board can *take legal actions against a member of the management* after its dismissal and sue it for damages because of neglect of duty (see sec. 93 subs. 2 AktG).[4]

2.2 Related literature

In a wider context, there are several recent studies providing support for the value relevance of corporate governance mechanisms (see Bebchuk et al., 2009; Lehn et al., 2007; Cremers and Nair, 2005; Klock et. al., 2005; Drobetz et al., 2004; Gompers et al., 2003). With special attention to the role of the media, Carretta et al. (2011) focus on the impact of different corporate governance news items on stock returns. Yet, the more specific question of how capital markets react to news about different kinds of supervisory board interventions has not been addressed so far.

Other studies in the field of corporate governance are closely related to our work as they concentrate on the board and its controlling function. While empirical work on control activities of supervisory boards in Germany is rather descriptive (see Vetter and Weber, 2012; Grothe, 2006; Köhler, 2005; Vogel, 1980; Pelke, 1972), previous international studies more specifically analyze the relation between stock market returns and control activities of boards of directors. These international studies, however, mostly focus on the dismissals of CEOs or other members of the management and, thus, only on one kind of intervention. Related work on dismissals of top executives can be classified into three groups: The first group deals with the question if CEO dismissals follow bad company performance. These studies find that more dismissals follow bad performance which supports the supposition of an effective control by the supervisory board (dualistic system) or the board of directors (monistic system) (see, e.g., Jenter and Kanaan, 2010; Kaplan and Minton, 2012). The second group analyzes the effects which dismissals of CEOs and members of the management have on the long-term performance of companies. These studies arrive at mixed results (see, e.g., Denis and Denis, 1995; Murphy and Zimmermann, 1993). The third and for our analysis most

[4] The supervisory board represents the company against the management in this case (see sec. 112 AktG).

relevant group of studies analyzes how the stock market responds to news about dismissals of CEOs or members of the management. They all use event study methodology in order to investigate stock price reactions. Cools and van Praag (2007) additionally study volumes of trade. So far, companies within the US, UK, France, the Netherlands and Japan have been subject to research (see, e.g., Cools and van Praag, 2007; Jenter and Kanaan, 2010). The results of these studies are mixed and shall therefore be presented in more detail: Several authors find evidence for a significant positive stock price reaction to the announcement of forced departures of executives or CEOs. Furtado and Rozeff (1987) and Denis and Denis (1995) observe this effect in the US for forced departures of top executives, Weisbach (1988) and Huson et al. (2001) for CEOs. Kang and Shivdasani (1996) confirm this result for CEOs in Japan. Other studies find no significant effect such as Warner et al. (1988) looking at top executives in the US, Dherment-Ferere and Renneboog (2002) studying CEO turnover in France and Danisevska et al. (2003) analyzing top executives and CEOs in the Netherlands. Significant negative stock price reactions are observed by Mahajan and Lummer (1993) for top executives in the US and by Dedman and Lin (2002) for British CEOs.

One explanation for these inconsistent empirical results is offered by Hermalin and Weisbach (1998, p. 110). In their formal model, they present two propositions (among others) which we will test within this paper. The two propositions from the model are discussed in more detail in the following section.

3 Theoretical background and development of hypotheses

Theoretical basis for our analysis is a formal model by Hermalin and Weisbach (1998) which explains the board selection process as a bargaining game between the CEO and the board of directors. In their model, Hermalin and Weisbach (1998) derive several propositions on board monitoring and CEO turnover. In our study, we focus on two propositions of Hermalin and Weisbach (1998) which state that a firm’s stock price falls if the CEO is fired on the basis of the board’s private information and rises if the CEO is fired on the basis of public information. While Hermalin and Weisbach (1998) arrive at these propositions analytically, there is also a very intuitive explanation to them. Due to the fact that the market will react only to new information conveyed by the news about the dismissal of a CEO, two scenarios with different implications for the reaction of the stock price can be distinguished: 1. If the market is not completely informed about the performance of the management, and the supervisory board's decision is based on information not available to the public (i.e., private information), we expect a negative stock price reaction. In this case news about the supervisory board's decision contains not only information about the supervisory board's action itself, but is likely to include additional information about the reason why the CEO was fired (such as poor CEO performance, which was revealed to the public by the supervisory board's action), thus triggering a negative stock price reaction. 2. If the market is completely informed about the performance of the management (i.e., all information is available to the public), and based on this information the supervisory board decides to dismiss the CEO, we expect a positive stock price reaction. In this case the supervisory board's action contains no news about the (bad) performance of the CEO, but good news about the supervisory board in the sense that it is acting in the shareholders' best interest.

In the following, this model is conveyed to our more general approach. As mentioned before, we look at all possible intervention activities by supervisory boards. The dismissal of the CEO or any other member of the management is in this context only one kind of possible intervention (as presented in section 2.1). The propositions by Hermalin and Weisbach (1998) are therefore generalized in the way that their idea is applied to all kinds of supervisory board interventions.

In order to be able to empirically test hypotheses geared towards the two propositions of Hermalin and Weisbach (1998), we look at companies with different levels of media coverage. If there is high media coverage on a company, the information advantage of supervisory boards over the public should be smaller because the public is relatively well informed. If media coverage is scarce, the public is consequently only poorly informed compared to the supervisory board. In combination with the arguments proposed by Hermalin and Weisbach (1998), this yields hypotheses 1a and 1b:

Hypothesis 1a The stock price reaction to intervention activities of the supervisory board is negative for companies with low media coverage.

In the case of companies with low media coverage, intervention activities are (to a considerable extent) based on information that is only available to the supervisory board. Therefore, the news about supervisory board's action does not only convey information about the intervention itself, but also contains some information about the reasons for this decision which were not known before. As a result, the stock price reaction to these interventions should be negative since they (also) reveal mismanagement to the market. Applying the same line of argumentation to companies with high media coverage yields:

Hypothesis 1b The stock price reaction to intervention activities of the supervisory board is positive for companies with high media coverage.

In this case the public is assumed to be completely informed about the (under-) performance of the company and its management. The supervisory board's intervention conveys no news about the management's performance, but solely about the supervisory board itself. The supervisory board is actively controlling the management, thus showing it is acting independently and fulfilling its legal obligations diligently.

As discussed in section 2.1, the supervisory board has a set of possible interventions at hand which can be applied depending on the circumstances in a given situation. The possible means of intervention can thereby be sorted by their intensity (see Figure B.1). Since the impact of a more severe intervention of the supervisory board is larger, it should cause a stronger market reaction. Depending on the level of media coverage (high or low) the market reaction is expected to be positive or negative. This yields:

Hypothesis 2 The stock price reaction is stronger, the more severe the supervisory board's intervention.

Members of management have different competencies and responsibilities. Especially the CEO of a company has a larger influence on the business policy, the long term strategy and major decisions. Thus, the dismissal of a CEO should have a stronger impact on the company and should result in a stronger stock price reaction than the dismissal of any other member of management. Again, the expected sign of the market's reaction depends on the level of media coverage. This yields:

Hypothesis 3 The stock price reaction is stronger if the dismissed member of the management is the CEO.

4 Empirical analysis of the stock price reaction to supervisory board interventions

4.1 Data description

For our analysis, we collect information about supervisory board activities of companies listed in one of the German stock exchange indices DAX, MDAX, SDAX or TecDAX[5] at the time of intervention. Sources for our data are all issues of one of Germany's major newspaper, the FAZ[6], ad hoc announcements[7] and corporate press releases which were published within the time period of January 1st, 2000 to December 31st, 2006.[8] All ad hoc announcement and corporate press releases, which we use for our analysis, originate from the database of the Deutsche Gesellschaft für Ad-hoc-Publizität (DGAP)[9]. Our final sample consists of 74 interventions by the supervisory boards of 43 different companies.

According to the classification in section 2.1, these interventions are distributed among the different categories of intensity as shown in Figure B.2. Note that in one news item the dismissal of a member of management after the completion of a special audit was

5 The DAX reflects the segment of blue chips admitted to the Prime Standard Segment and comprises the 30 largest and most actively traded companies that are listed on the FWB® Frankfurter Wertpapierbörse (the Frankfurt Stock Exchange). The index portfolio of the MDAX comprises 50 mid-cap issues from traditional sectors which, in terms of size and turnover, rank below the DAX. These companies are also selected from the continuously traded companies in the Prime Standard Segment. The SDAX comprises the next 50 issues from the traditional sectors within the Prime Standard Segment that are ranked below the MDAX. The TecDAX tracks the 30 largest and most liquid issues from the various technology sectors of the Prime Standard Segment beneath the DAX (see Deutsche Börse, 2009).

6 The full text archive of the FAZ is also used in other empirical studies using event study methodology (see, e.g., Langmann, 2007).

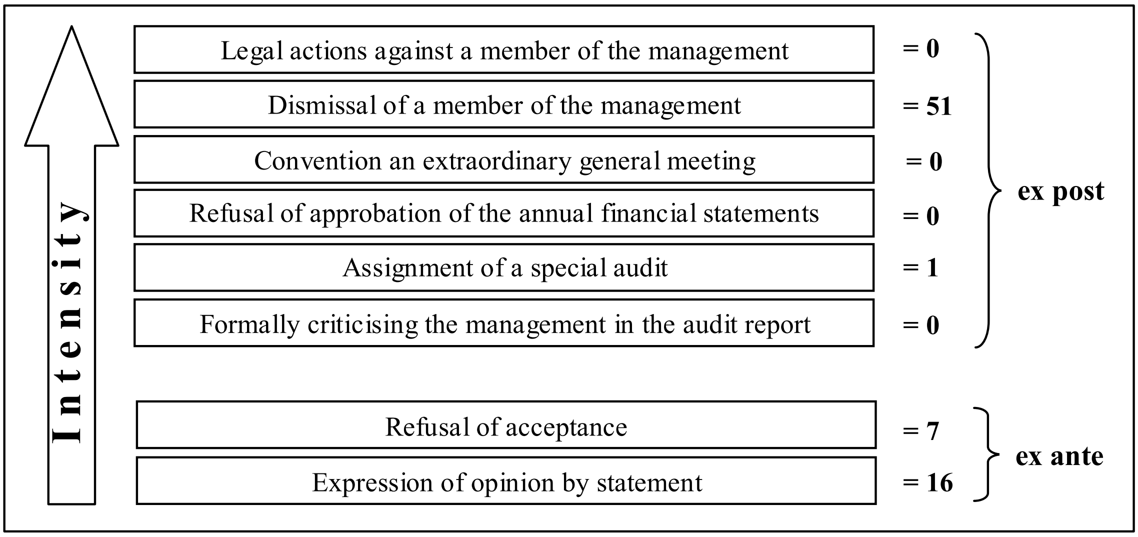
7 On January 1st 1995, the second Financial Market Development Act and readjustments of sec. 15 WpHG came into effect. Ever since, emitters of shares traded at any German stock exchange are obliged to announce facts not publicly known, which could influence the stock price, to the Federal Financial Supervisory Authority and to publish them immediately to prevent insider trading (see Röder, 2000, p. 568).

8 Due to the three different sources, multiple announcement dates of one event are possible. In this case, the announcement with the earliest date is included in our analysis.

9 The Deutsche Gesellschaft für Ad-hoc-Publizität (DGAP) is an institution which facilitates the compliance of disclosure requirements. In 2006, the providers Deutsche Börse AG, Reuters AG and vwd aligned with each other and took over the publication of ad hoc announcements, corporate press releases and other news for traded companies (see DGAP, 2009).

announced. Since this event falls into two categories the sum over all events in Figure B.2 adds up to 75.

Figure B.2: Observed number of supervisory board interventions by intensity[10]



According to our data, supervisory boards made use of the weaker *ex-ante* measures of intervention in 23 cases. Of these, 16 interventions are identified as expressions of opinion by statement while seven fall into the category of a refusal of acceptance. By comparison, the supervisory boards used more frequently (in total 52 times) ex-post measures of intervention. In 51 cases they applied the second strongest measure, namely the dismissal of a member of the management. Only in one case a supervisory board assigned a special audit. To all other measures of intervention, no activities by the supervisory boards were found.

A reliable proxy for the level of media coverage on the companies in our sample is crucial for our analysis. We use the number of newspaper articles on a company to proxy for the company's overall media coverage.[11] For this purpose we refer to the electronic database of the FAZ, one of Germany's leading newspapers. In this database company labels are applied to all news items relevant to a specific company. This feature allows for searching all news items with firm-specific information about a

[10] Based on the illustration of Vetter and Weber (2012) following Vogel (1980) and Westerburg (2002).

[11] The number of newspaper articles as a proxy for media coverage is also used in other studies (see, e.g., Fang and Peress, 2009).

particular company over a certain period of time.[12] By using this specific search option we identify and count all news items with relevant information for all companies included in our dataset. Sorting the companies by the number of news items identified and splitting the 43 companies at the median in two groups yields a group of 21 companies with high media coverage and a group of 21 companies with low media coverage (adding up to 42 companies plus the median company and 73 interventions plus the intervention of the median company).[13]

Table B.1 shows the number of news items found for the companies in each group within the time period of January 1st, 2000 to December 31st, 2006. On average, we find 512 news items per company for the 42 companies included in the analysis. More specifically, there are on average 889 news items for each company in the group of companies with high media coverage and 135 news items in the group of low media coverage companies.

Table B.1: Number of relevant news items for the different groups of media coverage

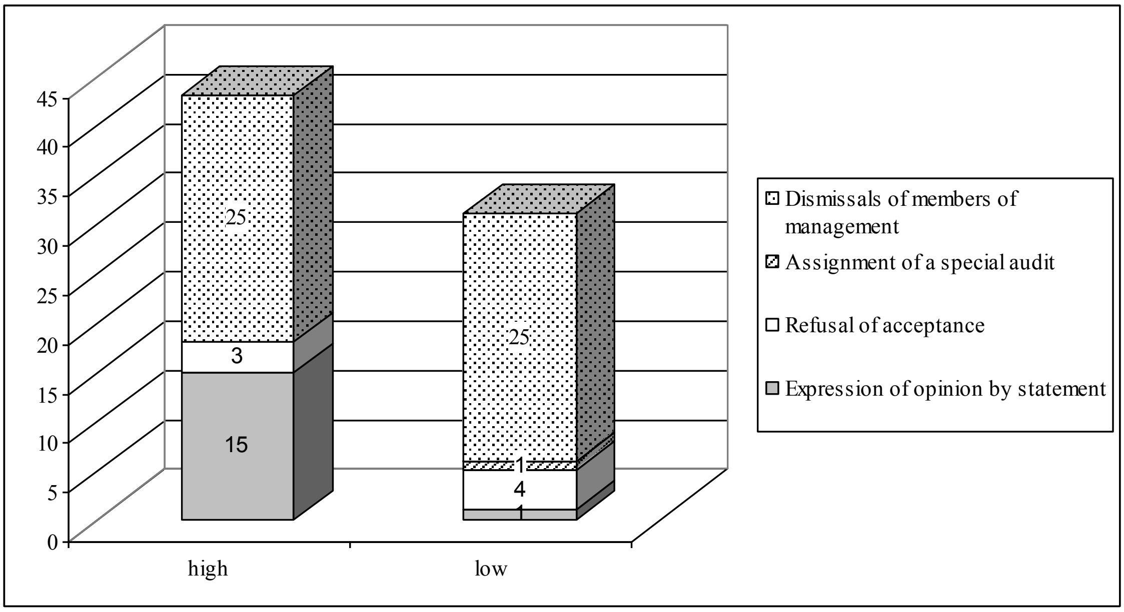
Group of companies with different levels of media coverage	FAZ reports	Ad hoc announcements	Corporate press releases	Sum	# of companies in sample	# of news items per company
high	17,909	699	68	18,676	21	889
low	2,085	592	165	2,842	21	135
Sum/Average	19,994	1,291	233	21,518	42	512

Figure B.3 apportions the intervening activities according to the two groups of different levels of media coverage. The supervisory boards of companies with high media coverage used their legal power to intervene in 43 cases. Thereof, 25 times they dismissed a member of the management, in three cases they refused their acceptance and 15 times they expressed their opinion by statement. The dismissals apply to 11 CEOs and 14 other members of the management. For the controlling bodies of the 21 companies with low media coverage, 31 intervening activities were found which consist of one expression of opinion by statement, four refusals of acceptance, one assigned special audit and dismissals of nine CEOs and 16 other members of the management.

12 Simply counting the occurrences of the companies' names in all newspaper articles yields a very similar picture; however, this approach is not without problems, since some of the companies' names are regular German words (e.g., Allianz or Premiere).

13 Alternative classifications of the companies according to their media coverage were applied as a robustness check leading to qualitatively identical results.

Figure B.3: Supervisory board interventions for groups of companies by media coverage



In sum, we find generally more interventions and in particular more ex ante interventions for companies with high media coverage than for companies with low media coverage, while the amount of dismissals is the same for both groups. A possible explanation is that supervisory boards of high media coverage companies are more active than supervisory boards of companies with low media coverage, especially in intervening with weaker measures. However, in some cases the newspaper editorial department may decide not to publish milder forms of intervention of less known companies because they might not be considered important enough. In addition, the small number of observed expressions of opinion by statement for companies with low media coverage could indicate that in smaller companies more expressions of opinion are communicated informally and are, therefore, not visible to media and public.

In order to control for several company characteristics (in particular size), a set of variables is included in the multivariate regression models used in the empirical analysis (see section 4.4). Summary statistics for these variables are presented in Table B.2. The company characteristics are displayed for the overall sample of supervisory board interventions as well as for supervisory board interventions in high media coverage companies and low media coverage companies respectively.

Table B.2: Company characteristics for the events in the sample

	N	Mean	Median	Min	Max
All companies					
Total assets (in bn. €)	73	83.16	6.14	0.12	903.51
Market value (in bn. €)	74	12.69	2.32	0.06	81.44
Employees	73	88,352	15,526	408	466,938
Price to book value	73	2.05	1.65	0.54	5.46
Beta	74	0.71	0.64	-0.25	2.23
Financial services	74	0.18	0.00	0.00	1.00
Companies with high media coverage					
Total assets (in bn. €)	42	143.23	33.09	1.18	903.51
Market value (in bn. €)	43	21.27	9.15	0.54	81.44
Employees	42	146,429	96,751	1,392	466,938
Price to book value	42	1.84	1.52	0.54	4.17
Beta	43	0.84	0.91	-0.03	2.23
Financial services	43	0.23	0.00	0.00	1.00
Companies with low media coverage					
Total assets (in bn. €)	30	1.63	1.01	0.12	12.62
Market value (in bn. €)	30	0.77	0.52	0.06	6.17
Employees	30	8,931	5,088	408	47,126
Price to book value	30	2.38	2.25	0.78	5.46
Beta	30	0.53	0.47	-0.25	1.47
Financial services	30	0.10	0.00	0.00	1.00

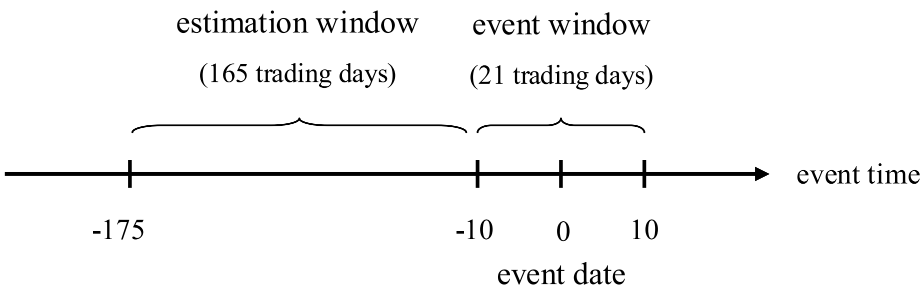
Total assets (in bn. Euro), market value (in bn. Euro) and employees are as of December 31st of the year preceding the event date and are proxies for company size. Price to book value accounts for the value vs. growth characteristics of firms. Beta measures the companies' systematic risk. Financial services is an industry dummy for banks and other firms in the financial industry (one if yes, zero otherwise). Total assets, employees and price to book value are available for all but one observation. The number of observations for the subsamples does not add up to the total as the observation with the median level of media coverage is not included.

4.2 Event study methodology

To analyze the effect of supervisory board interventions on stock prices, we apply standard event study methodology (as discussed by MacKinlay, 1997). This technique is based on the work of Ball and Brown (1968) studying the reaction of stock prices to unexpected earnings announcements and Fama et al. (1969) analyzing the stock market reaction to the announcement of stock splits. In an event study, the effect of new information on stock prices is measured by calculating abnormal returns (AR) around the announcement date of the event under investigation.

