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Firm, market and top management antecedents of speculation: Lessons for corporate governance

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ABSTRACT

In this paper, we explore the corporate governance traits of companies that posted hefty losses related to derivatives trading in the aftermath of the financial crisis. Using concepts from agency theory, cognitive decision making and institutional theory we theorize on potential facilitators of trading losses. Our sample is comprised of 346 companies from 10 international markets, of which 49 companies (and a subsample of 14 distressed companies) lost an aggregate of US$18.9 billion in derivatives. An event study shows that most companies experience substantial and long-term abnormal returns following these incidents. The results of a probit model indicate that the lack of a formal hedging policy, weak monitoring of the top management, overconfidence in technical trends, *hubris* and remuneration contribute to the mismanagement of hedging policies. Our study contributes to the existing financial risk management literature by identifying antecedents of derivatives losses.

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1. Introduction

The purpose of this paper is to relate risk management with corporate governance by investigating the characteristics of non-financial companies that posted hefty losses in derivatives trading during the financial crisis that started in 2007. Dodd (2009) estimates that for 12 countries that include Poland and the economies of Asia and Latin America, derivative trading affects possibly 50,000 firms, with losses of roughly $530 billion. Kamil et al. (2009) present a small subsample of companies in Mexico (6 companies) with total losses of US$4.7 billion (an average loss of 23% of total assets) and 3 companies in Brazil with total losses of US$5.5 billion—and an average loss of 46% of total assets.

During the financial crisis hedging scandals became more frequent. These scandals resulted in companies filing for bankruptcy; stocks plummeting; and costly lawsuits between companies, banks and shareholders. How this is possible, considering that the primary goal of hedging is to reduce a company's risk and ensure stable cash-flows for strategic investment (Froot et al., 1994; Stulz, 2013), is a question finance researchers have yet to answer. One explanation for this could be simple incompetence of managers confronted with increasingly complex derivatives. A more plausible explanation, however, is that those companies intentionally or carelessly engaged in speculation.

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In this paper, we analyze the factors that contributed to such derivatives mismanagement and investigate which corporate governance mechanisms failed in providing sufficient protection and monitoring to shareholders. We identify characteristics that distinguish mismanaged companies from a matched control group.

First, we show that the disclosure of losses from derivatives contracts by 49 non-financial companies results in negative abnormal results, for most companies. While this itself is not sufficient evidence of hedging failure, it is evidence of a sustained destruction of shareholder value. Then, we use a probit cross-sectional model to compare the corporate governance structure of companies with derivatives losses (treatment group) to matched companies. We establish a binary dependent variable which assumes the value 1 for the companies in our sample that reported losses and 0 for the control group without losses. Since we have a clearly defined event – the losses – the probit model is suitable to analyze which corporate governance mechanisms and characteristics fail in preventing executives from engaging in value-destroying hedging strategies. It is important to note that there are limits to the generalizability of our results due to possible sample selection. However, case control methodology is the only possible approximation of a randomized experiment in this particular empirical setting.

Our results indicate that 10 out of 14 companies experience negative absolute returns one year after the incident, confirming the long-term ramifications of financial mismanagement. We hand-collect data on qualitative indicators of corporate governance, proxies for top management *hubris*, and other management characteristics such as the remuneration scheme and the ownership stake of the management in the companies. We cannot disentangle the roles and dynamics between different positions within the top management team (i.e. CEO, CFO) which is why the interpretation of our measures and results is limited at the top management team level. Results of two econometric models based on probit panel data show that skewed incentives for managers coupled with lax governance structure (especially a formal hedging policy and no monitoring) contribute to companies' mismanagement of hedging policies.

The present paper contributes to the current literature in two ways. First, it presents hard evidence on sustained value destruction for speculating non-financial companies during the financial crisis through an event study. Second, it relates these losses to corporate governance mechanisms and to contextual developments within affected companies. Several authors have theorized about the relationship between agency theory and risk management (Sheedy, 1999; Wiseman and Gomez-Mejia, 1998) but no research, to our knowledge, has attempted to empirically model agency predictors of corporate hedging losses.