To calculate abnormal returns around the announcement date of supervisory board interventions, the calendar dates of all interventions $j = 1, \ldots, N$ have to be converted to event time. Therefore, the day of the announcement of the supervisory board's intervention is defined as day [0], i.e., the event date. Abnormal returns are calculated on a daily basis by subtracting expected returns from actual returns. While actual or realized returns can be calculated directly from the stock market data[14] of Thomson Reuters Datastream, we estimate expected returns using the market model (see Brown and Warner, 1985). The market model estimates the expected return of a stock by determining the historic relation between the stock and the market using ordinary least squares (OLS). The resulting regression parameters are α (a constant) and β (a measure of the stock's responsiveness to changes in the market return). We choose the CDAX, which encompasses all German securities across Prime and General standard, as our market index and an estimation period of 165 days from day [-175] to day [-11] preceding the event day. Thus, in our particular case, the time line for the event study is as follows:

Figure B.4: Time line of event study



The parameters of the market model are obtained from the stock market data on the securities and the market index in the estimation period by OLS. Using the market model to estimate the expected return, the abnormal returns for each event is

$$AR_{jt} = R_{jt} - \hat{\alpha}_j - \hat{\beta}_j R_{mt} \quad (1)$$

where R_{jt} is the return of the affected company of event *j* on day *t* and R_{mt} is the CDAX return on day *t*. The coefficients $\hat{\alpha}_j$ and $\hat{\beta}_j$ are the OLS estimates of the parameters of the market model.

Abnormal returns are aggregated over events by computing average abnormal returns across all events at day *t* in the event period as follows:

$$AR_t = \frac{1}{N} \sum_{j=1}^{N} AR_{jt} \quad (2)$$

[14] Here, the Total Return Index, which is adjusted for dividends and stock splits, was used.

In order to aggregate abnormal returns through time, cumulative abnormal returns (CAR) are calculated over time periods of two or more trading days beginning with day t_1 and ending with day t_2:

$$CAR_{t_1,t_2} = \sum_{t=t_1}^{t_2} AR_t \tag{3}$$

To test for statistical significance of the (cumulative) abnormal returns, we apply the traditional t-test as surveyed by Brown and Warner (1985). The sample variance measure $\sigma^2_{\varepsilon_i}$ from the market model regression in the estimation window is used as an estimator to calculate the variance of the abnormal returns:

$$\hat{\sigma}^2(AR_t) = \frac{1}{N^2}\sum_{j=1}^{N} \hat{\sigma}^2_{\varepsilon_j} \tag{4}$$

The variance of the cumulative abnormal returns is obtained by summing up the variances of the abnormal returns starting from day t_1 to day t_2:

$$\hat{\sigma}^2(CAR_{t_1,t_2}) = \sum_{t=t_1}^{t_2} \hat{\sigma}^2(AR_t) \tag{5}$$

The null hypothesis to be tested is that stock prices do not respond to the announcement of supervisory board interventions. Assuming that abnormal returns are independent, identically distributed, and normal, the test statistic is distributed student-t under the null hypothesis. The test statistic for the t-test performed on the average abnormal returns is:

$$t = \frac{AR_t}{\hat{\sigma}(AR_t)} \tag{6}$$

Similarly, the test statistic for the cumulative abnormal returns is given by:

$$t = \frac{CAR_{t_1,t_2}}{\hat{\sigma}(CAR_{t_1,t_2})} \tag{7}$$

4.3 Discussion of results

The following section presents the results of the empirical analysis of the stock market reaction to supervisory board interventions. Since our hypotheses differ for companies with high media coverage on the one hand and companies with low media coverage on the other, the following tables and figures display the results for both groups respectively.

Table B.3 presents the abnormal and cumulative abnormal returns with the corresponding levels of significance for the overall sample of supervisory board interventions over the window [-10;+10] around the event day. The displayed cumulative abnormal returns of Table B.3 are illustrated graphically in Figure B.5.

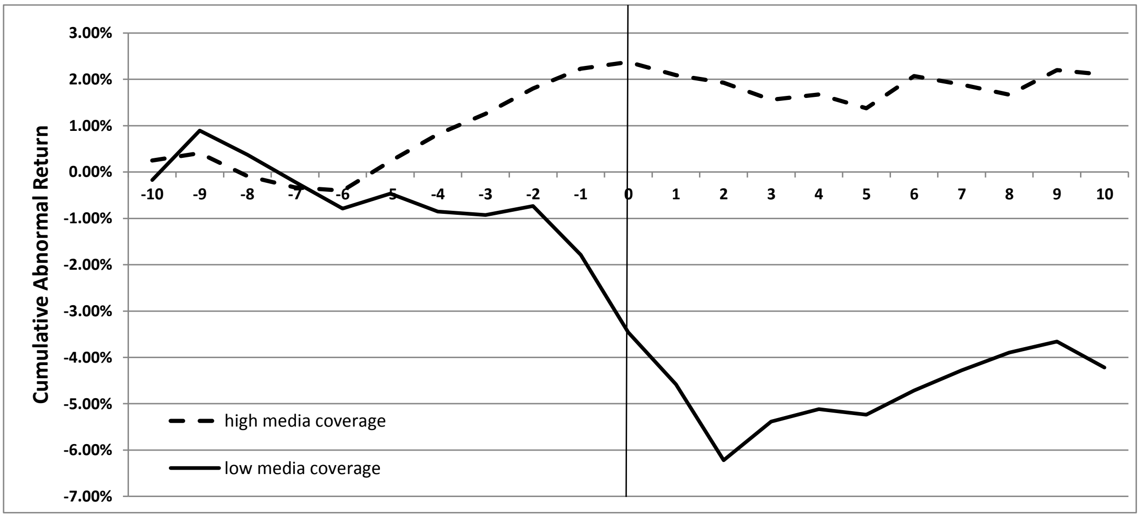
Table B.3: Abnormal (AR) and cumulative abnormal returns (CAR) for all supervisory board interventions and companies with different levels of media coverage

Companies with high media coverage							Companies with low media coverage						
Event Day	AR_t	t-stat		$CAR_{-10,t}$	t-stat		Event Day	AR_t	t-stat		$CAR_{-10,t}$	t-stat	
-10	0.25%	0.72		0.25%	0.72		-10	-0.17%	-0.38		-0.17%	-0.49	
-9	0.16%	0.45		0.41%	0.83		-9	1.07%	2.34	**	0.89%	1.82	*
-8	-0.50%	-1.43		-0.09%	-0.15		-8	-0.52%	-1.15		0.37%	0.62	
-7	-0.24%	-0.70		-0.33%	-0.48		-7	-0.58%	-1.28		-0.21%	-0.30	
-6	-0.07%	-0.20		-0.40%	-0.52		-6	-0.58%	-1.26		-0.79%	-1.02	
-5	0.63%	1.83	*	0.23%	0.27		-5	0.32%	0.71		-0.46%	-0.55	
-4	0.58%	1.68	*	0.82%	0.89		-4	-0.39%	-0.86		-0.85%	-0.93	
-3	0.44%	1.27		1.25%	1.28		-3	-0.07%	-0.15		-0.93%	-0.94	
-2	0.55%	1.59		1.80%	1.74	*	-2	0.19%	0.42		-0.73%	-0.71	
-1	0.43%	1.24		2.23%	2.04	**	-1	-1.05%	-2.32	**	-1.79%	-1.63	
0	0.14%	0.41		2.38%	2.07	**	0	-1.67%	-3.67	***	-3.46%	-3.01	***
1	-0.29%	-0.83		2.09%	1.74	*	1	-1.12%	-2.46	**	-4.58%	-3.82	***
2	-0.16%	-0.47		1.93%	1.54		2	-1.64%	-3.60	***	-6.22%	-4.98	***
3	-0.37%	-1.06		1.56%	1.20		3	0.83%	1.83	*	-5.38%	-4.15	***
4	0.11%	0.32		1.67%	1.25		4	0.27%	0.59		-5.12%	-3.81	***
5	-0.29%	-0.85		1.38%	0.99		5	-0.12%	-0.26		-5.23%	-3.78	***
6	0.69%	1.99		2.07%	1.45		6	0.52%	1.14		-4.72%	-3.30	***
7	-0.18%	-0.52		1.89%	1.29		7	0.44%	0.97		-4.28%	-2.91	***
8	-0.22%	-0.63		1.67%	1.11		8	0.38%	0.84		-3.89%	-2.58	**
9	0.53%	1.53		2.20%	1.42		9	0.24%	0.52		-3.66%	-2.36	**
10	-0.10%	-0.29		2.10%	1.32		10	-0.56%	-1.23		-4.22%	-2.66	**

This table shows abnormal returns (AR_t) and cumulative abnormal returns ($CAR_{-10,t}$) for the event period [-10;+10]. To test for statistical significance t-statistics based on Brown and Warner (1985) are displayed next to the (cumulative) abnormal returns. ***/**/* indicate significance at the 1%-/5%-/10%-level (two-tailed test).

As can be seen in Table B.3, (cumulative) abnormal returns of interventions in high and low media coverage companies differ remarkably over the time around the event day. Daily abnormal returns for the group of interventions in companies with low media coverage are significantly negative during the [-1;+2] period around the event day. Due to this strong stock market reaction, cumulative abnormal returns are also statistically significant negative from the event day on. In contrast, abnormal returns for the group of interventions in companies with high media coverage are positive on and prior to the event date, even though mostly not significant. However, cumulative abnormal returns are statistically significant for certain time periods around the event day. Figure B.5 illustrates the results from Table B.3 graphically.

Figure B.5: Cumulative abnormal returns (CAR) for all supervisory board interventions and companies with different levels of media coverage



This figure plots cumulative abnormal returns for all supervisory interventions of companies with different levels of media coverage. The CAR of day [t] equals the sum of ARs from trading day [-10] to [t].

Table B.4 shows (cumulative) abnormal returns with the corresponding levels of significance for different types of interventions and different event windows. According to our main hypotheses, we expect a negative stock price reaction to supervisory board interventions for firms with low media coverage (hypothesis 1a) and a positive stock price reaction to supervisory board interventions for companies with high media coverage (hypothesis 1b). Examining the results for companies with low media coverage, we find a negative and highly significant AR on the event day (-1.67 percent); CARs for all other event windows are negative (between -2.72 percent and -5.48 percent) and highly significant as well. Looking at the AR and CARs for the companies with high media coverage, we do not observe significant returns. However, the differences in the means of the two groups (high media coverage and low media coverage) are statistically significant for all event windows. Even though there is no evidence for a positive stock price reaction for companies with high media coverage when focusing on small event windows (Table B.4), cumulating abnormal returns over time, including the trading days before the intervention, reveals a positive and statistically significant effect on stock prices (CARs fluctuate around 2 percent starting from day [-1]; see Table B.4). On the grounds of these results we cannot reject hypothesis 1a and hypothesis 1b.

Table B.4: Abnormal (AR) and cumulative abnormal returns (CAR) for different types of supervisory board interventions and different levels of media coverage

	CAR(-1,0)	AR(0)	CAR(0,+1)	CAR(-1,+1)	CAR(0,+2)	CAR(-1,+2)	CAR(-1,+3)
All interventions (hypotheses 1a and 1b)							
Low media coverage companies (n=30)	-2.72% ***	-1.67% ***	-2.79% ***	-3.84% ***	-4.43% ***	-5.48% ***	-4.65% ***
High media coverage companies (n=43)	0.57%	0.14%	-0.14%	0.28%	-0.31%	0.12%	-0.25%
Difference mean(high) - mean(low)	3.29% ***	1.81% **	2.65% **	4.12% ***	4.12% ***	5.60% ***	4.40% **
Dismissals and other interventions (hypothesis 2)							
Dismissals Low media coverage companies (n=25)	-2.93% ***	-1.80% ***	-2.91% ***	-4.04% ***	-4.86% ***	-5.99% ***	-5.06% ***
Other interventions Low media coverage companies (n=5)	-1.70%	-1.00%	-2.18%	-2.87%	-2.26%	-2.96%	-2.58%
Difference mean(other) - mean(dismissal)	1.23%	0.80%	0.73%	1.20%	2.60%	3.03%	2.48%
Dismissals High media coverage companies (n=25)	-0.17%	-0.04%	0.25%	0.12%	0.28%	0.15%	-0.35%
Other interventions High media coverage companies (n=18)	1.60% **	0.40%	-0.70%	0.51%	-1.12%	0.08%	-0.10%
Difference mean(dismissal) - mean(other)	-1.77%	-0.44%	0.95%	-0.39%	1.40%	0.07%	-0.25%
Dismissals of CEOs and other members of the management (hypothesis 3)							
Dismissals of CEOs Low media coverage companies (n=9)	-3.48% ***	-2.17% ***	-3.55% ***	-4.87% **	-6.88% ***	-8.20% ***	-6.52% ***
Dismissals of other members Low media coverage companies (n=16)	-2.62% ***	-1.60% **	-2.55% ***	-3.57% ***	-3.73% ***	-4.75% ***	-4.24% ***
Difference mean(other member) - mean(CEO)	0.86%	0.57%	1.00%	1.30%	3.15%	3.45%	2.28%
Dismissals of CEOs High media coverage companies (n=11)	-0.41%	0.23%	0.59%	-0.05%	1.24%	0.60%	0.19%
Dismissals of other members High media coverage companies (n=14)	0.02%	-0.25%	-0.01%	0.26%	-0.47%	-0.20%	-0.77%
Difference mean(CEO) - mean(other member)	-0.43%	0.48%	0.60%	-0.31%	1.71%	0.80%	0.96%

This table reports ARs and CARs by type of supervisory board intervention and amount of media coverage for seven different event windows. To test for statistical significance of the ARs and CARs a parametric t-test was applied. The table also reports the difference in means of the ARs and CARs of two respective groups. To test for statistical significance of these differences, a two-sample t-test with unequal variances was used. ***/**/* indicate significance at the 1%-/5%-/10%-level (two-tailed test).

Hypothesis 2 suggests that the stock market reaction is stronger the more severe the supervisory board's intervention. Our sample of interventions is composed of dismissals, refusals of acceptance and expressions of opinion. In order to be able to test hypothesis 2, we compare the group of dismissals with the group of refusals of acceptance and expressions of opinion ("other"). With respect to companies with low media coverage, we find negative returns for both groups, "dismissals" and "other" (a AR of -1.80 percent and CARs between -2.91 percent and -5.99 percent for "dismissals" and a AR of -1.00 percent and CARs between -1.70 percent and -2.96 percent for "other"). The ARs and CARs for the two groups, however, differ from each other in the way that we find stronger reactions and high significance levels for dismissals while the AR and CARs for the group of other interventions are insignificant. While the differences in returns for the two groups are in line with our hypothesis, empirical support remains scarce due to the small number of other interventions. Consequently, a two sample t-test yields no statistically significant difference in the means. Turning to companies with high media coverage, the resulting ARs and CARs for the two groups of intervention "dismissal" and "other" are inconsistent and except for one event window in the case of "other" insignificant. Looking at the fact that CARs for all supervisory board activities in companies with high media coverage are close to zero (and not significant), this is not very surprising. In addition, the independent two sample t-test reveals that there is no statistically significant difference in the means of the two groups. Even though the differences in returns for the two groups of interventions have the expected sign, looking at the companies with low media coverage, we have to reject hypothesis 2 as these differences are (although economically considerable) statistically not significant.

Finally, hypothesis 3 proposes a stronger market reaction to dismissals of CEOs than to dismissals of any other members of the management. Looking at the companies with low media coverage, our results suggest that there are some differences in the ARs and CARs for the two groups of intervention: For dismissals of CEOs, we observe highly significant negative returns (i.e., an AR of -2.17 percent and CARs between -3.48 percent and -8.20 percent). When other members of the management are dismissed, the stock market reaction is highly significant and negative but not as pronounced (i.e., an AR of -1.60 percent and CARs between -2.55 percent and -4.75 percent). However, the differences in the means of the two groups are not significant. In the case of the companies with high media coverage, the AR and CARs for dismissals of the CEO and dismissals of other members of management show different signs over event windows and are insignificant. Differences in means are close to zero and not statistically significant. Thus, we reject hypothesis 3.

The fact that our results differ for companies with high and low media coverage is in accordance with the mixed findings of previous literature (see section 2.2). However, we are able to show that results vary systematically for companies depending on their level of media coverage. Even though the stock market reaction to interventions of supervisory boards of high media coverage companies is not significant when focusing on small event windows, our overall results clearly support Hermalin and Weisbach (1998).

4.4 Controlling for company characteristics

Event study results show a striking difference in the development of abnormal returns around the time of intervention for the companies with high media coverage and the companies with low media coverage. However, the question arises whether the observed effect is indeed due to different levels of media coverage or whether results are driven by other company characteristics which might differ systematically for the two groups. In particular, it can reasonably be argued that company size and media coverage are strongly related and that, in consequence, the observed differences are due to a concealed size effect rather than media coverage. With the objective of corroborating our results, we estimate multivariate regression models with (cumulative) abnormal returns as the dependent variable and several variables to control for company characteristics on the right hand side. More specifically, the variables included in the models are the following: *Media coverage* is a dummy variable indicating whether the company belongs to the high media coverage group or the low media coverage group (one if high, zero if low). *Total assets* which equals the total assets of the firm (in billion Euro) as of December 31st of the year preceding the event date controls for company size. The variable *price to book value* accounts for the value vs. growth characteristics of firms. *Beta* is the β-coefficient from the market model (see section 4.2) and measures the companies' systematic risk. Finally, *financial services* is an industry dummy for banks and other firms in the financial industry (one if yes, zero otherwise) which is included because of the specific characteristics of these companies. Two models are estimated for every dependent variable, i.e., the (cumulative) abnormal returns from different event windows: a short model with media coverage as well as a size variable (e.g., total assets) as independent variables and a long model with all the variables described above on the right hand side. In other words, the short model controls for size only, while the long model controls for various company characteristics.

Table B.5: Multivariate results

	CAR(-1,0)		AR(0)		CAR(0,+1)		CAR(-1,+1)		CAR(0,+2)		CAR(-1,+2)		CAR(-1,+3)	
Constant	-0.027 ***	-0.0543	-0.0167 ***	-0.0331 ***	-0.0279 ***	-0.0361 **	-0.0384 ***	-0.0572 **	-0.0443 ***	-0.0394 **	-0.0548 ***	-0.0605	-0.0465 ***	-0.0637 **
	(0.010)	(0.018)	(0.006)	(0.012)	(0.010)	(0.017)	(0.014)	(0.024)	(0.011)	(0.020)	(0.015)	(0.026)	(0.016)	(0.027)
Media coverage (0/1)	0.0368 ***	0.0379 **	0.0200 **	0.0186 **	0.0312 **	0.0315 ***	0.0480 ***	0.0508 ***	0.0457 ***	0.0402 ***	0.0625 ***	0.0595 ***	0.0474 **	0.0458 **
	(0.014)	(0.015)	(0.008)	(0.008)	(0.012)	(0.011)	(0.018)	(0.017)	(0.014)	(0.013)	(0.019)	(0.019)	(0.020)	(0.019)
Total assets (in bn. €)	-0.0000	0.0000	0.0000	0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 *	-0.0000	-0.0000	-0.0000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Price to book value		0.0080		0.0032		0.0026		0.0074		-0.005		-0.0005		0.0038
		(0.009)		(0.004)		(0.008)		(0.013)		(0.008)		(0.013)		(0.015)
Beta		0.0197		0.0196 **		0.0063		0.0064		0.0177		0.0177		0.0226
		(0.012)		(0.008)		(0.017)		(0.019)		(0.018)		(0.019)		(0.023)
Financial Serv. (0/1)		-0.0258		-0.0161		-0.0128		-0.0225		-0.0156		-0.0253		-0.0381
		(0.023)		(0.012)		(0.015)		(0.025)		(0.015)		(0.025)		(0.028)
Prob > F	0.0155	0.0143	0.0033	0.0107	0.0466	0.1444	0.0307	0.1281	0.0073	0.0396	0.0055	0.0463	0.0708	0.1318
R^2	0.1138	0.1643	0.1187	0.1979	0.0932	0.1031	0.1089	0.1279	0.1405	0.1794	0.1554	0.1762	0.0836	0.1174
Adj. R^2	0.0881	0.1009	0.0931	0.1372	0.0996	0.0351	0.0830	0.0619	0.1155	0.1173	0.1309	0.1137	0.0570	0.0505

This table shows results based on OLS regressions of AR and CARs on media coverage and firm characteristics. The independent variables are defined as follows: Media coverage is a dummy variable indicating whether the company belongs to the high media coverage group or the low media coverage group (one if high, zero if low). Total assets equals the total assets of the firm (in bn. Euro) as of December 31st of the year preceding the event date and controls for company size. The variable price to book value accounts for the value vs. growth characteristics of firms. Beta is the β-coefficient from the market model and measures the companies' systematic risk. Financial services is an industry dummy for banks and other firms in the financial industry (one if yes, zero otherwise). Robust standard errors in parentheses. ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

Results (see Table B.5) show that the coefficient of the dummy variable for media coverage is positive and statistically significant (at the 10 percent level or better) in all regression models irrespective of the event window and the model under consideration. In contrast, coefficients of controls are insignificant with few exceptions where single coefficients are significant for one specific event window only. Thus, the level of media coverage has an effect on the stock price reaction to supervisory board interventions even when controlling for size and other company characteristics. The same models were estimated using employees or market capitalization instead of total assets as size variable. Results (not reported) do not differ qualitatively from the evidence presented in Table B.5.

In order to test hypotheses 2 and 3 in a multivariate regression setting, we estimated models with dummy variables for different types of interventions (dismissal vs. other intervention and dismissal of CEO vs. dismissal of other member of management) from the data of the subsamples for high media coverage and low media coverage. Results are in line with overall findings but the coefficients of the variables of interest with respect to hypotheses 2 and 3 are not significant. Moreover, regression models with interaction terms for the event type variables and the media coverage variable did also not provide evidence in support of hypotheses 2 and 3. Consequently, results are not reported in more detail.

5 Conclusion

With our analysis, we are able to show that news about supervisory board interventions has significant effects on stock prices. In line with our hypotheses based on the considerations of Hermalin and Weisbach (1998), we find that these effects vary for different groups of companies which contributes to the explanation of mixed results in previous literature. Dividing our sample into two groups based on the companies' level of media coverage yields the following results: For companies with high media coverage we observe insignificant abnormal returns around the time of intervention but significant positive abnormal returns when cumulated over time including the days prior to the date of intervention. For companies with low media coverage, in contrast, we find a significant negative stock price reaction to interventions. Thus, we are among the first to provide empirical evidence in support of Hermalin and Weisbach (1998). While differences in the magnitude of the market's reaction to different types of intervention (i.e., more severe vs. weaker measures of intervention and dismissals of the CEO vs. other members of management) prove not to be significant, our main results can be confirmed in a multivariate regression setting when controlling for company characteristics in particular size.

Our results suggest that supervisory boards and their members of companies with high media coverage should not hesitate to take corrective action in fear of "causing" a negative stock price reaction. Especially when they do not act based on strictly private information, they can assume that the market perceives the intervention as good news while the reasons for the intervention were already reflected in the stock price before the board's decision. For supervisory boards of companies with only little attention by the media it seems much harder to give advice. Even if the supervisory board's intervention is optimal from the shareholders' point of view, it is not unlikely that the news will send the stock price falling because the market simultaneously learns about the reasons for the intervention. However, communicating actively that the supervisory board's decision should be considered a reaction to an existing problem or mismanagement and that, if necessary, further measures will be taken might help to alleviate the situation.

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Essay C:

Operational and Reputational Risk in the European Banking Industry: The Market Reaction to Operational Risk Events

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1 Introduction

While operational risk has been receiving significant attention by regulators for more than a decade, incidents such as the exceptional loss at Société Générale of almost five billion Euro in 2008 caused by the trader Jérôme Kerviel once more spurred the interest paid to operational risk by regulators, supervisors, bank executives, and the public. Other prominent examples of operational risk events include the failure of Barings bank in 1995, the 850 million Euro loss due to unauthorized trading at AIB in 2002, the unimaginable Ponzi scheme of Bernard Madoff discovered in 2008 and, most recently, the loss of UBS caused by rogue trading exceeding 1.5 billion Euro in September 2011. Even though these events led to an increased awareness of operational risk and its importance, operational losses keep surfacing and the times of financial crises reveal new deficits of the operational risk management practices in place. The reliance on information technology and automation as well as the increasing complexity of new products in financial services firms are changing their exposure to operational risk. Automation, for example, can help to reduce the likelihood of minor errors in manual processing, but it increases the risk of system-wide failures. In light of these recent developments, it is not surprising that a considerable amount of research is focusing on operational risk and the advancement of risk management tools for banks.

Most operational losses are characterized by an individual coincidence of circumstances involving some kind of failure or problem. Thus, they attract the attention of the media and the public even though financial losses are sometimes relatively small. This increased attention on operational risk events is why they can be especially harmful to firm reputation, in particular if the loss is not caused by an external event (de Fontnouvelle and Perry, 2005). Sometimes the negative consequences in the aftermath of an operational risk event, such as the loss of customers or executive employees, might be more severe than the direct effect from the loss itself. However, while the Basel II accord obliges institutions to quantify operational risk and to account for it when calculating minimum capital requirements they are not required to hold capital for reputational risk.

The multifaceted nature of operational losses makes it difficult to define operational risk and in some cases it is hard to draw the line between operational risk and other types of risk (see Moosa, 2007 for a controversial discussion on the definition of operational risk). However, the following definition of operational risk by the Basel Committee on Banking Supervision has evolved into a consensus definition in literature:

> Operational risk is the risk of losses resulting from inadequate or failed internal processes, people and systems or from external events. This definition includes legal risk, but excludes strategic risk and reputational risk (Basel Committee, 2006, p. 144).

Even though this definition excludes reputational risk, it is widely acknowledged that operational losses also effect the reputation of financial institutions, thus posing a risk exceeding the effect of the direct financial loss itself. Interestingly, the 2006 version of the Basel II accord excludes reputational risk from the definition of operational risk but does not provide a definition of reputational risk. While in a previous Basel Committee publication reputational risk has only been described rather vaguely as "the risk of significant negative public opinion that results in a critical loss of funding or customers" (Basel Committee, 1998, p. 7), the Basel Committee on Banking Supervision includes a full section on reputational risk in its proposed enhancements to the Basel II framework presenting a definition of reputational risk:

> Reputational risk can be defined as the risk arising from negative perception on the part of customers, counterparties, shareholders, investors, debt-holders, market analysts, other relevant parties or regulators that can adversely affect a bank's ability to maintain existing, or establish new, business relationships and continued access to sources of funding (Basel Committee, 2009a, p. 19).

Furthermore, the Committee states that "reputational risk is multidimensional and reflects the perception of other market participants" (Basel Committee, 2009a, p. 19). An alternative definition and a survey of the scarce empirical literature on reputational risk in banking are provided by Walter (2007).

This study aims at providing insights about the magnitude of reputational damage resulting from operational loss events affecting European financial institutions by analyzing the stock market reaction to the announcement of operational losses. Accounting for the nominal loss amount itself, I try to separate the direct effect of the operational loss from the indirect effects on reputation. Previous empirical studies have put their focus on US financial institutions in consequence of the origin of the data used. So far only Gillet et al. (2010) provide event study results for the European banking industry. However, with a small (sub-)sample of 49 operational loss events from European banks empirical evidence for European financial institutions remains relatively scarce. This study presents new data from a Germany-based data provider allowing for a particular focus on the European financial industry. Results suggest that quantifying operational risk (e.g., in order to determine capital requirements) using data based on nominal loss amounts underestimates the full consequences of operational risk events because possible damages to reputation are neglected. Even without more regulatory requirements, additional risk management tools to avoid these events may be advisable considering the cost of reputational damage to shareholders.

This paper is similar to previous literature using event study methodology in that abnormal returns around the announcement date of information on operational losses are assessed. I follow the more detailed approach of Gillet et al. (2010) and identify different event dates for every operational loss, thus accounting for the gradual release of information in the case of a lawsuit, investigation or similar processes.

The remainder of this paper is organized as follows. Section 2 reviews prior literature related to this study and develops the research hypotheses. Section 3 describes the data used for the analysis and outlines the methodology applied. Results are presented and discussed in section 4 and section 5. Section 6 concludes.

2 Prior literature and research hypotheses

Since the history of operational risk is still young when compared to the ones of credit and market risk, data availability on operational risk is limited. Consequently, empirical research on operational risk is still hindered by the lack of data. However, in a more general (i.e., not banking specific) context there are several studies dealing with aspects closely related to operational risk and reputation such as fraud.

Palmrose et al. (2004) analyze the effect of earnings restatement announcements on stock prices of firms in financial and non-financial industries. The authors consider 403 restatements announced between 1995 and 1999; they find a negative stock market reaction to the announcement of earnings restatements with a stronger stock market reaction to restatements involving fraud. Murphy et al. (2009) examine the market impact of allegations of a variety of different illegal activities such as fraud, anti-trust violations, bribery, or copyright and patent infringements. Their study comprises 452 events of misconduct between 1982 and 1996 in firms of all sectors. The authors find that allegations of misconduct are accompanied by declines in reported earnings, declines in analysts' earnings estimates, increased stock return volatility, and a loss in firm value. Both studies are different from this paper, because they do not focus on the financial services industry, which implies a much wider concept of operational risk.

Most previous event studies with a particular focus on the operational risk of banks and insurance companies use data from Algorithmics, a Canada-based vendor which is part of the Fitch Group. These data sets are Algo OpData (formerly called OpVar), which contains publicly reported loss events, and OpVantage FIRST, a large collection of case studies on operational losses.

Cummins et al. (2006) conduct an event study analysis based on a sample of 492 banking and insurance operational loss events stemming from the OpVar database. Their results show a strong, statistically significant stock price reaction to the announcement of operational losses, which is more pronounced for insurance companies than for banks. The authors attribute the smaller negative impact for banks to a better management of operational risk in the banking sector following the Basel II regulation compared to risk management practices in insurance companies. According to their results, the market value loss significantly exceeds the operational loss amount reported in the news indicating a negative impact on company reputation.

De Fontnouvelle and Perry (2005) analyze the stock market reaction to operational loss events using event study methodology based on the two proprietary data sets of Algorithmics (OpData and OpVantage FIRST). Searching for further loss announcements in online news archives resulted in a collection of 115 operational loss events occurring at financial firms between 1974 and 2004. They find that market values decline at a one-to-one rate with announced loss amounts when losses are caused by external events, but fall by over twice the loss percentage when involving internal fraud. As they do not find evidence that the market reacts more than one-to-one in the case of non-internal fraud announcements, they conclude that losses due to internal fraud have a negative impact on reputation, while externally caused losses have no reputational impact.

Based on a small hand-collected sample of 22 operational loss events Solakoğlu and Köse (2009) study the stock market reaction to operational risk events in the Turkish banking sector. The authors analyze operational loss events between 1998 and 2007 focusing their analysis on two sub-periods (pre-October 2001 and post-October 2001). Interestingly, they find a significant negative stock price reaction to the announcement of operational loss events for the first sub-period, but not for the later sub-period studied. The authors attribute this difference in findings to effective regulation of the banking sector.

Cannas et al. (2009) examine a group of 20 loss events of banks and insurance companies from the OpVar database occurring between 2000 and 2006. The authors focus on losses involving internal fraud, since they are considered more likely to produce reputational effects than other operational losses. Estimating abnormal returns in an event study setting, they find that stock prices react negatively to the announcement of operational losses due to internal fraud. The study concludes with the estimation of a reputational value-at-risk as an approach to quantify the economic capital needed to face reputational effects.

The study of Gillet et al. (2010) tries to separate the effect from the operational loss and the damage to reputation by examining the stock market reaction to operational loss events stemming from the OpVantage FIRST database. The 154 events used for their analysis occurred in companies listed on major European and US stock exchanges between 1990 and 2004. With only 49 losses affecting European institutions the focus of their analysis clearly is on the US. The authors find significant, negative abnormal returns at the announcement date accompanied by increased volumes of trade. In cases involving internal fraud the loss in market value is greater than the operational loss amount announced, which the authors interpret as a sign of reputational damage. However, with respect to reputational damage results for the European subsample differ from overall findings in their study.

To the knowledge of the author, this paper is the first analysis of the stock market reaction to operational loss events using proprietary data from a vendor other than Algorithmics allowing for a reassessment of previous results. Furthermore, the data from ÖffSchOR used in this study is based on information collected by a Germany-based data provider. Thus, when analyzing the European financial industry, it may be preferable over data stemming from the US. Data based on publicly available information will most likely reflect the origin of the information, depending on the public sources included in the screening process when collecting the data. With only one study in previous literature providing empirical evidence on a small subsample of European financial institutions, this paper aims at delivering further results regarding the impact of operational risk events on the reputation of listed European banks.

The discussion of previous literature suggests several hypotheses regarding the stock market reaction to information about operational losses. The first hypothesis tests whether the announcement of information on operational loss events contains relevant information for the stock market at all. If the announcement of information about a loss due to operational risk conveys relevant and unexpected information to the stock market it will affect the value of the firm. Thus, the first hypothesis is:

Hypothesis 1 Announcements of information on operational loss events have a significant negative impact on the stock price of the financial institution incurring the loss.

The second hypothesis focuses on the question of reputational risk associated with operational loss events. There are several reasons why negative (indirect) effects on reputation can result in losses for a company (in addition to the operational loss): (1) Current or future customers might switch to a competitor, (2) managers or employees may leave the company for a more attractive employer, (3) current business partners can revise terms and conditions of cooperation; future business partners might be harder to find, (4) the loss may trigger other costly events such as management reorganization, regulatory investigations, and lawsuits. For these reasons, operational loss events might change the expectations about the *future* cash flows of the firm and the market value loss exceeds the operational loss. If so, operational losses convey information to the stock market beyond the loss amount itself. This discussion suggests the following hypothesis:

Hypothesis 2 Operational loss events adversely affect firm reputation, i.e. they have a significant impact on stock prices after accounting for the direct impact of the loss amount.

The third hypothesis is concerned with different types of operational loss events. Studying the market reaction to earnings restatements, Palmrose et al. (2004) find that the market reacts more negatively to earnings restatements involving fraud. Thus, the market reaction to operational loss events may differ depending on the event type of the operational loss. Accordingly, the third hypothesis is:

Hypothesis 3 The impact on reputation of operational loss events differs depending on the event type of the loss.

The last hypothesis addressed in this paper deals with the relative size of operational losses. If operational losses adversely affect firm reputation we would intuitively expect larger losses to cause more severe reputational damages. However, prior literature suggests that market participants do not account perfectly for the relative size of operational losses in their (re-)valuation of the company (see Gillet et al., 2010). More precisely, for relatively small losses, the market value loss exceeds the loss amount, while for relatively large losses the market value loss is smaller than the amount of the operational loss. In other words, the market overestimates the negative consequences of relatively small losses and underestimates the consequences of relatively large losses. In order to test whether there is a relation between damages to reputation and the relative size of losses, I suggest the following hypothesis:

Hypothesis 4 The impact of operational loss events on reputation differs depending on the relative size of the loss.

No empirical support for this hypothesis suggests that the market assigns similar reputational penalties to operational losses irrespective of the relative size of the loss amount.

In order to address the questions outlined above, the null hypotheses of no effect on stock prices of the financial institutions is tested in an event study setting.

3 Data and methodology

3.1 Description of data

The empirical analysis is based on a collection of 136 loss events from 36 different financial institutions with loss amounts reported between January 1st 2000 and December 31st 2009. The vast majority of these loss events stems from a proprietary database of publicly reported operational losses (ÖffSchOR) provided by the Association of German Public Sector Banks (Bundesverband öffentlicher Banken, VÖB). The provider of the database collects all operational losses in financial institutions exceeding 100,000 Euro on the basis of publicly available information. ÖffSchOR provides a detailed description of approximately 800 loss events affecting financial institutions. The main reason why the number of observations reduces to 136 loss events in the final sample is that only a minority of the banks included in

ÖffSchOR is publicly listed reflecting the characteristics of the European banking sector. Other losses had to be deleted from the sample due to incomplete information (e.g., it was not possible to unambiguously identify the event date in all instances). In consequence of the requirement of being publicly listed, nearly all losses in the final sample affect (rather large) commercial banks.[1] The ÖffSchOR database states the loss amount (in Euro), indicates whether the original loss amount was reported in a foreign currency, and classifies operational loss events according to the Basel II business lines and event type categories. I identify all losses included in ÖffSchOR with loss amounts reported between January 1st 2000 and December 31st 2009 occurring in publicly traded European financial institutions and add (more recent) loss events not (yet) contained in the ÖffSchOR database reported by the daily press. All information on the losses used for the analysis is verified by checking the information from the original sources provided by ÖffSchOR (newspapers, press releases, news websites) by means of LexisNexis. Table C.1 reports summary statistics for the sample of 136 loss events.

Table C.1: Summary statistics for the sample of 136 loss events

	Mean	Median	Std Dev.	Min	Max
Operational losses (in million Euro)	149.88	11.53	500.69	0.10	4,900.00
Market capitalization (in million Euro)*	41,654	38,344	32,488	13	159,906
Total assets (in million Euro)*	799,775	782,989	556,236	12	2,583,668
Total liabilities to total assets (%)*	95.37	96.47	5.66	43.91	98.55
Price to book value*	1.7	1.6	0.8	0.1	5.3
Operational loss / Market cap (%)**	0.7	0.1	1.9	0.0	17.2

* Market capitalization, total assets, total liabilities to total assets, and price to book value of financial institution affected by the loss are reported as of December 31st preceding the date of the initial news article.

** Operational loss divided by the market capitalization of affected financial institution at day [-20] preceding the date of the initial news article.

The minimum loss amount in the data of 0.1 million Euro represents the threshold of losses to be included in the ÖffSchOR database, whereas the maximum of 4.9 billion Euro corresponds to the exceptional trading loss at Société Générale. Similar to the data used in Cummins et al. (2006) the severity distribution of losses in the sample is significantly skewed to the right. Indeed, only 8 out of 136 losses exceed 500 million Euro explaining the relatively low median of 11.53 million Euro compared to the average loss amount of 149.88 million Euro. For comparison, Cummins et al. (2006) report an average (median) loss amount of 69.53 million USD (32.33 million USD) for a sample of 403 publicly reported loss events in the US banking industry. Gillet et al.

[1] Classification based on Bureau van Dijk's Bankscope definitions. Among the few exceptions are Carnegie Investment Bank and Crédit Agricole.

(2010) document an average loss amount of 277 million USD for a subsample 49 European banks.[2] Thus, the data on operational losses employed in this study seems to be generally comparable to the data used in previous work. However, comparing the loss data with the numbers reported in previous studies is not without problems, because the data reported in prior work stems from different time periods and is denominated in US dollars. Moreover, other sources of data use different thresholds for loss events to be included in the database. Apart from these problems, (average) loss amounts may differ by geographical region even when loss data originates from the same source; examining the losses of two data collections of publicly reported operational losses in different countries, de Fontnouvelle et al. (2003) find that non-US losses are significantly larger than losses occurring inside the US.[3]

Table C.2 and Table C.3 classify all loss events according to the Basel II business lines and event types. While Table C.2 reports the number of loss events, Table C.3 provides information on loss amounts. Interestingly, the relative frequency distribution of loss events over event type categories as displayed in Table C.2 almost identically matches the one reported in Cummins et al. (2006). Gillet et al. (2010) do not provide information about the distribution of losses across event types, but state that operational losses of the "Clients, products and business practices" (CPBP) event type make up 72 percent of their global sample. Thus, operational losses of the CPBP group seem to be the most frequent event type in data collections based on publicly available information in contrast to their relative frequency in internally collected data (see Basel Committee, 2009b, Annex D). Examples for losses of the CPBP category are losses related to the misuse of confidential information, market manipulation, violations of antitrust provisions, inappropriate commissions or fees, and money laundering, among others.

2 Gillet et al. (2010) do not report the median loss of their sample. Losses of European banks range from 11 million USD to 3 billion USD in their study.

3 De Fontnouvelle et al. (2003) conclude that data collection processes may differ for US vs. non-US losses. Both providers of data used in this study rely on publicly available information. Therefore, a plausible explanation is that from outside the US in particular relatively large losses are reported and recorded in the data while some of the smaller losses go unnoticed.

Table C.2: Individual loss events per business line and event type

Business lines	Internal fraud	External fraud	Employment practices and workplace safety	Clients, products & business practices	Damage to physical assets	Business disruption and system failures	Execution, delivery & process management	Total across event types
Corporate finance	2.9%	1.5%	1.5%	8.8%	0.0%	0.0%	0.0%	14.7%
Trading and sales	6.6%	1.5%	0.7%	11.8%	0.0%	0.0%	0.7%	21.3%
Retail banking	2.2%	5.9%	0.0%	17.6%	0.0%	0.0%	0.0%	25.7%
Commercial banking	0.7%	0.7%	0.0%	2.9%	0.0%	0.0%	0.7%	5.1%
Payment and settlement	0.0%	0.0%	0.0%	2.9%	0.0%	0.7%	0.0%	3.7%
Agency services	0.0%	0.0%	0.0%	0.7%	0.0%	0.0%	0.0%	0.7%
Asset management	0.7%	3.7%	0.0%	2.9%	0.0%	0.0%	0.0%	7.4%
Retail brokerage	0.0%	0.0%	0.0%	2.9%	0.0%	0.0%	0.0%	2.9%
No business line information	10.3%	0.7%	1.5%	5.1%	0.0%	0.7%	0.0%	18.4%
Total number of events	32	19	5	76	0	2	2	136
Total across business lines	23.5%	14.0%	3.7%	55.9%	0.0%	1.5%	1.5%	100.0%

Table C.3: Loss amounts (in million Euro) of individual loss events by business line and event type

Business lines	Internal fraud	External fraud	Employment practices and workplace safety	Clients, products & business practices	Damage to physical assets	Business disruption and system failures	Execution, delivery & process management	Total across event types
Corporate finance	2.3%	1.1%	0.0%	6.9%	0.0%	0.0%	0.0%	10.3%
Trading and sales	40.1%	3.9%	0.1%	0.9%	0.0%	0.0%	0.0%	45.1%
Retail banking	0.0%	0.1%	0.0%	11.1%	0.0%	0.0%	0.0%	11.3%
Commercial banking	0.9%	3.6%	0.0%	2.0%	0.0%	0.0%	0.1%	6.6%
Payment and settlement	0.0%	0.0%	0.0%	2.1%	0.0%	0.0%	0.0%	2.1%
Agency services	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Asset management	0.0%	13.0%	0.0%	0.4%	0.0%	0.0%	0.0%	13.4%
Retail brokerage	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
No business line information	6.4%	0.0%	0.4%	3.3%	0.0%	1.0%	0.0%	11.1%
Total loss amount (in million Euro)	10,151	4,442	99	5,454	0	209	29	20,384
Total across business lines	49.8%	21.8%	0.5%	26.8%	0.0%	1.0%	0.1%	100.0%

In order to account for the (potentially) gradual release of information on the operational loss, I follow the approach of Gillet et al. (2010) and check whether there are multiple event dates for each operational loss (see also Karpoff and Lott, 1993). More precisely, I identify two different event dates for each loss searching the LexisNexis news database:

1. The date of the first news article mentioning the loss, as identified in LexisNexis. The extent of information released on this date ranges from the announcement of a lawsuit or investigation (with the loss amount still being unknown) to a comprehensive report covering details of the loss including the loss amount.
2. The settlement date, as identified in LexisNexis. At this point in time the loss is considered to be definite and all loss amounts are known. Examples for news items in this group include the announcement of a compensation payment in a previously reported lawsuit or the announcement of the fine in an investigation whose beginning was already covered by the news.