2. Risk management and corporate governance

Tufano (1996, p. 1097) remarks that academics know remarkably little about corporate risk management practices. Even though academia has been playing catch up in the last 15 years (recent models include Purnanandam, 2008; Fehle and Tsyplakov, 2005), we are still ignorant of many risk management practices. Because risk strategies are not completely disclosed in financial statements it is difficult to properly assess the extent of hedging policies and their effectiveness. In the present paper there is a clear event in which risk management strategies are unveiled as a consequence of the financial crisis. The losses by public companies are an ideal background on which to further investigate risk management practices and their effects on stock prices. We also look into the antecedents of losses, relating the corporate governance structures of the affected companies to comparable matches without reported losses.

There exists a number of direct and indirect benefits of hedging (see Fok et al., 1997; Brown, 2001; Stulz, 2013). As Stulz (1996) and Bartram (2000) show, to generate value, hedging policies need to reduce bankruptcy or distress costs related to expected tax payments, expected payments to stakeholders or costs of raising funds. Hedging practices differ immensely across companies (on determinants see Smith and Stulz, 1985; Nance et al., 1993; Mian, 1996; Goldberg et al., 1998) and the success of hedging ultimately depends on the motivations behind it (see Dobson and Soenen, 1993; Hagelin, 2003). However, it is essential to note that the success of hedging strategies must be seen in the context of the individual company's motive. Until the late 1990s the prevailing theoretical goal of hedging has been to reduce the variance of cash-flows. Stulz (1996) and others proposed that the elimination of costly lower tail outcomes and securing a company's ability to make important strategic investments should be the primary goal of hedging since. Since then, the focus shifted from reducing cost of financial distress through variance minimization to reducing cost of financial distress through reducing downside risks. In both cases, losses from hedging appear naturally. Most recently, however, Aabo (2015) has shown that these two strategies have the same effect on average, but may differ in terms of their maximum loss and standard deviation. Hence, a hedging strategy that might be considered a "failure" in one strategy may still constitute an optimal hedge for the other strategy. This makes the ex-post identification of suboptimal hedging strategies extremely difficult and contingent on prior assumptions.

Tufano (1996) shows that determining if companies hedge or not can be expressed by two variables, related to executives: the amount of shares owned by managers and the nature of the managerial compensation contract. Managers maximize their utilities through risk management in two ways: if managerial wealth is affected by share prices companies hedge substantially, the converse being true if management owns a small stake. If executive compensation involves options or similar features, managers are more risk-prone and thus hedge less.

More recent models, like Fehle and Tsyplakov (2005) and Purnanandam (2008), expand theoretical literature by including more sophisticated hypotheses, but the main results remain the same-risk management is strongly influenced by managers' incentives resulting from ownership of shares and the structure of managerial compensation (as in Tufano, 1996).

Additionally, recent literature has been investigating the impact of the institutional context on the behavior of management in designing hedging policies. The main idea is that managers are affected by the institutional environment in

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Fig. 1. Theoretical framework that impact the design of hedging strategies.

which executives are embedded. Wiseman et al. (2012) is an example of a theoretical contribution that highlights the institutional impact on risk management theory. This means that legal issues, stakeholders' proactivity, corporate governance and even managers' innate characteristics also influence risk management practices. For instance, Zhang (2009) argues that new transparency regulation in the American market (SFAS 133) may have discouraged firms' speculative use of derivative instruments; Bremer et al. (2009) show that the provision of job security as a proxy for employee interests has a significant effect on the likelihood of CFO dismissal and affects the risk-taking behavior of CFOs, thus affecting possible hedging strategies. Indjejikian and Matejka (2009) argue that firms mitigate earnings management or other misreporting practices in part by deemphasizing CFO incentive compensation; Magnan et al. (2008) find that *hubris* (characterized by exaggerated self-confidence, arrogance and oblivion to reality by executives) may be a critical factor to understand corporate financial frauds (Roll, 1986). Top management hubris can lead to overestimation of capabilities, and chances of success and to an increased propensity to take risks (Picone et al., 2014). Hubris generates a misapprehension of control and an overestimation of your own chances of success in complex uncertain tasks. Consequences of hubris are both positive and negative and include excessive R&D focus, misguided diversification strategies, overambitious internationalization, overreliance on acquisitions and excessive debt finance (Li and Tang, 2010; Picone et al., 2014). Ben-David et al. (2006) show how CFOs build overconfidence by, among other factors, a focus on a recent series of past successes. They also argue that CFOs draw their "worst case scenario" from recent realizations of the market and the firm, but upper confidence bounds are affected only by the past 3-month stock market movement. Dionne and Triki (2005) find that better educated directors relate positively to better risk management strategies and enhance corporate value. The authors find that financially educated directors seem to encourage corporate hedging while financially active directors and those with an accounting background play no active role in hedging strategies.