If the date of the first news article and the settlement date are the same for a specific loss, the loss event is only included in the first group. Thus, the sample reduces to 73 loss events for the analysis of the stock market reaction to the announcement of the settlement.

The information on the announcement dates of the events (date of first news article in the press and settlement date), the classification into business lines and event type categories as well as the nominal loss amount reported by the news[4] is verified via LexisNexis. If news were announced on a weekend, the news item is assigned to the next trading day. All information on stock prices for the event study analysis is obtained from Thomson Reuters Datastream.

3.2 Methodology

In order to analyze the effect of operational losses on stock prices, I apply standard event study methodology following the set-up of MacKinlay (1997). More precisely, I assess abnormal returns (ARs) around the date of the initial news article and the date of settlement of operational losses. Therefore, the calendar date of each news item is converted to event time by defining the day when the news about the operational loss is

[4] In cases where a range was reported for the loss amount, the arithmetic mean is calculated.

released as day [0], i.e. the event day. Abnormal returns are calculated on a daily basis by subtracting expected returns from actual returns. While actual or realized returns can be directly calculated from the stock market data[5] on Thomson Reuters Datastream, I estimate expected returns using the market model (see Brown and Warner, 1985). I choose the FTSEurofirst 100 as the market index and an estimation period of 200 days from day [-220] to day [-21] preceding the event day.[6] The parameters of the market model are obtained from the stock market information in the estimation period using OLS. In order to test for statistical significance, I apply the traditional t-test as surveyed by Brown and Warner (1985).[7] Cumulative abnormal returns (CAR) are calculated by aggregating abnormal returns over time for different event windows allowing for the evaluation of stock prices around the event date. Standardized returns (as proposed e.g. by Boehmer et al., 1991) are not reported in the tables in order to maintain the economic information of returns (see Kolari and Pynnönen, 2010).

To measure the effect of operational loss events on the reputation of financial institutions the direct effect of the operational loss has to be accounted for. While Cummins et al. (2006) estimate regression models to examine the effect of operational losses on reputation, Gillet et al. (2010) suggest adjusting average abnormal returns for the direct effect of the operational loss. More precisely, the authors add the return due to the operational loss (i.e., the loss amount divided by the market value of the company) to the abnormal return at the event date. I follow this approach and calculate abnormal returns corrected for the direct effect of the nominal loss amount as:

$$AR_{i0}(Rep) = AR_{i0} + \frac{Loss_i}{Market\ Cap_i} \tag{1}$$

where: AR_{i0} is the abnormal return of company i at time 0,
$Loss_i$ is the operational loss amount of company i,
$Market\ Cap_i$ is the market value of the company at day [-20].

5 Here, the Total Return Index, which is adjusted for dividends and stock splits, was used.

6 As a robustness check, the analysis was also conducted with an alternative estimation window from day [-125] to [-25]. Results remain qualitatively unchanged.

7 As a robustness check, test statistics using the standardized cross sectional method proposed by Boehmer et al. (1991) were calculated in order to test for statistical significance of abnormal returns. Significance levels tend to be somewhat lower, but overall, statistical significance and the pattern of returns are confirmed.

When the loss amount is not known at the date of the initial news article[8], the loss amount as released at the settlement date is used, assuming that the market rationally anticipates the loss amount. The abnormal return corrected for the direct financial operational loss $AR_{i0}(Rep)$ captures the damages to reputation suffered by the company and thus reflects the stock market reaction due to reputational risk. Correspondingly, the expression $CAR_{i0}(Rep)$ denotes adjusted cumulative abnormal returns, i.e. the loss amount divided by the market value of the company is added at day [0]. Cumulative abnormal returns as well as adjusted cumulative abnormal returns are reported with the corresponding significance levels in the following section. The analysis focuses on different symmetric and asymmetric event windows to allow for the possibility of information leakage and/or the arrival of new information following the event as observed by Cummins et al. (2006).

4 Univariate analysis

4.1 Stock market reaction to the initial news article

In line with the findings of previous literature, event study results show that the stock market reacts negatively to the first indication of operational losses in the press even though details on the consequences and the loss amount may still be unknown. Cumulative abnormal returns are significantly negative for a variety of different event windows surrounding the date of first press mention of the loss (see Table C.4). For the overall sample of 136 loss events negative cumulative abnormal returns between -1.1 percent and -1.7 percent are observed. Even after adding the nominal loss amount divided by the market value of the affected firm at day [0] cumulative abnormal returns are negative for all event windows. Moreover, they are statistically significant at the 10 percent level over several different event windows providing evidence for damages to firm reputation.

8 Cases where the loss amount is unknown at the time of the first news article are loss events where the loss amount is yet to be determined (e.g., in a lawsuit or investigation) or the loss amount has not yet been released to the press.

Table C.4: (Adjusted) CAR for all loss events around the date of the initial news article

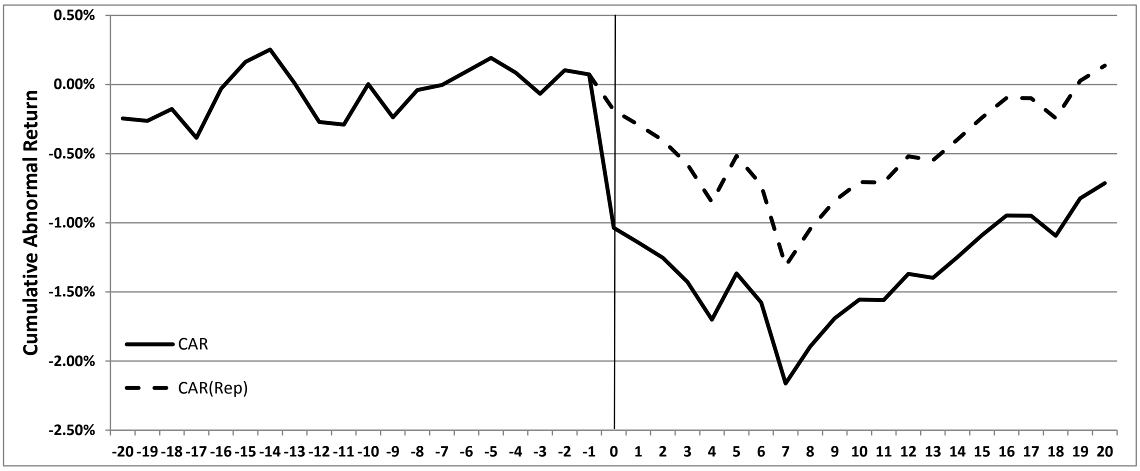
N	Window	Mean CAR (%)	t-value	N	Window	Mean CAR(Rep) (%)	t-value
136	(0,0)	-1.11	-5.81 ***	136	(0,0)	-0.26	-1.36 *
136	(-1,+1)	-1.25	-3.77 ***	136	(-1,+1)	-0.39	-1.19
136	(-3,+3)	-1.51	-3.00 ***	136	(-3,+3)	-0.66	-1.32 *
136	(-5,+5)	-1.46	-2.31 **	136	(-5,+5)	-0.61	-0.96
136	(-10,+10)	-1.27	-1.45 *	136	(-10,+10)	-0.42	-0.48
136	(0,+1)	-1.22	-4.50 ***	136	(0,+1)	-0.36	-1.35 *
136	(-1,+3)	-1.53	-3.59 ***	136	(-1,+3)	-0.68	-1.59 *
136	(-1,+5)	-1.47	-2.91 ***	136	(-1,+5)	-0.62	-1.23
136	(-1,+10)	-1.66	-2.51 ***	136	(-1,+10)	-0.81	-1.22

This table displays cumulative abnormal returns (CAR) and cumulative abnormal returns adjusted for the nominal loss amount (CAR(Rep)) for different event windows. CAR(Rep) is adjusted by adding the loss amount divided by the market value at day [0]. To test for statistical significance t-statistics based on Brown and Warner (1985) are displayed next to the CAR and CAR(Rep). ***/**/* indicate significance at the 1%-/5%-/10%-level (unilateral test).

Figure C.1 graphically visualizes the strong stock market reaction (solid line) to the first mention of operational losses in the press by displaying cumulative abnormal returns from day [-20] to day [+20]. The dashed line indicates the impact on firm reputation as the effect of the financial loss is accounted for at day [0] by adding the loss amount divided by the market value. The graphical illustration underlines the immediate negative impact of operational losses on stock prices following the date of the initial information about the loss in the press. The immediate market value loss clearly exceeds the operational loss reported, which is attributed to reputational damage. The observation that cumulative abnormal returns are less pronounced for event windows including more than four days following the event might be due to announcements of corrective action[9] in the aftermath of an operational risk event. Moreover, similar patterns of stock returns, i.e. short-term underreaction followed by overreaction (or price reversal) to negative events, are observed in other empirical studies (see Brown et al., 1988; Corrado and Jordan, 1997; Hong and Stein, 1999; Spyrou et al., 2007).

[9] The detailed descriptions of operational risk events in the ÖffSchOR database provide evidence for corrective action in response to operational risk events. Examples include additional controls, back-up systems, training of staff and disciplinary action against responsible employees among others.

Figure C.1: (Adjusted) CAR for all loss events around the date of the initial news article



This figure displays cumulative abnormal returns from day [-20] to day [+20] around the date of the initial news article. For the dashed line the loss amount divided by the market value is added at day [0] to illustrate the impact of operational losses on reputation.

Table C.5 reports cumulative abnormal returns for of all operational losses by event type. At the time of the initial news article 51 operational losses involve internal or external fraud (Panel A). With respect to the uncorrected cumulative abnormal returns the results for this subsample do not differ remarkably from overall findings. I observe significant, negative cumulative abnormal returns for all but one event window. With a significant cumulative abnormal return of -2.14 percent over a [-1,+3] event window the negative stock price reaction for fraud events may be a little more pronounced compared to the stock price decline for the overall sample. However, results for the corrected cumulative abnormal returns for this group are ambiguous. Note that the adjustment for the loss amount of this group is relatively large (1.63 percentage points) indicating that the losses involving fraud are large relative to the market capitalization of the affected financial companies.

Panel B of Table C.5 provides the results for the subsample of the "Clients, Products & Business Practices" (CPBP) event type. At the time of the initial news article 76 operational loss events fall into this category. In line with the results for the overall sample, unadjusted cumulative abnormal returns are significantly negative for all event windows. After adding the loss amounts divided by the market value to adjust for the monetary impact of the losses, cumulative abnormal returns are still negative and statistically significant for several different event windows, indicating negative effects on firm reputation. The small size of CPBP losses (expressed as a percentage of market value) results in a relatively small adjustment of cumulative abnormal returns (0.41 percentage points).

Table C.5: (Adjusted) CAR by event type around the date of the initial news article

N	Window	Mean CAR (%)	t-value	N	Event Window	Mean CAR(Rep) (%)	t-value
Panel A: Operational losses involving fraud (i.e. of the event types internal and external fraud)							
51	(0,0)	-1.56	-7.03 ***	51	(0,0)	0.07	0.31
51	(-1,+1)	-1.55	-4.04 ***	51	(-1,+1)	0.08	0.20
51	(-3,+3)	-1.76	-3.00 ***	51	(-3,+3)	-0.13	-0.23
51	(-5,+5)	-1.25	-1.70 **	51	(-5,+5)	0.38	0.52
51	(-10,+10)	-0.61	-0.60	51	(-10,+10)	1.02	1.00
51	(0,+1)	-1.43	-4.55 ***	51	(0,+1)	0.20	0.64
51	(-1,+3)	-2.14	-4.30 ***	51	(-1,+3)	-0.50	-1.02
51	(-1,+5)	-1.77	-3.02 ***	51	(-1,+5)	-0.14	-0.24
51	(-1,+10)	-1.78	-2.31 **	51	(-1,+10)	-0.15	-0.20
Panel B: Operational losses of the CPBP (Clients, Products and Business Practices) event type							
N	Window	Mean CAR (%)	t-value	N	Event Window	Mean CAR(Rep) (%)	t-value
76	(0,0)	-0.85	-3.85 ***	76	(0,0)	-0.45	-2.01 **
76	(-1,+1)	-1.12	-2.90 ***	76	(-1,+1)	-0.71	-1.84 **
76	(-3,+3)	-1.40	-2.38 ***	76	(-3,+3)	-0.99	-1.69 **
76	(-5,+5)	-1.51	-2.05 **	76	(-5,+5)	-1.10	-1.50 *
76	(-10,+10)	-2.08	-2.04 **	76	(-10,+10)	-1.67	-1.64 *
76	(0,+1)	-1.07	-3.42 ***	76	(0,+1)	-0.67	-2.12 **
76	(-1,+3)	-1.22	-2.46 ***	76	(-1,+3)	-0.82	-1.64 *
76	(-1,+5)	-1.31	-2.23 **	76	(-1,+5)	-0.90	-1.54 *
76	(-1,+10)	-1.82	-2.37 ***	76	(-1,+10)	-1.41	-1.84 **
Panel C: Other operational losses							
N	Window	Mean CAR (%)	t-value	N	Window	Mean CAR(Rep) (%)	t-value
9	(0,0)	-0.71	-1.42 *	9	(0,0)	-0.54	-1.08
9	(-1,+1)	-0.59	-0.68	9	(-1,+1)	-0.42	-0.49
9	(-3,+3)	-1.06	-0.81	9	(-3,+3)	-0.89	-0.68
9	(-5,+5)	-2.24	-1.35 *	9	(-5,+5)	-2.07	-1.25
9	(-10,+10)	1.83	0.80	9	(-10,+10)	2.00	0.88
9	(0,+1)	-1.19	-1.69 **	9	(0,+1)	-1.02	-1.45 *
9	(-1,+3)	-0.70	-0.48	9	(-1,+3)	-0.54	-0.48
9	(-1,+5)	-1.08	-0.82	9	(-1,+5)	-0.91	-0.69
9	(-1,+10)	0.42	0.24	9	(-1,+10)	0.59	0.34

This table displays cumulative abnormal returns (CAR) and cumulative abnormal returns adjusted for the nominal loss amount (CAR(Rep)) for different event windows. CAR(Rep) is adjusted by adding the loss amount divided by the market value at day [0]. To test for statistical significance t-statistics based on Brown and Warner (1985) are displayed next to the CAR and CAR(Rep). ***/**/* indicate significance at the 1%-/5%-/10%-level (unilateral test).

Comparing the results for the event types involving fraud (Panel A) with the results for the CPBP events (Panel B) and the remaining events (Panel C) it seems that operational losses of the CPBP event type cause more severe damages to reputation than other events. When adjusted for the impact of the loss amount, cumulative abnormal returns for the CPBP event type are significantly negative for all but two event windows, while corrected abnormal returns for the two other groups are mostly not significant.

Table C.6: (Adjusted) CAR by relative loss size around the date of the initial news article

N	Window	Mean CAR (%)	t-value	N	Event Window	Mean CAR(Rep) (%)	t-value
Panel A: Operational losses with large relative size (median level: 0.09% of market cap)							
68	(0,0)	-1.86	-6.36 ***	68	(0,0)	-0.17	-0.58
68	(-1,+1)	-2.46	-4.87 ***	68	(-1,+1)	-0.77	-1.53 *
68	(-3,+3)	-2.38	-3.08 ***	68	(-3,+3)	-0.69	-0.90
68	(-5,+5)	-2.45	-2.53 **	68	(-5,+5)	-0.76	-0.79
68	(-10,+10)	-1.42	-1.06	68	(-10,+10)	0.27	0.20
68	(0,+1)	-2.12	-5.14 ***	68	(0,+1)	-0.43	-1.05
68	(-1,+3)	-2.66	-4.08 ***	68	(-1,+3)	-0.97	-1.49 *
68	(-1,+5)	-2.75	-3.57 ***	68	(-1,+5)	-1.07	-1.38 *
68	(-1,+10)	-2.44	-2.41 **	68	(-1,+10)	-0.75	-0.74
Panel B: Operational losses with small relative size (median level: 0.09% of market cap)							
N	Window	Mean CAR (%)	t-value	N	Event Window	Mean CAR(Rep) (%)	t-value
68	(0,0)	-0.36	-1.50 *	68	(0,0)	-0.35	-1.44 *
68	(-1,+1)	-0.03	-0.07	68	(-1,+1)	-0.02	-0.04
68	(-3,+3)	-0.65	-1.01	68	(-3,+3)	-0.64	-0.99
68	(-5,+5)	-0.47	-0.59	68	(-5,+5)	-0.46	-0.57
68	(-10,+10)	-1.12	-1.01	68	(-10,+10)	-1.10	-0.99
68	(0,+1)	-0.31	-0.91	68	(0,+1)	-0.30	-0.87
68	(-1,+3)	-0.40	-0.74	68	(-1,+3)	-0.39	-0.72
68	(-1,+5)	-0.19	-0.29	68	(-1,+5)	-0.17	-0.27
68	(-1,+10)	-0.88	-1.05	68	(-1,+10)	-0.87	-1.03

This table displays cumulative abnormal returns (CAR) and cumulative abnormal returns adjusted for the nominal loss amount (CAR(Rep)) for different event windows. CAR(Rep) is adjusted by adding the loss amount divided by the market value at day [0]. To test for statistical significance t-statistics based on Brown and Warner (1985) are displayed next to the CAR and CAR(Rep). ***/**/* indicate significance at the 1%-/5%-/10%-level (unilateral test).

Table C.6 summarizes the results on stock market returns around the date of the initial news article for operational losses by relative size. Not surprisingly unadjusted returns are significantly negative for losses of large relative size (Panel A). After adjusting for the relative size of losses cumulative abnormal returns are still significantly negative for several different event windows surrounding the event date reaching a low with a CAR(Rep) of -1.59 percent over a [-1,+4] event window (not reported). In contrast, (unadjusted) abnormal returns are not significant for losses of small relative size with the exception of the abnormal return on the event day (Panel B).

4.2 Stock market reaction to the announcement of settlement

The subsample for the analysis of the stock market reaction to the settlement announcement consists of 73 operational loss events with a settlement date different from the date of the initial news article. While the first press article may only be the first strong indication of an operational loss, all uncertainty about the loss is resolved at the settlement date as final loss amounts are known and losses are considered to be definite. Even if the announcement of settlement does not provide new information to investors, the news item reporting the settlement may be regarded as bad press affecting the reputation of the company.

Table C.7: (Adjusted) CAR for all loss events around the settlement date

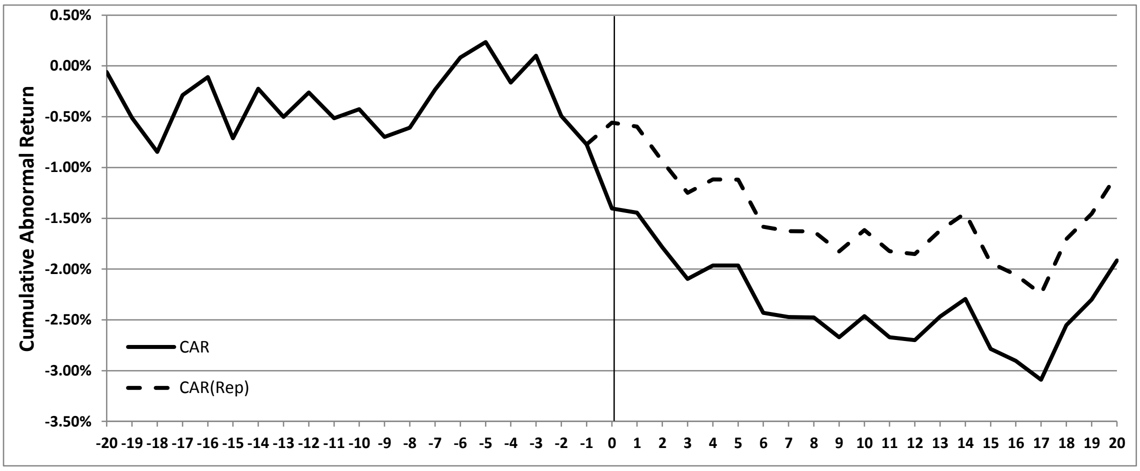
N	Window	Mean CAR (%)	t-value	N	Window	Mean CAR(Rep) (%)	t-value
73	(0,0)	-0.63	-2.70 ***	73	(0,0)	0.22	0.92
73	(-1,+1)	-0.95	-2.35 ***	73	(-1,+1)	-0.10	-0.26
73	(-3,+3)	-1.93	-3.13 ***	73	(-3,+3)	-1.09	-1.76 **
73	(-5,+5)	-2.05	-2.64 ***	73	(-5,+5)	-1.20	-1.55 *
73	(-10,+10)	-1.95	-1.82 **	73	(-10,+10)	-1.10	-1.03
73	(0,+1)	-0.67	-2.03 **	73	(0,+1)	0.18	0.53
73	(-1,+3)	-1.60	-3.07 ***	73	(-1,+3)	-0.76	-1.45 *
73	(-1,+5)	-1.47	-2.38 ***	73	(-1,+5)	-0.63	-1.01
73	(-1,+10)	-1.97	-2.43 ***	73	(-1,+10)	-1.12	-1.39 *

This table displays cumulative abnormal returns (CAR) and cumulative abnormal returns adjusted for the nominal loss amount (CAR(Rep)) for different event windows. CAR(Rep) is adjusted by adding the loss amount divided by the market value at day [0]. To test for statistical significance t-statistics based on Brown and Warner (1985) are displayed next to the CAR and CAR(Rep). ***/**/* indicate significance at the 1%-/5%-/10%-level (unilateral test).

Table C.7 presents cumulative abnormal returns and adjusted cumulative abnormal returns for different event windows around the settlement date. When not adjusting for the loss amount I find significantly negative cumulative abnormal returns for all event windows ranging from -0.63 percent to -2.05 percent. Even after correcting for the direct impact of financial losses, adjusted cumulative abnormal returns are negative and statistically significant for several different event windows. That is, the market value loss exceeds the operational loss, which I attribute to negative impacts on firm reputation.

Figure C.2 illustrates the negative stock price reaction to the announcement of settlement (solid line) by reporting cumulative abnormal returns from day [-20] to day [+20] around the settlement date. The impact on firm reputation is indicated by the dashed line, as the effect of the financial loss is accounted for at day [0] by adding the loss amount divided by the market value. The price reversal observed after the negative stock price reaction to the initial news article (see Figure C.1) is much less pronounced after the settlement date (see Figure C.2), when losses are confirmed and have to be considered as definite.

Figure C.2: (Adjusted) CAR for all loss events around the settlement date



This figure displays cumulative abnormal returns from day [-20] to day [+20] around the date of the initial news article. For the dashed line the loss amount divided by the market value is added at day [0] to illustrate the impact of operational losses on reputation.

Table C.8 summarizes the results on stock market returns around the settlement date for operational losses by event type. At the time of settlement 30 operational losses are categorized as internal or external fraud events. The corresponding results are reported in Panel A. Uncorrected abnormal returns do not differ qualitatively from overall findings. Cumulative abnormal returns are negative and statistically significant for most of the event windows around the settlement date. Naturally, the return adjustment (0.96 percentage points) for the direct impact of losses brings cumulative abnormal returns closer to zero. After the adjustment abnormal returns remain significantly negative for three symmetric event windows. The stock market reaction to the announcement of settlement for the 39 CPBP event type losses is quite similar (see Panel B). Unadjusted cumulative abnormal returns are negative and statistically significant for all but one of the symmetric event windows. After accounting for the return adjustment (0.81 percentage points) there is only little evidence for reputational damage provided by a significantly negative cumulative abnormal return over the [-10,+10] event window. Adding the loss amount divided by the market value even yields a positive and statistically significant adjusted abnormal return at day [0]. At the time of settlement only four events remain in the group of other operational losses. Consequently mean abnormal returns are rather volatile and not statistically significant with the exception of the abnormal return not corrected for the direct impact of the loss on the event day. Comparing the results over different event types does not reveal any remarkable differences, with the exception of the positive abnormal return at day [0] for the CPBP events after the return adjustment mentioned above.

Table C.8: (Adjusted) CAR by event type around the settlement date

N	Window	Mean CAR (%)	t-value	N	Event Window	Mean CAR(Rep) (%)	t-value
Panel A: Operational losses involving fraud (i.e. of the event types internal and external fraud)							
30	(0,0)	-1.15	-3.00 ***	30	(0,0)	-0.19	-0.49
30	(-1,+1)	-0.90	-1.36 *	30	(-1,+1)	0.06	0.09
30	(-3,+3)	-2.58	-2.55 ***	30	(-3,+3)	-1.62	-1.60 *
30	(-5,+5)	-2.95	-2.33 **	30	(-5,+5)	-1.99	-1.57 *
30	(-10,+10)	-0.48	-0.27	30	(-10,+10)	0.48	0.27
30	(0,+1)	-0.79	-1.47 *	30	(0,+1)	0.17	0.31
30	(-1,+3)	-2.17	-2.54 ***	30	(-1,+3)	-1.21	-1.41 *
30	(-1,+5)	-2.39	-2.37 ***	30	(-1,+5)	-1.43	-1.42
30	(-1,+10)	-2.37	-1.79 **	30	(-1,+10)	-1.41	-1.07
Panel B: Operational losses of the CPBP (Clients, Products and Business Practices) event type							
N	Window	Mean CAR (%)	t-value	N	Window	Mean CAR(Rep) (%)	t-value
39	(0,0)	-0.19	-0.56	39	(0,0)	0.63	1.89 **
39	(-1,+1)	-1.00	-1.74 **	39	(-1,+1)	-0.19	-0.33
39	(-3,+3)	-1.59	-1.80 **	39	(-3,+3)	-0.77	-0.88
39	(-5,+5)	-1.49	-1.34 *	39	(-5,+5)	-0.67	-0.61
39	(-10,+10)	-3.18	-2.08 **	39	(-10,+10)	-2.37	-1.55 *
39	(0,+1)	-0.62	-1.31 *	39	(0,+1)	0.20	0.42
39	(-1,+3)	-1.30	-1.74 **	39	(-1,+3)	-0.48	-0.65
39	(-1,+5)	-0.87	-0.98	39	(-1,+5)	-0.05	-0.06
39	(-1,+10)	-1.83	-1.58 *	39	(-1,+10)	-1.01	-0.88
Panel C: Other operational losses							
N	Window	Mean CAR (%)	t-value	N	Window	Mean CAR(Rep) (%)	t-value
4	(0,0)	-0.87	-1.35 *	4	(0,0)	-0.62	-0.96
4	(-1,+1)	-0.66	-0.59	4	(-1,+1)	-0.41	-0.37
4	(-3,+3)	-0.37	-0.22	4	(-3,+3)	-0.12	-0.07
4	(-5,+5)	-0.60	-0.28	4	(-5,+5)	-0.35	-0.16
4	(-10,+10)	-0.73	-0.24	4	(-10,+10)	-0.48	-0.16
4	(0,+1)	-0.23	-0.25	4	(0,+1)	0.02	0.02
4	(-1,+3)	-0.29	-0.20	4	(-1,+3)	-0.04	-0.03
4	(-1,+5)	-0.37	-0.22	4	(-1,+5)	-0.12	-0.07
4	(-1,+10)	-0.29	-0.13	4	(-1,+10)	-0.04	-0.02

This table displays cumulative abnormal returns (CAR) and cumulative abnormal returns adjusted for the nominal loss amount (CAR(Rep)) for different event windows. CAR(Rep) is adjusted by adding the loss amount divided by the market value at day [0]. To test for statistical significance t-statistics based on Brown and Warner (1985) are displayed next to the CAR and CAR(Rep). ***/**/* indicate significance at the 1%-/5%-/10%-level (unilateral test).

Results on stock returns around the settlement date for operational losses by relative loss size are provided in Table C.9. For operational losses with large relative size (Panel A) cumulative abnormal returns around the settlement date are significantly negative reaching as low as -2.72 percent over a [-5,+5] event window. The adjustment for the large relative size of losses results in significantly positive cumulative abnormal returns corrected for the loss amount over event windows of less than three days and brings corrected cumulative abnormal returns for longer event windows closer to zero. As a result, only three of the symmetric event windows indicate damages to reputation as corrected cumulative abnormal returns are still significantly negative. Not surprisingly the stock market reaction to the announcement of settlement is less abrupt for operational losses of small relative size (Panel B). However, cumulative abnormal returns are statistically significant negative for several different event windows and even fall below 2.2 percent for some of the longer event windows. Naturally, the small relative size of losses results in a very small adjustment of cumulative abnormal returns when accounting for the loss amount. In consequence, corrected cumulative abnormal returns remain statistically significant negative for several different event windows after the adjustment.

Table C.9: (Adjusted) CAR by relative loss size around the settlement date

Panel A: Operational losses with large relative size (median level: 0.09% of market cap)							
N	Window	Mean CAR (%)	t-value	N	Window	Mean CAR(Rep) (%)	t-value
49	(0,0)	-0.63	-1.97 **	49	(0,0)	0.63	1.97 **
49	(-1,+1)	-0.95	-1.71 **	49	(-1,+1)	0.31	0.56
49	(-3,+3)	-2.36	-2.80 ***	49	(-3,+3)	-1.11	-1.31 *
49	(-5,+5)	-2.72	-2.57 ***	49	(-5,+5)	-1.46	-1.39 *
49	(-10,+10)	-2.06	-1.42 *	49	(-10,+10)	-0.81	-0.55
49	(0,+1)	-0.66	-1.47 *	49	(0,+1)	0.59	1.31 *
49	(-1,+3)	-1.89	-2.65 ***	49	(-1,+3)	-0.63	-0.89
49	(-1,+5)	-1.77	-2.10 **	49	(-1,+5)	-0.52	-0.61
49	(-1,+10)	-1.85	-1.68 **	49	(-1,+10)	-0.60	-0.54

Panel B: Operational losses with small relative size (median level: 0.09% of market cap)							
N	Window	Mean CAR (%)	t-value	N	Window	Mean CAR(Rep) (%)	t-value
24	(0,0)	-0.64	-1.92 **	24	(0,0)	-0.63	-1.88 **
24	(-1,+1)	-0.97	-1.46 *	24	(-1,+1)	-0.95	-1.44 *
24	(-3,+3)	-1.06	-1.05	24	(-3,+3)	-1.05	-1.04
24	(-5,+5)	-0.68	-0.54	24	(-5,+5)	-0.67	-0.53
24	(-10,+10)	-1.71	-0.97	24	(-10,+10)	-1.69	-0.97
24	(0,+1)	-0.69	-1.46 *	24	(0,+1)	-0.67	-1.25
24	(-1,+3)	-1.02	-1.37 *	24	(-1,+3)	-1.01	-1.18
24	(-1,+5)	-0.86	-0.85	24	(-1,+5)	-0.85	-0.84
24	(-1,+10)	-2.21	-1.67 **	24	(-1,+10)	-2.19	-1.66 **

This table displays cumulative abnormal returns (CAR) and cumulative abnormal returns adjusted for the nominal loss amount (CAR(Rep)) for different event windows. CAR(Rep) is adjusted by adding the loss amount divided by the market value at day [0]. To test for statistical significance t-statistics based on Brown and Warner (1985) are displayed next to the CAR and CAR(Rep). ***/**/* indicate significance at the 1%-/5%-/10%-level (unilateral test).

Overall, the results from the event study suggest the following implications. First, nominal loss amounts which are typically recorded in internal and external loss collections[10], may significantly underestimate the risk associated to operational losses because losses due to reputational damage are neglected. Second, even if not triggered by more stringent regulatory requirements, further improving the risk management mechanisms to avoid losses from operational (and reputational) risk, may be in the shareholders' best interest because reputational losses can be extremely costly.

5 Multivariate analysis of stock returns

After assessing the impact of operational losses on stock returns and separating the direct effect of the operational loss from damages to reputation, the following analysis focuses on explaining what drives reputational damages caused by operational loss events. Therefore several characteristics of loss events and firm characteristics are included as explanatory variables in a regression model with cumulative abnormal returns adjusted for the impact of the loss amount on the left hand side. As for the characteristics of the loss event the following indicator variables are included: *internal fraud*, *external fraud*, and *CPBP*. These variables equal one if losses belong to the event type category and zero otherwise. *Other* is the category not included in the regressions. For the analysis of the stock market reaction to the initial news article, the variable *knowledge of loss amount* indicates whether loss amounts are known on the event date (one if yes, zero otherwise). With respect to firm characteristics the variable *total assets* is a proxy for firm size, *price to book value* controls for differences in the market's valuation of banks relative to their book value, and the ratio of *total liabilities to total assets* is a measure of financial leverage. Finally, the variable *time*, which equals the number of days between January 1st 1990 and the event date, is included in the regression to control for a potential time trend. All regressions are estimated using Eicker-Huber-White heteroskedasticity-robust standard errors. Low VIF values for all independent variables (below 5) suggest that multicollinearity is not causing problems. Results of the analysis of stock market returns around the date of the initial news article are presented in Table C.10, results of the analysis of returns around the settlement date in Table C.11.

[10] The use of internal and external loss data is required when using the Advanced Measurement Approach (AMA) to quantify operational risk.

Table C.10: Regression analysis of stock market returns around the date of the initial news article

	CAR(Rep) (0)	CAR(Rep) (-3,+3)	CAR(Rep) (-5,+5)	CAR(Rep) (-10,+10)	CAR(Rep) (0,+1)	CAR(Rep) (-1,+3)	CAR(Rep) (-1,+5)	CAR(Rep) (-1,+10)
Internal fraud (yes=1/no=0)	1.4893	2.1853	2.7312	-2.3371	1.6480 *	1.6123	1.6180	-1.5203
	(1.57)	(1.43)	(0.97)	(-1.14)	(1.81)	(1.23)	(0.89)	(-0.82)
External fraud (yes=1/no=0)	-0.0045	-1.3428	-0.2947	-2.9129	0.2994	-3.3498	-3.1799	-4.4960
	(-0.00)	(-0.53)	(-0.07)	(-0.72)	(0.23)	(-1.51)	(-0.98)	(-1.07)
CPBP (yes=1/no=0)	-0.1178	-0.4417	0.4076	-4.3424 **	0.1176	-0.5625	-0.5354	-2.5725 *
	(-0.15)	(-0.31)	(0.14)	(-2.52)	(0.15)	(-0.49)	(-0.31)	(-1.66)
Knowledge of loss amount (yes=1/no=0)	-0.2953	0.53059	0.70055	-0.8453	0.32077	0.60438	2.0647 *	1.1993
	(-0.44)	(0.51)	(0.59)	(-0.52)	(0.47)	(0.62)	(1.87)	(0.72)
Total assets (in bn. Euro)	0.0011	-0.0002	-0.0018	-0.0014	-0.0004	-0.0007	-0.0022	-0.0043 *
	(1.31)	(-0.12)	(-0.93)	(-0.61)	(-0.42)	(-0.50)	(-1.25)	(-1.68)
Total liabilities to total assets (%)	-0.2628 *	-0.2937 **	-0.4248 ***	-0.5957 ***	-0.1930	-0.1991	-0.3350 ***	-0.3462 **
	(-1.82)	(-2.45)	(-4.81)	(-3.26)	(-1.30)	(-1.43)	(-3.39)	(-2.53)
Price to book value	0.5191	0.9743	-0.0319	-1.1979	0.5348	0.3356	-0.6121	-1.6224
	(0.84)	(1.07)	(-0.03)	(-0.89)	(0.89)	(0.39)	(-0.73)	(-1.29)
Time (days since January 1st, 1990)	-0.0003	-0.0003	0.0000	0.0003	-0.0001	0.0000	-0.0001	0.0002
	(-0.82)	(-0.38)	(-0.05)	(0.24)	(-0.21)	(-0.02)	(-0.11)	(0.17)
Constant	24.900 *	27.267 **	40.595 ***	61.723 ***	17.449	18.567	34.008 ***	39.103 **
	(1.89)	(2.25)	(3.6)	(3.13)	(1.25)	(1.39)	(3.03)	(2.60)
Adj. R^2	0.1522	0.1336	0.1713	0.1400	0.1335	0.1393	0.2072	0.1421
Prob > F	0.2151	0.0388	0.0000	0.0010	0.4796	0.0887	0.0000	0.0001
N	136	136	136	136	136	136	136	136

This table shows results based on OLS regressions of CAR adjusted for the impact of loss amounts on loss event and firm characteristics. The independent variables are defined as follows: internal fraud, external fraud and CPBP are indicator variables for the event type of the loss. Knowledge of loss amount indicates whether the loss amount was known at the time of the initial news item. Total assets is the book value of total assets, total liabilities to total assets is the ratio of total liabilities to total assets (in %), and price to book value equals the market value compared to the book value of a firm on the event date. Time is equal to the number of days between January 1st, 1990 and the event date. T-values are given in parentheses. ***/**/* indicate statistical significance at the 1%-/5%-/10%-level. All regressions are estimated using Eicker-Huber-White heteroskedasticity-robust standard errors.

Results of the analysis of stock returns around the first press date show that coefficients of the event type variables are not significant with few exceptions in single regressions for some event windows (Table C.10) and not significant for any of the event windows in the analysis of stock returns around the settlement date (Table C.11). Thus, damages to reputation seem to be largely unaffected by event characteristics. As the coefficient of the variable *knowledge of loss amount* is not significant in the regressions with only one exception, investors apparently assign similar reputational penalties independently of whether loss amounts are known at the time of the first announcement or not (see Table C.10). With respect to company characteristics, the coefficient of the variable *total liabilities to total assets* is significantly negative (at the 10 percent level or better) for all of the symmetric event windows and several of the asymmetric windows in the analysis of stock returns around the date of the initial news article (Table C.10).

In the analysis of stock returns around the settlement date the coefficient of the variable *total liabilities to total assets* is significantly negative (at the 1 percent level) for all event windows (Table C.11). Thus, financial firms with a high level of liabilities suffer more severe damages to reputation from operational loss events than companies with more equity. A possible explanation for this finding is that the reasons for reputational damage cited above are exacerbated by financial distress. In contrast, according to the regression results presented, other firm characteristics, in particular the price to book value of firms and firm size (in terms of *total assets*), do not affect the impact of operational losses on reputation. In sum, multivariate regression results emphasize the importance of the findings from the previous section because the regressions show that banks with a low equity cushion are the ones most sensitive to reputational damage.

Table C.11:Regression analysis of stock market returns around the settlement date

	CAR(Rep) (0)	CAR(Rep) (-3,+3)	CAR(Rep) (-5,+5)	CAR(Rep) (-10,+10)	CAR(Rep) (0,+1)	CAR(Rep) (-1,+3)	CAR(Rep) (-1,+5)	CAR(Rep) (-1,+10)
Internal fraud (yes=1/no=0)	-0.4181	2.8984	4.7572	2.2736	-0.3920	2.6560	4.4596	2.8511
	(-0.37)	(1.29)	(1.22)	(0.91)	(-0.39)	(1.08)	(1.13)	(0.74)
External fraud (yes=1/no=0)	-1.5108	-5.3574	-3.1449	4.4863	-2.3548	-4.6901	-4.7842	-0.8885
	(-0.95)	(-1.45)	(-0.51)	(0.96)	(-1.62)	(-1.22)	(-0.79)	(-0.15)
CPBP (yes=1/no=0)	0.0369	1.3419	3.8223	-0.8326	-0.6974	1.7229	4.1451	2.7837
	(0.04)	(0.63)	(0.95)	(-0.35)	(-0.94)	(0.69)	(1.00)	(0.68)
Total assets (in bn. Euro)	-0.0001	-0.0026	-0.0016	0.0025	0.0002	-0.0029	-0.0025	-0.0013
	(-0.10)	(-1.10)	(-0.48)	(0.88)	(0.13)	(-1.28)	(-0.81)	(-0.57)
Total liabilities to total assets (%)	-0.3487 ***	-0.2616 ***	-0.2326 ***	-0.6113 ***	-0.3634 ***	-0.3374 ***	-0.2527 ***	-0.4631 ***
	(-18.22)	(-3.81)	(-2.75)	(-8.50)	(-14.07)	(-5.30)	(-3.25)	(-7.09)
Price to book value	0.7663 *	1.4104	0.6332	1.0679	0.7627	1.1251	0.4735	0.7985
	(1.97)	(1.47)	(0.55)	(0.80)	(1.23)	(1.52)	(0.50)	(0.88)
Time (days since January 1st 1990)	0.0006 *	0.0008	0.0001	-0.0006	0.0010 **	0.0012	0.0013	0.0009
	(1.91)	(0.83)	(0.10)	(-0.40)	(2.31)	(1.48)	(1.19)	(0.79)
Constant	29.085 ***	18.735 *	17.694	56.213 ***	28.423 ***	24.214 ***	14.289	35.624 ***
	(10.15)	(1.93)	(1.36)	(4.83)	(7.01)	(2.80)	(1.23)	(3.52)
Adj. R^2	0.4844	0.3277	0.1733	0.1973	0.4040	0.3781	0.2507	0.2256
Prob > F	0.0000	0.0000	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000
N	73	73	73	73	73	73	73	73

This table shows results based on OLS regressions of CAR adjusted for the impact of loss amounts on loss event and firm characteristics. The independent variables are defined as follows: internal fraud, external fraud and CPBP are indicator variables for the event type of the loss. Total assets is the book value of total assets, total liabilities to total assets is the ratio of total liabilities to total assets (in %), and price to book value equals the market value compared to the book value of a firm on the event date. Time is equal to the number of days between January 1st, 1990 and the event date. T-values are given in parentheses. ***/**/* indicate statistical significance at the 1%-/5%-/10%-level. All regressions are estimated using Eicker-Huber-White heteroskedasticity-robust standard errors.