Moreover, it is difficult, if not impossible, for investor to properly monitor speculative behavior, good or bad, in public listed companies. Géczy et al. (2007) present a comprehensive analysis of corporate companies that actively speculate. They find that in the US, of the 186 firms in their sample using either interest rate or FX derivatives, 102 firms never speculate, 61 sometimes speculate, and 13 frequently speculate. They also find that frequent speculation is associated with weaker firm-wide governance mechanisms, but that there are improved internal controls and reports to the board regarding their activities. Internal monitoring works in lieu of corporate governance in this case.

The empirical evidence on derivatives usage shows unequivocally the relevance of such instruments for non-financial companies (e.g. Bodnar et al., 1995; Phillips, 1995; Berkman and Bradbury, 1996; Berkman et al., 1997; Fok et al., 1997; Howton and Perfect, 1998; Bodnar et al., 1998; De Ceuster et al., 2000; Mallin et al., 2001; Bartram et al., 2009).

There is no explicit theory that relates corporate governance with risk management since the theoretical background uses theories from corporate finance and agency theory. The links between agency and managerial risk taking are firmly established (Leland, 1998; Morellec and Smith, 2007; Wiseman and Gomez-Mejia, 1998) and yet under-researched (Sheedy, 1999). The theoretical framework that we follow is the one present in Fig. 1 below, and it summarizes the main findings in

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the literature. Accordingly, risk management and hedging policies are the outcome of a combination of mechanisms based on finance and agency theory. Also, these hedging policies must be seen in the broader institutional context.

3. Hypotheses, data and methodology

3.1. Data description

Given our aim is to study firms suffering losses from hedging, it is difficult to construct a reliable sample for several reasons one being that companies do not report on hedging losses often. If hedging loses are reported, they are not necessarily due to bad risk management strategies and may occur naturally as a result of changes in the prices of the underlying financial assets. A researcher would be required to test if the hedging losses are indeed matched by operational gains (including indirect effects on quantities sold) for each case. Because of these issues, we have decided to use media reports as an initial indicator of potential mismanagement and later test if there have been abnormal stock returns on the media announcements. Despite this obvious limitation regarding reporting bias, we consider this the most efficient sampling procedure, especially since the research on hedging efficiency and governance is still at as earlier stage in the corporate governance literature.

Because of such constraints, data on the 49 companies in the treatment group are hand collected following three criteria: losses should have been public, thus posted in the media through newspapers, websites, magazines etc.; financial statements should reveal those losses; finally, data on the corporate governance structure of the companies (described in Section 3.2) have to be able to be reconstructed. The idea behind using news media as a source of information has a long tradition in empirical research, leading to the development of the methodology of event studies, which we use to analyze abnormal stock returns given some new publicly available information[1]. The control group was selected using comparably sized companies in the same country and industry. For instance, take the steel industry in Brazil. There are four listed companies, one of which present large losses in derivatives, CSN, and is part of the sample of 49 companies with losses. The other companies, Aços Villares, Gerdau and Usiminas, are part of the control group. For the case of Controladora Comercial Mexicana, the other companies in the sample include El Palacio de Hierro, El Puerto de Liverpool, Grupo Sanborns, and Soriana. The idea behind the matching methodology is to use companies in the same sector and country with similar incentives to enter derivatives contracts.