In order to control for the potential influence of event characteristic in more detail, several other variables were included in the regression models. Alternative models estimated for the analysis of stock returns around the first press date included a variable counting the *number of losses in the same company*, a dummy variable indicating whether the loss is the *first loss within one year* (one if yes, zero otherwise) and a dummy variable for *relative size* (one if relative loss size above median, zero otherwise). The regressions for the analysis of stock returns around the settlement date also contained a variable counting the *days elapsed since first press date*. Results (not reported) show that coefficients of these additional variables turn out to be insignificant and, more importantly, overall results as presented above (Table C.10 and Table C.11) are not sensitive to these changes. While this seems to be in line with the overall finding that event characteristics do not explain reputational damage, the nature of data used for this analysis may cause some problems for two of the additional variables above. The ÖffSchOR database collects information on operational losses from public sources. However, no claim can be made that all publicly reported losses are contained in the data, which in turn may lead to inaccuracy of the variables *number of losses in the same company* and *first loss within one year*.

6 Conclusion

This paper studies the impact of operational losses on the reputation of European financial companies by examining the stock market reaction to information on operational loss events. More precisely, I assess cumulative abnormal returns around the date of the initial news article and the settlement date of operational losses. Correcting for the impact of the loss amount allows for an analysis of damages to reputation due to operational losses. The analysis is based on a new data set from a German data provider allowing for a specific focus on the European financial industry. Results show significant negative abnormal returns following first indications of the loss in the press. The negative stock market reaction to the announcement of settlement is somewhat more pronounced. Even after accounting for the direct financial impact of operational losses I observe significant negative cumulative abnormal returns, providing evidence for the negative impact of operational losses on firm reputation. In contrast to previous literature, I do not find that reputational damages differ by event characteristics[11]. However, multivariate regression results suggest that financial companies with a high liabilities to assets ratio suffer more severe reputational damages from operational loss events than companies with more equity. Furthermore, damages to reputation caused by operational loss events seem to be largely unaffected by firm size and the price to book value of firms.

[11] There are several potential reasons why the results for European banks differ in some respects from the findings for the US. First, the present study suggests that company characteristics may play a role. Beyond the characteristics included in this study, it is possible that differences in the ownership structure of firms have an influence on how investors react to operational risk events (e.g., small investors might overestimate the impact of events with a lot of media attention). Second, recent empirical findings of the corporate governance literature provide evidence that the tone of the news has an impact on stock returns (see Carretta et al., 2011). Following this line of argument, differences in media reporting might explain part of the differences in results.

Overall, results show that capital requirements for operational risk based on nominal loss amounts which are typically recorded in internal and external loss collections, may significantly underestimate the risk associated to operational losses because losses due to reputational damage are neglected. This is particularly critical, because damages to reputation are more pronounced for banks with high leverage (i.e., a low equity cushion). Results also suggest that even if regulation neglects the reputational losses associated to operational risk, improving the risk management mechanisms in place to avoid such losses may be money well spent from a shareholder value perspective because reputational losses (even though hard to quantify for a single event) can be extremely costly.

Provided the necessary data is available, future research may conduct similar analyses for other financial instruments such as bonds, credit default swaps and equity swaps. While Plunus et al. (2009) are currently working on the analysis of bonds, swaps have not been considered in a similar setting so far. Over the long run, deficits in (operational) risk management and changes in bank reputation will be reflected in the credit rating of banks. Thus, for a more long-term perspective future research may also look at rating downgrades to examine the effect of operational risk and damages to bank reputation.

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Essay D:

How Much Should Creditors Worry About Operational Risk? The CDS Spread Reaction to Operational Risk Events

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1 Introduction

Losses of financial institutions due to operational risk are often highly publicized events because they result – almost by definition[1] – from some kind of (intentional or unintentional) wrongdoing, failure or problem with a unique "story", which is readily covered by the media. Previous research on operational risk examines the market reaction to news items reporting operational losses and the associated wealth effects. More precisely, several studies focus on the shareholder wealth effects of operational risk events using stock market data (de Fontnouvelle and Perry, 2005;

[1] In consequence of its binding character, the Basel definition is now by far the most prevalent definition of operational risk. According to the Basel Committee operational risk is "the risk of losses resulting from inadequate or failed internal processes, people and systems or from external events" (Basel Committee, 2006, p. 144).

Cummins et al., 2006; Gillet et al., 2010; Sturm, 2013a), while Plunus et al. (2012) investigate the effects of operational losses on the bond market.

Empirical results from the stock market are not only interesting for shareholders; they are also of relevance in the context of the regulatory changes of Basel II introduced in 2006, which require banks to hold capital in order to buffer losses from operational risk.[2] Since the full scope of operational losses is notoriously difficult to quantify (e.g., because of damages to reputation) results from the stock market provide another estimate of the losses resulting from operational risk (i.e., other than nominal and/or reported loss amounts).[3] This paper is similar to previous work in that it assesses the impact of operational losses on the banks incurring the loss by looking at the market reaction to the announcement of operational risk events. In contrast to prior studies, however, this paper looks at credit default swaps (CDS), thus taking the perspective of creditors (not shareholders), and addresses the following question: To what extent do large operational risk events affect the default risk and, thus, debt holders of the banks' incurring the loss? In order to provide an answer to this question, the following analysis examines CDS spreads, which can be interpreted as an insurance premium for protection against the risk of default.

The paper is motivated by the fact that rating agencies give considerable importance to operational risk when evaluating the creditworthiness of financial institutions (Moody's, 2003; Ferry, 2003; Fitch, 2004). More detailed examples of rating changes triggered by operational risk include the downgrade of Société Générale by Fitch, Moody's as well as Standard & Poor's following the enormous loss caused by the trader Jérôme Kerviel in 2008 (Fitch, 2008; Moody's, 2008; Standard & Poor's, 2008); similarly, Moody's places the rating of UBS on review after the loss due to unauthorized trading by Kweku Adoboli (Moody's, 2011). News items such as these suggest the use of ratings to study the impact of operational risk on the soundness of financial institutions, even though ratings are obviously influenced by many other factors (especially when not triggered by a single event). However, ratings are commonly issued as credit grades (e.g., from

[2] The Basel Committee has recently stressed the importance given to operational risk with the publication of its Principles for the Sound Management of Operational Risk (Basel Committee, 2011a) and the Supervisory Guidelines for the Advanced Measurement Approaches (Basel Committee, 2011b).

[3] The loss in market value may be seen as a more comprehensive estimate of the loss compared to the nominal or pure financial loss amounts typically reported.

AAA to C or D). Consequently, issuers are assigned to a specific rating class rather than given a rating on a continuous scale. Therefore, ratings are at best a very rough measure for the impact of operational losses on a bank's default risk in cases where the loss is large enough to trigger a rating change (or review). In contrast, CDS spreads, expressing a reference entity's default risk as an insurance premium, can adjust continuously on a daily basis also reflecting smaller variations in a bank's creditworthiness, e.g. due to changes in the exposure to operational risk. Furthermore, the empirical work by Norden and Weber (2004) suggests that rating agencies react to changes in CDS spreads (not the other way round), indicating that information about credit quality is incorporated by markets first rather than discovered and disclosed by rating agencies.

The remainder of the paper is organized as follows: Section 2 reviews prior literature and motivates the hypotheses to be tested. Section 3 describes the dataset and the methodology used for the empirical investigation. Section 4 presents and discusses univariate as well as multivariate results for the CDS market's response to operational risk events. Section 5 concludes.

2 Related literature and hypothesis development

2.1 Related literature

The paper most closely related to this work is the study by Plunus et al. (2012). In their empirical investigation the authors examine the bond market reaction to the announcement of operational losses by financial institutions. More precisely, the authors calculate cumulated abnormal bond returns by applying traditional event study methodology to the bond market. The Plunus et al. (2012) paper is based on loss data stemming from the Algo FIRST database of the Fitch Group providing a sample of 71 losses exceeding 10 million US dollars which occurred in 41 US companies between 1994 and 2006. The authors document a significant bond market reaction for up to three different announcement dates (press, recognition and settlement date). Analyzing CDS rather than bonds offers several potential advantages: a) CDS spreads are a pure measure of credit risk not influenced by interest rate risk b) CDS markets react faster than bond markets (see, e.g., Daniels and Jensen, 2005; Blanco et al., 2005; Zhu, 2006), c) CDS spreads are available on a daily basis with a constant maturity (e.g., 5 years) and, thus, time to maturity issues are not causing problems as in the case of bonds.

Previous event study results from the stock market have documented and discussed the reputational effects of operational risk (de Fontnouvelle and Perry, 2005; Cummins et al., 2006; Gillet et al., 2010; Sturm, 2013a). Looking at the CDS market, it is difficult, if not impossible, to disentangle the impact of the financial loss and potential reputational effects because financial losses cannot be directly attributed to the equity position. From the perspective of creditors and regulatory authorities, however, the overall impact of operational losses might perhaps be of greater interest than the separated effects of the financial and reputational loss.

As of 2012 there are only a handful of event studies analyzing the impact of a certain set or type of events on CDS spreads. The reason why the history of CDS event studies (and empirical work on CDS in general) is still rather short compared to event studies focusing on the stock or bond market is that CDS have been introduced on a larger scale in the US not before 1997 (Subrahmanyam, 2012, p. 16). At the beginning, CDS were only available for major companies and it was not until 2004 when information on CDS became available on major databases (see Mayordormo et al., 2010, p. 15 for a comparison of the major data providers). Compared to the equity market, the availability and quality of information on CDS prices is more problematic because the CDS market is an over-the-counter (OTC) market (with almost exclusively institutional investors) and there are no organized exchanges or clearing houses[4] providing reliable information. Thus, the information on CDS is typically gathered from market participants by data providers but a certain extent of disagreement on prices among different sources is posing a challenge to empirical research (see Mayordormo et al., 2010, p. 9). However, with the increasing coverage and reliability of CDS data available, CDS event studies are a promising field, as they allow for an analysis of the effect on debt holders without suffering the drawbacks of bond event studies (such as limited coverage, illiquidity, and methodological issues). For a first discussion of the emerging field of CDS event studies and the applied methodology see Jacobs (2010). The remainder of this literature review summarizes a few of the most relevant papers analyzing CDS in an event study setting and provides information on the data used in these studies.

4 Central clearinghouses were introduced in the US and Europe only in 2009 in an attempt to counter the problems related to CDS in the financial crisis (for more information on ICE, providing clearing for North American and European CDS see www.theice.com).

The first authors in the field using CDS in an event study approach are Norden and Weber (2004) publishing simultaneously with Hull et al. (2004). Both studies focus on the informational efficiency of the credit default swap market by analyzing the market's reactions to rating announcements. Norden and Weber (2004) use daily spread observations of senior CDS with 5-year maturity provided by a large European bank for their analysis. The final sample contains CDS spread observations over the time from January 2000 to December 2002 for a total of 90 firms (58 from Europe). The authors look at positive and negative rating events (231 rating changes and 166 reviews) by Standard & Poor's, Moody's and/or Fitch. Hull et al. (2004) use 5-year CDS quotes from GFI, a specialized broker for credit derivatives, covering the time period from October 1998 to May 2002, but limit their analysis to corporations rated by Moody's. Overall, their sample of positive and negative rating events comprises 105 rating changes, 138 reviews and 82 outlooks. In both studies, the authors compute absolute changes in CDS spreads adjusted by the spread changes of indices constructed from their respective samples. The main result of Norden and Weber (2004) and Hull et al. (2004) is that the credit default swap market anticipates rating announcements by the major rating agencies. In the context of the present paper, this finding is important because it suggest to look at the CDS market directly (rather than the announcements of rating agencies) in order to examine the impact of operational losses on the default risk of banks suffering the loss.

Following the line of research established by Norden and Weber (2004) and Hull et al. (2004), Galil and Soffer (2011) as well as Burghof et al. (2012) are aiming at more detailed aspects of the CDS market's reaction to rating announcements. With a larger data set, Galil and Soffer (2011) confirm the previous finding that the CDS market's response to bad news is stronger than to good news.[5] Taking into account the clustering of events, the authors show that the common practice of using "uncontaminated" samples underestimates the market's response. The recent working paper by Burghof et al. (2012) does not only look at the reference entity rated by a credit rating agency but also at the companies within the same industry, thus addressing the question of spillover

[5] Norden and Weber (2004) as well as Hull et al. (2004) provide already some evidence for this observation. However, their samples for positive ratings events are relatively small.

effects. The authors find that rating announcement can result in spillover effects for firms within in the same industry. However, results vary for different industries and depend on the rating agency issuing the rating.

Among the CDS event studies not analyzing rating announcements is the work of Wei and Yermack (2011). Their study examines the reaction of stock and bond prices as well as changes in CDS spreads to the disclosure of CEOs' inside debt positions initiated by a SEC disclosure reform in 2007. The authors use data on CDS from Markit CDS pricing on 235 North American firms in their sample for the analysis of CDS spreads. In particular, they use 5-year, senior unsecured CDS arguing that this CDS type is the most common and most liquid. The results of Wei and Yermack (2011) indicate that equity prices tend to fall and debt values tend to rise when the CEO holds large amounts of inside debt. As losses to stockholders are larger than the gains to bondholders, the net effect appears to be negative.

Addressing yet another research topic, Koziol and Theis (2011) analyze debt value effects of mergers and acquisitions and use 5-year senior CDS data from Thomson DataStream for their analysis. CDS spread data availability restricts the global sample from 627 mergers and 3,252 acquisitions of non-financial companies to 20 mergers and 293 acquisitions between July 2003 and June 2007. The authors find that mergers lead to falling CDS spreads whereas acquisitions are associated with rising CDS spreads of the acquiring firm.

2.2 Hypothesis development

The previous studies on the stock market reaction to operational risk events cited above have shown that operational losses have a negative impact on stock prices. From a naïve point of view, one could argue that operational risk events should not have an impact on a bank's debt holders because financial losses are entirely borne by shareholders as the residual claimants of the bank, leaving CDS and bond markets unaffected.[6] However, while this line of argument might seem plausible for small losses it is unlikely to be true

6 Plunus et al. (2012) argue along those lines for bonds with the following statement: "As shareholders' equity represents a residual claim on the economic value of the firm, it naturally experiences the first, mechanical loss due to an operational event, whatever its magnitude and degree of certainty. Thus, although the return effect is likely to be much less pronounced on debt contracts, it is also presumably purely reputational" (Plunus et al., 2012).

in general for several reasons: First, sufficiently large (operational) losses will obviously impair a bank's ability to repay its debt, thus affecting its credit risk, and may even cause bankruptcy as in the famous case of Barings Bank. Second, previous empirical work has shown that CDS spreads and equity returns are inversely correlated, confirming intuitive considerations.[7] Thus, decreasing CDS spreads are generally associated with positive equity returns and vice versa (Acharya and Johnson, 2007). Furthermore, there is empirical evidence that CDS spreads react more strongly to negative than to positive news (see Zhang and Zhang, 2011; Acharya and Johnson, 2007). Third, large operational loss events may induce or reveal a permanent shift in the risk profile of banks, which will be reflected in higher CDS spreads after the event indicating increased (credit) risk of the reference entity. For example, the research note accompanying Moody's decision to review the credit rating of UBS in September 2011 states that the review "will centre on ongoing weaknesses in the Group's risk management and controls that have become evident again by the events leading to UBS announcing a loss due to unauthorised trading" (Moody's, 2011). Moreover, it points out clearly that it is not the financial loss itself that is causing worries as "Moody's believes that a loss of that magnitude would be manageable for the Group given its sound liquidity and capital position. However, the losses call into question the Group's ability to successfully complete the rebuilding of its investment banking operations". While Moody's acknowledges that UBS has improved its risk management, it expresses "concerns with regards to the ability of the management to develop a robust risk culture and effective control framework" and considers this "a key downside risk for the Group".

The considerations above provide reason to assume that operational losses may have an impact on CDS spreads. As there is no empirical evidence on this issue so far, the primary question to be addressed in this paper is whether CDS spreads react to the announcement of operational risk events. To be more precise, the main hypothesis is that CDS spreads increase around the announcement dates of operational risk events.

Hypothesis 1 Operational loss events have a positive impact on CDS spreads of the bank incurring the loss (i.e., spreads increase).

[7] The intuitive line of argument is that good (bad) news for the company are good (bad) news for equity holders and debt holders. However, there are interesting exceptions such as wealth-transfer and risk-shifting events.

An increase in CDS spreads might be not so much due to the financial loss itself but could also stem from a) reputational effects in the CDS market and/or b) new information revealed by the operational loss about the riskiness of the business model.

The second hypothesis focuses on the event characteristics of the loss events in the sample. Intuitively, one would expect that the market accounts for the (relative) size of the loss, i.e. the market reaction is stronger for large losses. Furthermore, following considerations in previous literature, one may argue that fraud events or events related to clients, products and business practices have a stronger impact on CDS spreads because they are particularly harmful to reputation. Since results from papers analyzing the stock market are not unambiguous, it seems appropriate to keep the second hypothesis very general.

Hypothesis 2 The CDS market reaction differs depending on event characteristics (i.e., relative loss size, loss amount and event type).

When considering the company characteristics, a bank's leverage may be an important factor for how sensitive CDS spreads react to the announcement of a loss (see Sturm, 2013a for stock market results). Similarly, a bank's credit rating may influence the CDS market's reaction to operational losses. However, two lines of argument seem plausible: On the one hand, a good credit rating could lead to a weaker market reaction providing a buffer to the operational loss. On the other hand, operational risk events could be particularly harmful to bank's with a good credit rating because a good rating implies a lower level of (operational) risk. The results expected for the CDS market may be different from stock market results because expectations about future cash flows (reflected in stock prices) are different from a banks default risk (reflected in CDS spreads). The third hypothesis tests whether the company characteristics of the bank incurring the loss influence the CDS market's reaction to the loss announcement.

Hypothesis 3 The CDS market reaction differs depending on company characteristics (i.e., leverage, credit rating, and firm size).

3 Data description and methodology

3.1 Data description and summary statistics

The information on operational losses used for the empirical analysis stems from the ÖffSchOR database operated by the Association of Public Sector Banks (Bundesverband öffentlicher Banken, VÖB). The provider systematically scans public news sources for information on operational losses and categorizes the loss events according to the regulatory guidelines. Overall, more than 1,500 loss events are reported in ÖffSchOR as of September 2012. While ÖffSchOR records all operational losses exceeding 100,000 Euro, the threshold is set to 1 million Euro for the analysis in this paper[8].

The sample of operational risk events used for the empirical analysis in this study is further restricted by the availability of CDS data. First, CDS quotes are not available before 2004 across different data providers (see Mayordormo et al., 2010, p. 13). This study uses CDS quotes from CMA Datavision, which is available via Thomson Reuters until September 2010 and information on the iTraxx Europe from Bloomberg. Consequently, the time frame considered for the investigation of CDS spreads is limited to a period of 81 months (January 2004 – September 2010). Second, only major banks are regularly traded on the CDS market providing the basis for the corresponding information to be available in the database. As in the case of the other CDS event studies presented above, 5-year senior credit default swaps are used for the analysis for reasons of availability and liquidity. The restructuring type of the CDS is MMR (Modified-Modified Restructuring) which is the most common restructuring type in Europe.[9] The final sample consists of 99 loss events from 33 different European financial institutions. Balance sheet information for all banks in the sample is from Bureau van Dijk's Bankscope database[10], credit rating information is from Standard & Poor's RatingsXpress[11]. Credit ratings are transformed into a cardinal scale as in

8 For comparison, the threshold in Plunus et al. (2012) is 10 million US dollars.

9 For more information on CDS contracts and restructuring type conventions see, e.g. Markit (2009).

10 In a few cases balance sheet information was complemented with data from annual reports.

11 There is no Standard & Poor's rating information available for three banks at the time of the event. In these cases Moody's credit rating was used.

Jorion et al. (2005) in order to obtain a numerical variable which can be included on the right hand side of multivariate regression models. Table D.1 reports summary statistics for the final sample of loss events.

Table D.1: Summary statistics for the sample of 99 loss events

	Mean	Median	Std Dev.	Min	Max
Operational losses (in million Euro)	205.06	45.00	577.63	1.10	4,900.00
Total assets (in million Euro)*	1,016,378	987,064	558,714	43,911	2,465,660
Total equity (in million Euro)*	33,093	29,936	17,287	3,846	90,130
Total liabilities (in million Euro)*	983,285	961,169	547,530	40,065	2,375,530
Total liabilities to total assets (%)*	96.31	96.56	1.47	91.24	98.55
RLS 1: Relative loss size (as % of total equity*)	0.8217	0.1196	2.0403	0.0026	15.6675
RLS 2: Relative loss size (as % of total assets*)	0.0295	0.0049	0.0657	0.0000	0.4572
Credit rating (from AAA = 1 to BBB = 9)	4.6	4 = AA-	1.4	2 = AA+	8 = BBB+

* Total assets, total liabilities, total liabilities to total assets of financial institution affected by the loss are reported as of December 31st preceding the date of the initial news article.

Table D.1 shows that the average loss in the sample is roughly 205 million Euro, whereas the median is only 45 million Euro indicating a right-skewed loss distribution. The minimum loss of 1.1 million Euro is slightly above the defined threshold of 1 million and the maximum of 4.9 billion Euro is the loss caused by Jérôme Kerviel at Société Générale. Summary information on the balance sheet structure of banks incurring the losses, their leverage, the relative size of losses (as a percentage of equity and a percentage of total assets), and credit rating information is also provided in Table D.1.

The distribution of losses over business lines and event types is displayed in Table D.2 (by number of loss events) and Table D.3 (by volume of loss amounts). Losses of the event type category "Clients, products and business practices" account for almost half of the loss events in the sample followed by the categories "Internal fraud" (27 percent) and "External fraud" (20 percent). Comparing these numbers from Table D.2 with the corresponding information in Table D.3 reveals that loss amounts caused by internal fraud are relatively large, making up 44.8 percent of total losses, while loss events from the "Clients, products and business practices" category caused only 26.2 percent of the total loss volume. Overall, the numbers reported in Table D.2 and Table D.3 are not very different from the distribution of losses over business lines and event types reported in the study of Sturm (2013a), which uses the same data from ÖffSchOR but focus on a different sample (publicly listed banks only) and a different time period (January 2000 – December 2009).

For every operational loss, two event dates are identified by searching for the corresponding news item in LexisNexis:

1. The date of the first news article mentioning the loss. While for some losses all details are disclosed on one single day, in other cases there may be only very little information released to the public (i.e., the announcement of an investigation).
2. The date of settlement for the loss. At this point in time all details of the operational loss are known. In many cases the settlement is the decision of a court or the announcement of a fine by a regulatory authority.

If the date of the first press item and the settlement date are identical, the loss event is only retained in the first group. In consequence, the sample reduces to 59 operational losses for the analysis of CDS spread changes around the settlement date.

Table D.2: Number of operational losses across business lines and event type categories

Business lines	Internal fraud	External fraud	Employment practices and workplace safety	Clients, products & business practices	Damage to physical assets	Business disruption and system failures	Execution, delivery & process management	Total across event types
Corporate finance	5.1%	2.0%	0.0%	9.1%	0.0%	0.0%	0.0%	16.2%
Trading and sales	7.1%	3.0%	1.0%	12.1%	0.0%	0.0%	1.0%	24.2%
Retail banking	4.0%	2.0%	0.0%	12.1%	0.0%	0.0%	0.0%	18.2%
Commercial banking	0.0%	3.0%	0.0%	2.0%	0.0%	0.0%	1.0%	6.1%
Payment and settlement	0.0%	0.0%	0.0%	3.0%	0.0%	0.0%	0.0%	3.0%
Agency services	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Asset management	2.0%	6.1%	0.0%	3.0%	0.0%	0.0%	0.0%	11.1%
Retail brokerage	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
No business line information	9.1%	3.0%	3.0%	5.1%	0.0%	1.0%	0.0%	21.2%
Total number of events	27	19	4	46	0	1	2	99
Total across business lines	27.3%	19.2%	4.0%	46.5%	0.0%	1.0%	2.0%	100.0%

Table D.3: Operational losses by volume (in million Euro) across business lines and event type categories

Business lines	Internal fraud	External fraud	Employment practices and workplace safety	Clients, products & business practices	Damage to physical assets	Business disruption and system failures	Execution, delivery & process management	Total across event types
Corporate finance	2.5%	1.1%	0.0%	4.0%	0.0%	0.0%	0.0%	7.5%
Trading and sales	35.9%	4.2%	0.0%	5.7%	0.0%	0.0%	0.5%	46.2%
Retail banking	0.0%	0.1%	0.0%	9.3%	0.0%	0.0%	0.0%	9.4%
Commercial banking	0.0%	3.9%	0.0%	0.1%	0.0%	0.0%	0.1%	4.2%
Payment and settlement	0.0%	0.0%	0.0%	3.0%	0.0%	0.0%	0.0%	3.0%
Agency services	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Asset management	0.0%	13.1%	0.0%	1.1%	0.0%	0.0%	0.0%	14.2%
Retail brokerage	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
No business line information	6.4%	0.1%	4.8%	3.1%	0.0%	1.0%	0.0%	15.5%
Total loss amount (in million Euro)	9,097	4,568	984	5,322	0	205	125	20,301
Total across business lines	44.8%	22.5%	4.8%	26.2%	0.0%	1.0%	0.6%	100.0%

3.2 Methodology

Adapting standard event study methodology (originally developed using stock market data) to the application on the CDS market, I estimate cumulative CDS spread changes (CSCs) and cumulative abnormal CDS spread changes (CASCs) broadly following the approach by Norden and Weber (2004). In the event study setup, CDS spread changes of the reference entity suffering the loss are adjusted by spread changes of a CDS index. As the sample consists of large European banks, the iTraxx Europe[12] is chosen as the market index. CDS spread changes are calculated for each reference entity (CDS_i) and the index ($iTraxx$) on a daily basis around the event day *t*. Subtracting the index change from the spread change of the reference entity suffering the loss yields the abnormal spread change:

$$ASC_{it} = (CDS_{it} - CDS_{it-1}) - (iTraxx_t - iTraxx_{t-1}) \quad (1)$$

Abnormal spread changes (ASCs) are easy to interpret because the resulting unit is an (abnormal) increase or decrease of CDS spreads in basis points. Even though these absolute changes in CDS spreads are widely used, a drawback of this measure is that the level of CDS spreads is not taken into account[13]. An alternative approach accounting for the level of CDS spread changes is to calculate relative changes in CDS spreads (see, e.g., Micu et al., 2006; Jacobs, 2010; Burghof et al., 2012):

$$ARSC_{it} = \left(\frac{CDS_{it} - CDS_{it-1}}{CDS_{it-1}}\right) - \left(\frac{iTraxx_t - iTraxx_{t-1}}{iTraxx_{t-1}}\right) \quad (2)$$

Average abnormal (relative) spread changes are obtained by computing the cross-sectional average across the loss events in the sample:

$$A(R)SC_t = \frac{1}{N}\sum_{i=1}^{N} A(R)SC_{it} \quad (3)$$

[12] The first series of the iTraxx Europe (Series 1) was introduced in June 2004. More precisely, data is available on Bloomberg starting June 17th, 2004. For the first months of 2004 the market index is calculated as an equally weighted index using 119 reference entities from the 125 entities of the first series where data is available as of January 1st, 2004.

[13] To give an example, there is no difference between a 5 bps increase from 5 bps to 10 bps and a 5 bps increase from 100 bps to 105 bps when calculating absolute changes in CDS spreads.

Cumulative abnormal spread changes (CASCs) and cumulative abnormal relative spread changes (CARSCs) are obtained by adding the abnormal (relative) spread changes over several days from t_1 to t_2 around the event date.

$$CA(R)SC_{t_1,t_2} = \sum_{t=t_1}^{t_2} A(R)SC_t \tag{4}$$

To test for statistical significance, cross-sectional test statistics are commonly applied in CDS event studies (see Jacobs, 2010). Following the literature, I calculate cross-sectional t-tests and non-parametric Wilcoxon signed-rank tests to analyze whether CDS spread changes are statistically different from zero (see Norden and Weber, 2004 and Burghof et al., 2012). In addition, the percentage of positive CDS spread changes is reported (for examples see Norden and Weber, 2004 and Jorion and Zhang, 2007). Given that time series data on CDS spreads for most European reference entities is not available via Thomson Reuters before January 2004, a cross-sectional approach offers the advantage of not requiring a long estimation period prior to the event.

4 Empirical results

4.1 CDS spread changes around the first press date

This section presents the event study results analyzing the CDS market's reaction to the first press date of operational losses, while the results for the settlement date are reported in section 4.2. In order to show the change in CDS spreads as observed on the market (i.e., not adjusted for the simultaneous changes of the iTraxx) and the CDS market's reaction adjusted for index changes, cumulative (relative) CDS spread changes and cumulative abnormal (relative) CDS spread changes are reported in the following tables. Table D.4 displays cumulative (abnormal) CDS spread changes for different event windows around the first press date (in basis points). The overall picture of results for CDS spread changes around the first press date is not very clear. Generally, CDS spreads seem to increase around the event date. However, cumulative CDS spread changes (CSCs) are very volatile over different event windows (even though significantly positive for some windows) and cumulative abnormal CDS spread changes (CASCs) are not statistically significant for any of the event windows with few exceptions. In order to counter a potentially increased volatility due to the financial crisis, the sample was split in two subsamples: a pre-crisis subsample with loss events before January 1st 2008 (42 observations) and a subsample covering the financial crisis with event dates after January 1st 2008 (57 observations). The volatility of spread changes is smaller in the pre-crisis sample, but results (not reported) are not more meaningful in terms of statistical significance compared to the full sample as the positive effect of smaller standard deviations is offset by smaller sample size.

Table D.4: Cumulative (abnormal) CDS spread changes for all loss events around the first press date

N	Window	Mean CSC (bps)	t-Value			% (> 0)	N	Window	Mean CASC (bps)	t-Value			% (> 0)
99	(0,0)	1.01	2.22	**	++	62.65	99	(0,0)	0.31	0.73			49.49
99	(-1,+1)	1.12	1.94	*	++	57.14	99	(-1,+1)	-0.62	-0.94			41.41
99	(-2,+2)	0.43	0.43			50.00	99	(-2,+2)	-1.34	-1.41			41.41
99	(-3,+3)	-0.42	-0.29			48.94	99	(-3,+3)	1.45	1.23			50.51
99	(-5,+5)	1.56	0.81		+	57.45	99	(-5,+5)	2.68	1.58		+	59.18
99	(-10,+10)	6.72	1.60		++	55.21	99	(-10,+10)	4.86	1.30			51.09
99	(0,+1)	1.78	3.09	***	+++	65.12	99	(0,+1)	0.75	0.16			49.49
99	(-1,+2)	1.27	1.44		+	55.29	99	(-1,+2)	-1.01	-1.21			43.43
99	(-1,+3)	0.95	0.88			56.98	99	(-1,+3)	0.27	0.31			50.51
99	(-1,+4)	1.29	1.14		+	59.09	99	(-1,+4)	1.45	1.58			48.48
99	(-1,+5)	1.53	1.08		+	59.55	99	(-1,+5)	2.02	1.75	*	+	55.56
99	(-1,+10)	0.15	0.07			50.56	99	(-1,+10)	1.60	0.80			55.21

This table displays cumulative spread changes (CSC) and cumulative abnormal spread changes (CASC) for different event windows around the first press date. ***/**/* (+++/++/+) indicate significance at the 1%-/5%-/10%-level according to the cross-sectional t-test (Wilcoxon signed-rank test). (Cumulative) spread changes of zero are not taken into account when calculating the percentage of positive spread changes.

Table D.5 presents cumulative (abnormal) relative spread changes for all operational losses around the first press date, hence, the numbers are to be interpreted as relative changes in CDS spreads (reported as a percentage similar to returns). Cumulative relative spread changes (CRSCs) are significantly positive for almost all event windows under consideration but with respect to their value still rather volatile (ranging from 1.21 percent on the event day to 8.94 percent over the [-10,+10] event window). Adjusting these spread changes for changes of the index results in smaller and less volatile spread changes, which are still positive for all event windows but only statistically significant for some of the longer ones. Generally, cross-sectional t-tests and Wilcoxon signed-rank tests produce almost identical results in terms of statistical significance.

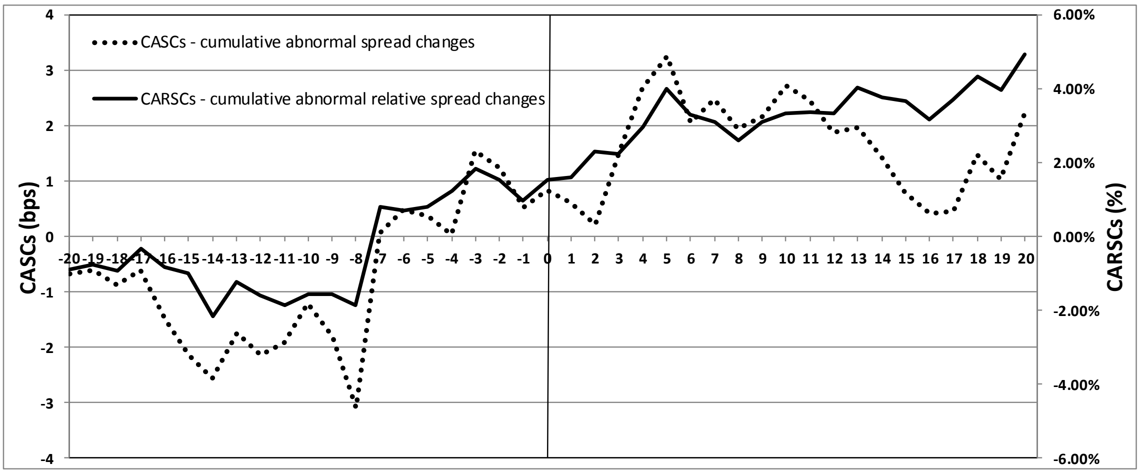
Table D.5: Cumulative (abnormal) relative spread changes for all loss events around the first press date

N	Window	Mean CRSC (%)	t-Value	% (> 0)	N	Window	Mean CARSC (%)	t-Value	% (> 0)
99	(0,0)	1.21	1.91 * ++	62.65	99	(0,0)	0.58	1.14	49.49
99	(-1,+1)	1.82	2.46 ** ++	60.00	99	(-1,+1)	0.06	0.09	49.49
99	(-2,+2)	2.58	1.96 *	53.26	99	(-2,+2)	0.48	0.47	50.51
99	(-3,+3)	1.17	0.69	51.58	99	(-3,+3)	1.00	0.68	51.52
99	(-5,+5)	4.20	2.15 ** ++	62.11	99	(-5,+5)	3.32	2.14 ** ++	60.61
99	(-10,+10)	8.94	3.41 *** +++	61.46	99	(-10,+10)	5.19	2.81 *** +++	59.60
99	(0,+1)	2.34	2.74 *** +++	65.52	99	(0,+1)	0.64	1.04	56.57
99	(-1,+2)	2.99	2.27 ** ++	58.24	99	(-1,+2)	0.76	0.79	53.54
99	(-1,+3)	2.00	1.47 +	61.29	99	(-1,+3)	0.71	0.62	58.59
99	(-1,+4)	2.54	1.69 * ++	62.37	99	(-1,+4)	1.43	1.37	48.48
99	(-1,+5)	3.64	2.26 ** +++	64.52	99	(-1,+5)	2.47	2.10 ** ++	60.61
99	(-1,+10)	2.17	1.14	54.74	99	(-1,+10)	1.80	1.32	54.55

This table displays cumulative relative spread changes (CSRCs) and cumulative abnormal relative spread changes (CARSC) for different event windows around the first press date. ***/**/* (+++/++/+) indicate significance at the 1%-/5%-/10%-level according to the cross-sectional t-test (Wilcoxon signed-rank test). (Cumulative) spread changes of zero are not taken into account when calculating the percentage of positive spread changes.

In order to give an overall picture of the impact of operational losses around the first press date, Figure D.1 puts the abnormal (absolute and relative) CDS spread changes around the first press date reported in Table D.4 and Table D.5 into a graph. This graph also visualizes the high volatility of CDS spreads around the first press date, possibly due to a high degree of informational uncertainty regarding the event and more relevant news to follow in the subsequent days. Not surprisingly, relative CDS spread changes (see CARSCs in Figure D.1, illustrated by the solid line), which take the level of CDS spreads into account, are less volatile than absolute CDS spread changes (see CASCs in Figure D.1, illustrated by the dotted line). Beyond that, the positive trend in CDS spreads seems to be more persistent when looking at the relative spread changes visualized by the solid line compared to the dotted line representing the corresponding absolute numbers.

Figure D.1: Cumulative abnormal absolute and relative spread changes for all loss events around the first press date



This figure display cumulative abnormal (relative) CDS spread changes in bps (%) from day [-20] to day [+20] around the date of the initial news.

4.2 CDS spread changes around the date of settlement

Table D.6 reports cumulative (abnormal) CDS spread changes for different event windows around the settlement date. Results show a statistically significant increase in (abnormal) CDS spread changes over different event windows around the event date. While the range of CDS spread changes is relatively large and not in all cases significant when unadjusted for changes of the iTraxx Europe (up to 12 basis points), the increase in CDS spreads narrows to the range of 3 to 7 basis points for the different event windows when index changes are accounted for. Looking across different event windows, the number of positive CDS spread changes is in line with the results for mean cumulative (abnormal) spread changes and the corresponding t-values, thus confirming overall findings. As in the case of the findings above, cross-sectional t-test and Wilcoxon signed-rank test produce almost identical results.

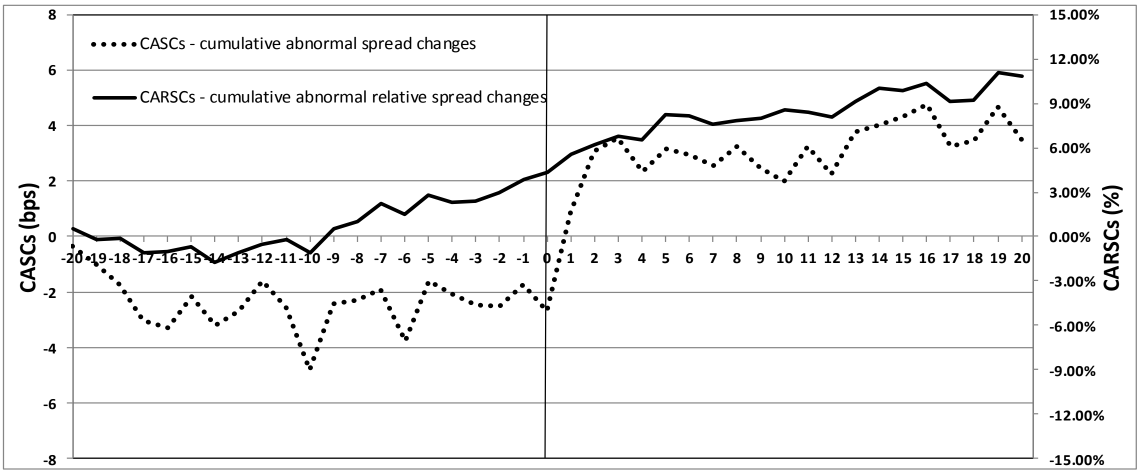
Table D.6: Cumulative (abnormal) spread changes for all loss events around the settlement date

N	Window	Mean CSC (bps)	t-Value	% (> 0)	N	Window	Mean CASC (bps)	t-Value	% (> 0)
59	(0,0)	-0.42	-0.34	49.06	59	(0,0)	-0.95	-0.85	42.37
59	(-1,+1)	2.79	2.25 **	51.79	59	(-1,+1)	3.36	3.35 *** +++	57.63
59	(-2,+2)	3.74	2.27 **	47.37	59	(-2,+2)	5.51	3.50 *** +++	61.02
59	(-3,+3)	2.92	2.33 **	49.12	59	(-3,+3)	5.65	3.77 *** +++	67.80
59	(-5,+5)	2.81	1.27	52.54	59	(-5,+5)	6.91	4.46 *** +++	72.88
59	(-10,+10)	12.25	4.35 *** +++	68.52	59	(-10,+10)	4.56	2.59 ** +++	66.10
59	(0,+1)	0.73	0.78	58.49	59	(0,+1)	2.61	3.00 *** +++	67.80
59	(-1,+2)	2.32	1.55	57.89	59	(-1,+2)	5.56	3.48 *** +++	61.02
59	(-1,+3)	2.11	1.32	53.45	59	(-1,+3)	6.07	3.76 *** +++	67.80
59	(-1,+4)	2.23	1.48	50.88	59	(-1,+4)	4.85	3.76 *** +++	67.80
59	(-1,+5)	2.77	1.63	54.24	59	(-1,+5)	5.67	4.37 *** +++	74.58
59	(-1,+10)	5.13	1.88 * ++	58.93	59	(-1,+10)	4.51	2.59 ** ++	61.02

This table displays cumulative spread changes (CSC) and cumulative abnormal spread changes (CASC) for different event windows around the settlement date. ***/**/* (+++/++/+) indicate significance at the 1%-/5%-/10%-level according to the cross-sectional t-test (Wilcoxon signed-rank test). (Cumulative) spread changes of zero are not taken into account when calculating the percentage of positive spread changes.