The final sample has 346 companies in 10 financial markets (Australia, Brazil, China, Hong Kong, India, Indonesia, Japan, South Korea, Mexico and Poland). Companies do not post losses in the same period due to different accounting systems and the timing of the financial crisis. We use for each company the financial year in which losses are revealed. The earliest period in the sample is June of 2008 for Indian companies and the latest March of 2009 for some Chinese companies. We treat this window as a single event for the purpose of our analysis of corporate governance structures and for the event study. The 49 companies with losses in the sample combine for a total of US$18.9 billion in losses. Table 1 includes a description of variables and presents the descriptive statistics for the whole sample, divided in three categories: companies that do not post derivative losses, those that do, and a subsample of companies that experience major distress following the losses (Table 2).

Table 3 presents figures for the absolute losses and the ratio between the losses and revenues, as well as market capitalization. We can see that losses differ in size and affect large companies like Embraer, but also smaller companies. Also, losses do not discriminate by developing or developed markets or by regions—the sample includes companies from five continents and the range of revenue is US$26 million (C-Motech from Korea) to US$33.7 billion (China Railway Group). The reason we don't find evidence for other countries is that searches on media sites about derivative losses did not unearth any cases in Europe or the United States, or any other country not in the sample. Even though the sample is heavily skewed towards industrial and exporting companies that have large foreign exchange exposures, it also includes companies that are hedging other risks, such as oil prices.

Losses as a percentage of revenue range from 0.6% to 88.1%, while as a share of market capitalization from 0.9% to 651%, which shows that companies are impacted in different ways. Because of this, we create a subsample composed of companies that experience major distress in the aftermath of their announcement. Major distress is defined as bankruptcy, acquisition by another company, major asset sales (Win4Net had to sell its headquarters building) or a restructuring of derivative contracts with banks to avoid a default. This subsample includes 14 companies (APN Property, Aracruz, Sadia, Citic Pacific, Win4Net, C-Motech, Taesan, Baiksan, Kalbe Farma, Controladora Mexicana, Gruma, Vitro, Ropczyce and Odlewnie Polskie).

3.2. Event study

Losses occur naturally in hedging transactions when the underlying cash-flows or assets increase in value, ideally leading to an offset between the positions. There is a lack of consensus among researchers on the primary goal of hedging policies. Most recently the focus of scholars has moved from reducing cash-flow volatility to eliminating lower-tail outcomes (Stulz, 1996; Aabo, 2015). Depending on the motives, optimal hedging ratios differ as well as the ex-post diagnosis of the outcomes

[1] Searches were made through the Internet for media reporting on derivative losses by non-financial companies. The search was conducted in 2011 and 2012.

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Table 1
Variable description.