Figure D.2 illustrates the increase observed in abnormal CDS spreads (CASCs) around the settlement date from Table D.6 (represented by the dotted line in the chart). Considering the sharp increase in CDS spreads at day 0, the event date seems to be well identified. The solid line in Figure D.2 visualizes the relative spread changes (CARSCs) around the settlement from Table D.7 below.

Figure D.2: Cumulative (abnormal) relative spread changes for all loss events around the settlement date



This figure display cumulative abnormal (relative) CDS spread changes in bps (%) from day [-20] to day [+20] around the date of settlement.

Table D.7 presents cumulative (abnormal) relative spread changes around the settlement date, confirming the overall picture of a significant CDS market reaction to operational risk events. Abnormal relative spread changes increase by as much as 8.77 percent over a [-10,+10] event window. While it seems plausible that the settlement of the operational loss is – to some extent – anticipated (e.g., due to preliminary press coverage prior to the settlement), it is surprising that it takes up to 5 days following the event before all information is fully incorporated into CDS prices (see Table D.7 and the solid line in Figure D.2) – even more so in the light of the fact that there are only institutional investors in the market. Note, however, that this is only the case when CDS changes are measured in relative terms (see the solid line in Figure D.2), while the market's reaction is more abrupt when looking at absolute spread changes (see the dotted line in Figure D.2). Again, absolute spread changes are much more volatile than relative spread changes.

Table D.7: Cumulative (abnormal) relative spread changes for all loss events around the settlement date

N	Window	Mean CRSC (%)	t-Value	% (> 0)	N	Window	Mean CARSC (%)	t-Value	% (> 0)
59	(0,0)	1.38	1.10	50.94	59	(0,0)	0.54	0.60	50.85
59	(-1,+1)	2.59	1.79 *	53.57	59	(-1,+1)	2.58	2.56 ** ++	62.71
59	(-2,+2)	3.52	1.69 *	50.88	59	(-2,+2)	3.81	2.82 *** ++	66.10
59	(-3,+3)	4.05	2.10 **	50.88	59	(-3,+3)	4.40	3.57 *** +++	66.10
59	(-5,+5)	6.63	2.29 ** +	52.54	59	(-5,+5)	6.77	4.31 *** +++	66.10
59	(-10,+10)	17.84	4.63 *** +++	74.58	59	(-10,+10)	8.77	4.90 *** +++	71.19
59	(0,+1)	0.89	0.90	58.49	59	(0,+1)	1.71	1.91 * ++	66.10
59	(-1,+2)	1.68	1.02	56.14	59	(-1,+2)	3.21	2.38 ** ++	64.41
59	(-1,+3)	1.73	0.99	50.88	59	(-1,+3)	3.77	2.66 ** +++	66.10
59	(-1,+4)	3.05	1.67 *	54.39	59	(-1,+4)	3.56	2.60 ** +++	69.49
59	(-1,+5)	4.71	2.21 ** ++	59.32	59	(-1,+5)	5.26	2.53 *** +++	76.27
59	(-1,+10)	8.88	2.82 *** +++	64.41	59	(-1,+10)	5.58	3.05 *** +++	64.41

This table displays cumulative relative spread changes (CSRCs) and cumulative abnormal relative spread changes (CARSC) for different event windows around the settlement date. ***/**/* (+++/++/+) indicate significance at the 1%-/5%-/10%-level according to the cross-sectional t-test (Wilcoxon signed-rank test). (Cumulative) spread changes of zero are not taken into account when calculating the percentage of positive spread changes.

4.3 Multivariate analysis

Univariate results in section 4.1 have shown that the spread changes observed around the first press date of operational losses are rather volatile and even show a negative, albeit not significant sign for some event windows when adjusted for changes in the iTraxx. The overall positive trend of spread changes is in line with the hypothesis of increasing spreads, but, due to the high variation in significance levels, results should be interpreted with caution. As a consequence of the fact that univariate results for the first press date are somewhat sensitive to the choice of the event window and considering the volatility in the observed changes in spreads, it does not seem very promising to use these spread changes as a dependent variable in a multivariate regression setting.[14] Thus, it may not be a surprise that multivariate regression models with cumulative spread changes on the left-hand side and a set of company as well as event characteristics on the right-hand side are not robust to changes in the event window and the choice of variables included in the model. In addition, most model specifications have little explanatory power and do not produce meaningful results. Therefore, multivariate results for the first press date are not reported.

For the settlement date, univariate results look much more favorable in terms of a robust estimate of the CDS market's reaction to the news on the loss (see section 4.2). In order to test for a potential effect of event characteristics (Hypothesis 2) and company characteristics (Hypothesis 3), estimated (relative) abnormal spread changes are regressed on a set of explanatory variables (for summary statistics and data description

[14] Ultimately, the decision on the "right" event window would be arbitrary.

see section 3). The results from these models with cumulative abnormal (relative) spread changes around the settlement date as the dependent variable are presented in Table D.8. Regression diagnostics (i.e., normal QQ plots and residual vs. fitted plots) do not provide reasons for concern and maximum values of Cook's distance are well below 0.5 in all regression models. To counter potentially remaining problems of non-normality, heteroscedasticity or observations with leverage all regressions are estimated with Eicker-Huber-White standard errors. All models have good explanatory power in terms of R^2 and VIF values for all independent variables (below 4) suggest that multicollinearity is not causing problems.

In both cases, i.e. no matter whether absolute spread changes (Table D.8, columns 1 to 5) or relative spread changes (Table D.8, columns 6 to 10) are considered, the coefficients of the variable *relative loss size* are positive and statistically significant for all event windows under consideration (with one exception, column 6) providing evidence that the CDS market takes the size of the loss (as a percentage of equity) into account when reacting to the loss event. The coefficient is also significantly positive if loss is size measured as a percentage of total assets or by the nominal loss amount (results not reported), but models have less explanatory power. Moreover, when looking at the models with absolute spread changes as the dependent variable (Table D.8, columns 1 to 5), the coefficient for the variable *credit rating* is significantly different from zero with a negative sign for all but the shortest event window.[15] In other words, there is some evidence that – when measured in absolute spread changes – banks with a good credit rating react stronger to operational risk events than banks with a poor rating. In contrast, internal fraud events are not followed by a particularly strong CDS market reaction as one might expect because of reputational damage.[16] When looking at the results with abnormal relative spread changes as the dependent variable (Table D.8, columns 6 to 10), the opposite seems to be the case. The coefficient of the *internal fraud* variable is significantly negative for all event windows considered.

[15] One could expect the independent variables *credit rating* and *liabilities to total assets* to be strongly correlated, but the correlation between the two variables is even slightly negative (-0.13) and not statistically significant.

[16] Intuitively, it seems plausible to expect damages to reputation in cases of (internal) fraud, but there has also been the argument that cases of *intended* and *systematic* fraud cannot entirely be prevented by the management and should *not* be particularly harmful to reputation.

As a robustness check, all regression models from Table D.8 are also estimated with a time variable in order to control for a potential time effect in the results (see Table D.9). This variable *time* is counting the days since January 1st, 2000 until the event date, thus including the calendar date in the analysis. Results show that the coefficients for this time variable are positive and statistically significant in all regression models (except for the models in column 1 and 8 in Table D.9) indicating a stronger reaction of the CDS market to operational losses over the course in time, which is potentially due to the changing dynamics of the CDS market during the financial crisis. Regarding all other variables, results are very similar (in terms of sign and significance level of the coefficients) compared to the results without the time variable (compare Table D.8 and Table D.9) confirming the robustness of results.

Table D.8: Multivariate results for the settlement date with CASCs and CARSCs as the dependent variable

	(1) Mean CASC (-1,+1)	(2) Mean CASC (-2,+2)	(3) Mean CASC (-3,+3)	(4) Mean CASC (-1,+2)	(5) Mean CASC (-1,+3)	(6) Mean CARSC (-1,+1)	(7) Mean CARSC (-2,+2)	(8) Mean CARSC (-3,+3)	(9) Mean CARSC (-1,+2)	(10) Mean CARSC (-1,+3)
RLS 1: Relative loss size (as % of total equity)	1.1592 **	2.8396 ***	3.1719 ***	2.4538 ***	2.8772 ***	0.3105	1.8501 *	2.1096 **	1.3692 *	1.7526 *
	(2.37)	(3.75)	(4.49)	(3.07)	(3.62)	(0.44)	(1.90)	(2.28)	(1.69)	(1.84)
Internal fraud (yes=1/no=0)	-6.6099	-5.6741	-4.2353	-7.1316	-7.1041	-0.1247 **	-0.1436 **	-0.1199 *	-0.1240 **	-0.1368 *
	(-1.47)	(-0.87)	(-0.72)	(-1.10)	(-1.00)	(-2.40)	(-2.10)	(-1.83)	(-2.16)	(-1.91)
External fraud (yes=1/no=0)	1.5450	6.7157	3.8489	4.7537	1.2477	-0.0552	-0.0477	-0.0435	-0.0449	-0.0459
	(0.31)	(0.84)	(0.50)	(0.58)	(0.14)	(-1.06)	(-0.68)	(-0.64)	(-0.73)	(-0.64)
CPBP (yes=1/no=0)	-1.2487	1.7852	0.6582	-1.5889	-3.8451	-0.0870	-0.0593	-0.0673	-0.0790	-0.1024
	(-0.27)	(0.27)	(0.11)	(-0.24)	(-0.54)	(-1.66)	(-0.85)	(-1.02)	(-1.42)	(-1.49)
Total assets (in million Euro)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(-0.43)	(-0.20)	(0.43)	(0.49)	(1.28)	(-0.36)	(-0.57)	(0.01)	(0.33)	(0.83)
Total liabilities to total assets (%)	1.4912	-40.1705	26.8187	-83.3798	-107.3380 *	-0.1074	-0.3293	0.3822	-0.3412	-0.1356
	(0.03)	(-0.76)	(0.36)	(-1.41)	(-1.81)	(-0.26)	(-0.67)	(0.79)	(-0.59)	(-0.22)
Credit rating	-0.7110	-1.8389 **	-1.6236 *	-1.9845 **	-2.0759 **	0.0029	-0.0126	-0.0098	-0.0061	-0.0035
	(-1.28)	(-2.27)	(-1.87)	(-2.20)	(-2.19)	(0.45)	(-1.53)	(-1.10)	(-0.59)	(-0.36)
Constant	6.9725	49.9865	-16.0209	93.5139	117.3952 *	0.2017	0.4848	-0.2257	0.4466	0.2431
	(0.15)	(0.95)	(-0.22)	(1.59)	(1.96)	(0.49)	(1.00)	(-0.47)	(0.77)	(0.39)
R^2	0.2234	0.2892	0.2679	0.2477	0.2231	0.2270	0.2895	0.2939	0.1723	0.2186
Prob > F	0.0075	0.0014	0.0016	0.0176	0.0169	0.0380	0.0041	0.0455	0.0690	0.0731
N	59	59	59	59	59	59	59	59	59	59

This table shows results based on OLS regressions of CASCs and CARSCs on loss event and firm characteristics. The independent variables are defined as follows: RLS 1 is the nominal loss amount divided by the book value of equity (in %), internal fraud (17 observations), external fraud (13 observations) and CPBP (24 observations) are indicator variables for the event type of the loss. Total assets is the book value of total assets, total liabilities to total assets is the ratio of total liabilities to total assets (in %), and credit rating is the S&P credit rating on a scale from 1 (AAA) to 9 (BBB). T-values are given in parentheses. ***/**/* indicate statistical significance at the 1%-/5%-/10%-level. All regressions are estimated using Eicker-Huber-White heteroskedasticity-robust standard errors.

Table D.9: Multivariate results for the settlement date with CASCs and CARSCs as the dependent variable (robustness)

	(1) Mean CASC (-1,+1)	(2) Mean CASC (-2,+2)	(3) Mean CASC (-3,+3)	(4) Mean CASC (-1,+2)	(5) Mean CASC (-1,+3)	(6) Mean CARSC (-1,+1)	(7) Mean CARSC (-2,+2)	(8) Mean CARSC (-3,+3)	(9) Mean CARSC (-1,+2)	(10) Mean CARSC (-1,+3)
RLS 1: Relative loss size (as % of total equity)	1.1090 **	2.7215 ***	3.0404 ***	2.3225 ***	2.7331 ***	0.2453	1.7596 *	2.0230 **	1.2257	1.5997
	(2.26)	(3.64)	(4.29)	(3.07)	(3.57)	(0.34)	(1.75)	(2.08)	(1.47)	(1.60)
Internal fraud (yes=1/no=0)	-6.2823	-4.9041	-3.3786	-6.2765	-6.1649	-0.1205 **	-0.1377 *	-0.1143	-0.1146 *	-0.1268
	(-1.40)	(-0.75)	(-0.57)	(-0.97)	(-0.86)	(-2.21)	(-1.91)	(-1.65)	(-1.89)	(-1.67)
External fraud (yes=1/no=0)	1.9761	7.7290	4.9762	5.8790	2.4835	-0.0496	-0.0400	-0.0360	-0.0326	-0.0328
	(0.40)	(0.97)	(0.63)	(0.73)	(0.28)	(-0.91)	(-0.54)	(-0.50)	(-0.51)	(-0.43)
CPBP (yes=1/no=0)	-1.2370	1.8127	0.6888	-1.5584	-3.8115	-0.0869	-0.0591	-0.0671	-0.0787	-0.1020
	(-0.26)	(0.27)	(0.11)	(-0.23)	(-0.53)	(-1.58)	(-0.80)	(-0.96)	(-1.30)	(-1.37)
Total assets (in million Euro)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(-0.54)	(-0.42)	(0.10)	(0.24)	(0.96)	(-0.53)	(-0.75)	(-0.19)	(0.10)	(0.58)
Total liabilities to total assets (%)	7.4714	-26.1161	42.4551	-67.7717	-90.1960	-0.0299	-0.2216	0.4852	-0.1707	0.0462
	(0.16)	(-0.47)	(0.53)	(-1.13)	(-1.48)	(-0.08)	(-0.48)	(0.98)	(-0.32)	(0.08)
Credit rating	-0.6908	-1.7913 **	-1.5706 **	-1.9316 **	-2.0178 **	0.0032	-0.0123	-0.0094	-0.0055	-0.0029
	(-1.28)	(-2.46)	(-2.04)	(-2.26)	(-2.34)	(0.48)	(-1.62)	(-1.23)	(-0.52)	(-0.30)
Time (days since January 1st, 2000)	0.0019	0.0046 **	0.0051 *	0.0051 **	0.0056 **	0.0000 *	0.0000 **	0.0000	0.0001 **	0.0001 **
	(1.43)	(2.07)	(1.99)	(2.36)	(2.41)	(1.68)	(2.08)	(1.62)	(2.33)	(2.52)
Constant	-4.8316	22.2446	-46.8854	62.7052	83.5588	0.0486	0.2723	-0.4289	0.1099	-0.1159
	(-0.10)	(0.40)	(-0.58)	(1.06)	(1.36)	(0.12)	(0.58)	(-0.84)	(0.20)	(-0.19)
R^2	0.2389	0.3239	0.3152	0.2893	0.2722	0.2528	0.3172	0.3238	0.2418	0.2903
Prob > F	0.0174	0.002	0.0038	0.0191	0.0156	0.0314	0.0055	0.0583	0.0497	0.0543
N	59	59	59	59	59	59	59	59	59	59

This table shows results based on OLS regressions of CASCs and CARSCs on loss event and firm characteristics. The independent variables are defined as follows: RLS 1 is the nominal loss amount divided by the book value of equity (in %), internal fraud (17 observations), external fraud (13 observations) and CPBP (24 observations) are indicator variables for the event type of the loss. Total assets is the book value of total assets, total liabilities to total assets is the ratio of total liabilities to total assets (in %), credit rating is the S&P credit rating on a scale from 1 (AAA) to 9 (BBB), and time is a variable counting the days since January 1st, 2000. T-values are given in parentheses. ***/**/* indicate statistical significance at the 1%-/5%-/10%-level. All regressions are estimated using Eicker-Huber-White heteroskedasticity-robust standard errors.

4.4 Discussion of empirical results

In line with hypothesis 1, results from the event study analysis provide some evidence for a reaction of the CDS market to news about operational losses as abnormal (relative) spread changes clearly increase around the settlement date (Table D.6 and Table D.7). However, contrary to the idea that the first press article brings the most important news to the market, the settlement date seems to be more relevant from the CDS market's perspective. In part weaker results around the first press date may be explained by a higher variation in spreads resulting in the fact that the overall positive trend in spread changes (see Figure D.1) is only backed by very few statistically significant cumulative abnormal (relative) spread changes over longer event windows. For the days following the first press date, it cannot be ruled out that part of the volatility is caused by news items related to the operational loss shortly after the first press article. Another possible explanation is that for debt holders the consequences of settlement are more relevant than the first press article, which announces the operational loss but leaves important questions (e.g., regarding the loss amount, actions taken by the management, consequences of supervisors, etc.) unanswered. This should particularly be true in cases where the first press article only reveals "the tip of the iceberg" while full scale and scope of the operational loss are uncovered at a later stage.[17]

Regarding the development of cumulative abnormal (relative) spread changes over the time around the event considered for the analysis (see Figures D.1 and Figure D.2), almost all noticeable changes in spreads occur during the time from day [-10] to day [+5]. While this time period can be considered a relatively long event window for event studies in general, this seems not to be the case in the context of operational risk. Studying the duration of the market's reaction to operational risk events on the stock market, Biell and Muller (2013) find that the median length of event windows around operational loss events is 24 days and conclude that the market react quickly but not instantaneously to operational losses. When the CDS market's reaction is measured in abnormal *relative* spread changes, the results for the settlement date of this study indicate some degree of information leakage or anticipation of the operational

[17] In an effort to ensure a consistent data collection process and with respect to the applied methodology, always the very first news item was recorded as the first press article. Therefore, the date of the first press article is not necessarily the same as the date when the incidents made it to the headlines of many other media sources.

loss (Cummins et al., 2006 report similar results for the stock market, Plunus et al., 2012 for the bond market). However, when the CDS market's reaction in this study is measured in abnormal *absolute* spread changes the market's reaction around settlement takes place precisely within a few days surrounding the event date.

Turning to the discussion of multivariate results and hypothesis 2, the strongest empirical finding is that the size of the operational loss measured as a percentage of equity (alternatively as a percentage of assets or by the nominal loss amount) clearly has an impact on the CDS market's reaction to operational losses no matter whether spread changes are measured in absolute or relative terms. The CDS market does not only react to the operational risk event but the magnitude of the reaction, which indicates the increase in risk, is also clearly influenced by the relative size of operational losses. In other words, from the debt market's perspective the amount of the financial loss plays an important role even though financial losses are primarily borne by shareholders.

Contrary to what de Fontnouvelle and Perry (2005) as well as Gillet et al. (2010) find for the stock market, internal fraud events are associated with a weaker reaction of the CDS market when the market's response is measured in abnormal *relative* spread changes (columns 6 to 10 in Table D.8 and Table D.9). Interestingly, Plunus et al. (2012) also report a weaker market reaction to fraud events compared to CPBP events for the bond market confirming the difference in results between the equity and the debt market.[18]

From the set of explanatory variables regarding the company characteristics (hypothesis 3) only banks' credit rating has an impact on the CDS market's reaction to operational losses when spread changes are measured in *absolute* terms (columns 1 to 5 in Table D.8 and Table D.9). The CDS spreads of banks with a good credit rating seem to react stronger to operational losses compared to banks with a poor rating. A possible interpretation of this finding is that – in light of the operational loss – the good rating of the bank is an overly positive estimate of its credit risk and the market is even more surprised to learn about the loss resulting in a stronger reaction of spreads. Similarly, Biell and Muller (2013) report the strongest stock market reaction to operational risk events for banks with the best credit rating.

[18] The explanation Plunus et al. (2012) provide is that CPBP losses are "indicative of a degradation of the intrinsic credit quality of the firm" (Plunus et al., 2012, p. 6).

5 Conclusion

This paper is the first to investigate the CDS market reaction to the announcement of operational risk events by looking at a sample of 99 operational losses occurring at large European banks across different business lines and event types. While results for the first press date of losses are not particularly meaningful, I find that on average there is a statistically significant increase in CDS spreads around the settlement date in the range of 5 basis points or roughly 5 percent when spread changes are measured in relative terms. Multivariate regression results show that the CDS market's reaction to operational risk events is clearly influenced by the (relative) size of losses. In the sense that the market reaction is directly influenced by the financial loss itself, this suggests that the effect is not "purely reputational" as proposed by Plunus et al. (2012) for the bond market. Surprisingly, internal fraud events seem to be less harmful from the CDS market's perspective, whereas other event characteristics do not influence the CDS market's reaction to the announcement of losses. Moreover, multivariate regressions results provide evidence that the increase in CDS spreads is more pronounced for banks with a good credit rating, supporting the line of argument that financial institutions with a good credit rating suffer more from operational losses (rather than being "protected") because in case of a high rating investors are even more disappointed by the loss.

While this paper provides first evidence on the market impact of operational losses by examining CDS spreads, future research may go a step further and calculate changes in implied default probabilities from observed CDS spreads around the announcement of operational loss events.

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