Primary analysis	
CAR	Cumulative abnormal return: Abnormal returns are computed given the market model parameters which are estimated with the GARCH model $r_{it} = C_i + \beta r_{mt} + \sum \lambda_h r_{i,t-h} + \varepsilon_{it}$ through the period (−190; −10) in event time, where r_{it} is the continuously compounded local return on date t in country i and r_{mt} is the continuously compounded daily market return on index on day t
MON	Lack of proper CFO monitoring: Binary variable indicating if CFO is formally responsible for managing and answering for the risk management strategy (1) or not (0) otherwise (when the audit committee or the risk committee is responsible for monitoring) (source: financial statements of the company)
DIS	Disclosure of derivatives information: Binary variable on the quality of disclosure of derivatives information compared to with the benchmark of its' market (following Solomon et al. (2000) and Zhang (2009). DIS assumes value 1 if a company does not disclose more information than it is required and 0 otherwise (source: financial statements of the company)
USA	Shares in the American market: Binary variable, assuming value 1 when the company does not have shares in the American market (source: financial statements of the company and company website)
CON	Ownership concentration: Continuous variable using proportion of shares in the hands of the three major shareholders (source: Datastream and Compustat Global)
IIN	Institutional investors: Binary variable that assumes value 1, if there is a representative for an institutional investor on the board (source: financial statements or companies' websites)
FHP	Formal Hedging Policy: Binary variable variable which assumes value 1 when the company has a policy in place and 0 otherwise (source: financial statements or companies' websites)
TRE	Trend of Major Source of Risk: exchange rate for derivatives contracts—local exchange rate against the US dollar (source: St. Louis Federal Reserve Bank). Oil prices (source: Bloomberg)
FIN	Recent Financial Results: Binary variable which indicates if the company posted higher than market-average financial results (defined as ROA higher than the average in each companies' local market) and assumes value 1 only if the result of the company beat the market in all three previous quarters (source: Datastream and Compustat Global)
REM	Remuneration: Binary variable following Indjejikian and Matejka (2009). If remuneration is tied to medium-term performance, it assumes value 0, otherwise it assumes value 1 (source: financial statements of the company and company website)
MAN	Management stake: Continuous variable that is the average of the management stake in the previous three years following Tufano (1996) (source: financial statements of the company and company website)
FAM	Family ownership: Binary variable if company is family owned (1) or not (0) (source: financial statements of the company and company website)
AGE	Firm age: Continuous variable (source: companies' websites & Datastream)
LEV	Leverage: Continuous variable based on the average financial debt ratio for the last three years (source: financial statements)
MKT	Market dummy: dummies for each international market used in first round estimation
Financial variables used in robustness checks (source: companies' websites, Datastream and Compustat)	
ROA	Return on assets
GRO	Capital expenditures/sales
TOB	Tobin's Q
DEB	Debt to equity ratio
DIV	Dividend dummy
LDR	Long-term debt ratio
SIZ	log of plant, property, equipment investment expenditures
BMR	Book to market ratio
Institutional variables used in robustness checks	
CEO	CEO duality: Binary variable that assumes value 1 for CEO duality and 0 otherwise (source: companies' websites)
HHI	Industry concentration: (National institutes of statistics)
ANA	Analyst coverage: Dummy variable, with value 1 if 3 or more analysts are dedicated to the company and 0 otherwise. (Bloomberg)
RES	Account restatements: Binary variable that assume value 1 if a company posted a restatement in the last 5 years (source: companies' websites)
GEO	Geographic diversification: Count measure of number of foreign markets in which the firm sells its product (source: companies' websites)

of hedging strategies. Firms minimizing cash-flow variance exhibit higher lower-tail outcomes in terms of a worst-case loss (Aabo, 2015). In such a case, a firm may well hedge cash-flows optimally but sustain high losses. The idea behind the event study is to verify if the losses by the sample companies can be regarded as value destroying. Even though this is not strictly an indication of failure of hedging policies, it makes sure that the market reacted negatively to the announcement of the losses.

Irrespective of the motive of risk management, hedging transaction losses should be matched to some degree by operational gains. Without detailed cash-flow data we rely on the market accurately weighing hedging losses against operational gains. Hence, we assume that if hedging losses were mostly book losses without any mismanagement involved the market would not respond with abnormal losses. Using the stock prices rather than cash flows, means that we are measuring the market response to reported losses, which relies on market participants accurately evaluating the effects and consequences of hedging losses (Martin and Mauer, 2005). Any causal interpretation of our results, hence, must be seen in the context of efficient market pricing. On the other hand, this approach has the major advantage of measuring the destruction of shareholder value directly. We follow the standard methodology summarized in MacKinlay (1997). The main caveat is that there is no precise way to define the exact period for the analysis since it is based on the date when the media reported the event.

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Table 2
Descriptive statistics.

Market	Companies with and w/o losses	No. obs.	MON		DIS		USA		CON		IIN		FHP		TRE		FIN		REM		MAN	
			Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D	Mean	S.D
Australia	No Losses	23	0.174	0.379	0.435	0.496	0.565	0.496	0.148	0.025	0.304	0.460	0.609	0.488	0.130	0.337	0.348	0.476	0.391	0.488	0.089	0.069
	Derivative losses	2	0.500	0.500	1.000	0.000	0.500	0.500	0.232	0.109	1.000	0.000	0.500	0.500	1.000	0.000	0.000	0.000	0.000	0.000	0.024	0.012
Brazil	No Losses	41	0.317	0.465	0.756	0.429	0.756	0.429	0.463	0.087	0.488	0.500	0.732	0.443	0.390	0.488	0.488	0.500	0.585	0.493	0.061	0.045
	Derivative losses	6	0.833	0.373	0.833	0.373	0.833	0.373	0.435	0.059	0.500	0.500	0.167	0.373	0.667	0.471	0.833	0.373	0.333	0.471	0.007	0.023
China	No Losses	37	0.378	0.485	0.784	0.412	0.541	0.498	0.545	0.102	0.135	0.342	0.622	0.485	0.405	0.491	0.459	0.498	0.514	0.500	0.039	0.033
	Derivative losses	6	0.500	0.500	0.833	0.373	0.833	0.373	0.473	0.065	0.000	0.000	0.333	0.471	0.667	0.471	0.833	0.373	0.500	0.500	0.018	0.021
Hong Kong	No Losses	25	0.240	0.427	0.880	0.325	0.600	0.490	0.332	0.101	0.200	0.400	0.680	0.466	0.480	0.500	0.280	0.449	0.520	0.500	0.048	0.054
	Derivative losses	2	0.000	0.000	0.500	0.500	0.500	0.500	0.208	0.201	0.500	0.500	0.000	0.000	0.500	0.500	1.000	0.000	0.500	0.500	0.038	0.033
India	No Losses	31	0.452	0.498	0.839	0.368	0.161	0.368	0.320	0.031	0.194	0.395	0.355	0.478	0.258	0.438	0.290	0.454	0.452	0.498	0.040	0.065
	Derivative losses	7	0.571	0.494	1.000	0.000	0.000	0.000	0.272	0.101	0.286	0.452	0.143	0.350	0.286	0.452	0.571	0.495	0.429	0.495	0.027	0.037
Indonesia	No Losses	25	0.400	0.490	0.720	0.449	0.200	0.400	0.302	0.091	0.240	0.427	0.400	0.490	0.320	0.466	0.360	0.480	0.440	0.496	0.019	0.030
	Derivative losses	4	0.750	0.433	0.750	0.433	0.500	0.500	0.195	0.052	0.250	0.433	0.250	0.433	0.250	0.433	0.500	0.500	0.500	0.500	0.079	0.008
Japan	No Losses	26	0.174	0.379	0.565	0.496	0.348	0.476	0.165	0.032	0.217	0.412	0.391	0.488	0.304	0.460	0.348	0.476	0.435	0.496	0.027	0.053
	Derivative losses	3	0.333	0.471	0.667	0.471	0.333	0.471	0.185	0.062	0.333	0.471	0.333	0.471	0.667	0.471	0.000	0.000	0.667	0.471	0.044	0.018
South Korea	No Losses	41	0.292	0.455	0.585	0.493	0.146	0.353	0.274	0.053	0.195	0.396	0.439	0.496	0.512	0.500	0.585	0.493	0.439	0.496	0.026	0.042
	Derivative losses	8	0.25	0.433	0.875	0.331	0.000	0.000	0.193	0.072	0.250	0.433	0.375	0.484	0.500	0.500	0.625	0.484	0.500	0.500	0.048	0.032
Mexico	No Losses	33	0.303	0.459	0.697	0.460	0.545	0.498	0.384	0.031	0.152	0.359	0.576	0.494	0.636	0.481	0.364	0.481	0.515	0.500	0.023	0.045
	Derivative losses	7	0.714	0.451	0.857	0.350	0.857	0.350	0.295	0.102	0.143	0.350	0.286	0.452	0.571	0.495	0.429	0.495	0.429	0.495	0.018	0.042
Poland	No Losses	15	0.200	0.400	0.800	0.400	0.200	0.400	0.236	0.064	0.067	0.249	0.267	0.442	0.400	0.490	0.133	0.340	0.333	0.471	0.027	0.055
	Derivative losses	4	0.250	0.433	0.500	0.500	0.000	0.000	0.184	0.102	0.000	0.000	0.000	0.000	0.250	0.433	0.500	0.500	0.250	0.433	0.052	0.034

Table 1 reports the descriptive data on the 49 companies in the sample with losses in derivatives in the year 2008. Columns give the mean and standard deviation for the main variables used in the estimation.

Table 3
Companies and losses with derivatives in the financial crisis.

Company	Country	Total Sales 2007 (US$ million)	Losses (US$ million)	Losses/revenue (%)	Losses/market cap (%)
APN European Retail Property	Australia	1319	86.14	88.1	651.0
Westfield Trust	Australia	24,322	504.79	35.6	2.3
Braskem	Brazil	11,800	737.75	7.5	10.9
Sadia	Brazil	4621	1290.52	20.8	24.3
Companhia Siderúrgica Nacional	Brazil	15,279	863.15	11.3	10.8
Embraer Sa	Brazil	8845	103.02	1.6	2.4
Aracruz	Brazil	5609	1145.91	32.2	34.5
Vicunha Textil Sa	Brazil	903	81.20	13.3	21.8
Air China	China	12,499	281.13	3.7	1.8
China Cosco Holdings	China	1067	338.36	1.8	3.4
China Eastern Airlines	China	9274	857.84	14.2	11.5
China Railway Construction	China	21,477	180.92	0.6	2.1
China Railway Group	China	29.615	595.74	1.8	6.1
Shenzhen Nanshan Power Co	China	760	30.56	6.7	6.8
China Haisheng Juice HLDG	Hong Kong	437	24.54	11.3	14.7
Citic Pacific	Hong Kong	13.694	2084.07	35.0	27.5
Aurobindo Pharma	India	909	66.68	9.4	6.1
HCL Technologies	India	1305	68.41	2.9	0.9
Kpit Cummins Infosystems	India	10.996	20.58	11.3	5.4
Rajshree Sugars & Chemicals	India	158	3.27	3.7	12.9
Sabero Organics Gujarat	India	43	3.19	3.7	3.1
Sundaram Multi Pap	India	36	5.65	19.0	8.2
Zee Entertainment Enterprise	India	997	20.34	4.1	2.5
Aneka Tambang	Indonesia	1281	27.74	3.0	1.4
Elnusa	Indonesia	230	3.22	1.2	1.5
Kalbe Farma	Indonesia	547	22.56	2.4	1.1
Timah	Indonesia	536	12.57	1.6	1.0
Ajinomoto	Japan	10.996	372.58	3.2	5.8
Ariake Japan	Japan	514	8.01	3.8	1.6
Saizeriya	Japan	539	160.45	18.8	20.5
Baiksan	Korea	109	25.45	15.6	22.3
C-Motech	Korea	85	5.37	20.0	26.8
Daewoo Shipbuilding & Marine	Korea	10,201	1,773.05	15.9	28.2
Han Kwang	Korea	147	3.68	10.0	19.2
Monami	Korea	171	18.51	7.5	10.2
Taesan LCD	Korea	272	685.67	81.3	94.2
Uju Electronics	Korea	204	10.90	13.3	5.4
Win4net	Korea	25	39.28	56.0	71.9
Alfa	Mexico	9141	537.29	5.2	6.8
Cemex	Mexico	49,908	1480.93	7.3	21.9
Controladora COML Mexic	Mexico	3756	2187.34	45.7	50.8
Gruma	Mexico	3121	1321.16	32.9	10.8
Grupo Industrial Saltillo	Mexico	1023	215.65	24.4	45.3
Grupo Posadas	Mexico	1209	128.58	20.8	18.9
Vitro	Mexico	2962	368.03	14.1	20.5
Apator	Poland	80	11.96	7.7	4.2
Odlewnie Polskie	Poland	26	47.39	77.3	46.6
Zaklady Magnezytowe Ropczyce	Poland	113	23.91	12.7	9.0
Zelmer	Poland	211	10.91	5.4	4.5

Table 2 reports data on the 49 companies in the sample with losses in derivatives in the year 2008. Columns give the companies' names, country of origin, the book value of losses, and the ratios of those losses, annual revenue and market capitalization. Market capitalization is at the immediate date before the reported losses.

For each company the event starts at time 0. As usual we present results for 7, 60 and 360-day windows. The abnormal rate of return (AR_{it}) is the difference between the actual return ($r_{i,t+e}$) and the forecast rate of return ($\hat{r}_{i,t+e}$):

$$AR_{it+e} = r_{i,t+e} - \hat{r}_{i,t+e} \tag{1}$$

The average and variation equations are based on Corhay and Tourani (1996), a GARCH (1,1) model that accounts for time-varying volatility effects. The goal is to try to find evidence of the effects of the announcement of losses with derivatives on stock prices, but here we are looking for weak evidence, and thus use the simplest specification. Variables ψ_t and h_{it-1} are respectively the information set at time t for firm i and the conditional variance. We assume a normal distribution. Equations are:

$$r_{it} = C_i + \beta r_{mt} + \sum \lambda_h r_{i,t-h} + \varepsilon_{it} \tag{2}$$

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Table 4
Abnormal daily stock market performance after announcement of derivative losses.

Company	Market	Date	Day 1 (%)	$t=0$	$t=7$	$t=60$	$t=360$
Major distress							
APN European Retail Property	Australia	8/26/2008	−5.35	−1.948	−4.030	−2.307	−16.999
Sadia	Brazil	9/25/2008	−35.50	−32.439	−41.945	−38.778	−60.477
Aracruz	Brazil	9/29/2008	−19.60	−17.009	−42.741	−55.820	−74.124
Citic Pacific	Hong Kong	10/21/2008	−55.10	−54.972	−45.952	−35.381	−19.103
C-Motech	Korea	6/2/2008	−9.50	−5.599	−1.966	−2.297	−14.492
Baiksan	Korea	7/7/2008	−8.28	−7.414	−2.675	−7.244	5.901
Taesan LCD	Korea	8/18/2008	−14.88	−14.337	−9.992	−11.930	−16.558
WIN4NET	Korea	8/14/2008	−14.85	−12.894	−8.550	3.522	4.424
Kalbe Farma	Indonesia	10/10/2008	−5.54	−1.796	2.890	7.267	13.921
Controladora COML Mexic	Mexico	10/8/2008	−75.39	−74.325	−72.157	−56.709	−31.301
Gruma*	Mexico	10/13/2008	−55.09	−53.260	−51.672	−48.449	−24.593
Vitro	Mexico	10/10/2008	−20.13	−16.988	−15.483	−1.932	−2.075
Odlewnie Polskie	Poland	10/15/2008	−5.03	−1.472	−12.025	−36.975	−35.190
Zaklady Magnezyt. Ropczyce	Poland	11/26/2008	−8.57	−8.565	−22.680	−34.576	−19.400
Non-distress							
Westfield Trust	Australia	8/26/2008	−3.36	−1.371	−2.298	−5.031	−2.030
Braskem	Brazil	10/3/2008	−6.30	−3.302	−0.874	−1.134	−1.811
Companhia Siderúrgica Nac.	Brazil	10/1/2008	−5.50	−1.894	2.229	1.344	0.277
Embraer Sa	Brazil	11/4/2008	−3.40	−1.382	0.380	1.097	5.235
Vicunha Textil Sa	Brazil	11/11/2008	−11.11	−10.574	−6.992	−9.859	−12.954
Air China	China	10/16/2008	−10.01	−8.704	−1.620	−1.204	−2.059
China Cosco Holdings	China	12/12/2008	−5.20	−5.178	−0.719	0.524	−1.287
China Eastern Airlines	China	10/24/2008	−5.27	−2.151	2.185	1.353	0.323
China Railway Construction	China	10/22/2008	−9.97	−6.169	−1.262	−0.276	0.155
China Railway Group	China	10/10/2008	−3.23	0.101	1.724	3.175	8.523
Shenzhen Nanshan Power Co	China	10/24/2008	−3.16	0.944	3.235	−0.622	0.861
China Haisheng Juice HLDG	Hong Kong	10/22/2008	−14.26	−13.266	−8.402	−12.109	−22.797
Aurobindo Pharma	India	3/4/2008	−3.73	−0.806	0.964	0.006	−0.006
HCL Technologies	India	7/11/2008	−5.62	−1.719	1.050	0.163	−0.113
KPIT Cummins Infosystems	India	4/28/2008	−12.41	−9.111	−5.782	−1.232	−7.201
Rajshree Sugars & Chemicals	India	3/17/2008	−8.74	−6.872	−4.159	−1.825	0.224
Sabero Organics Gujarat	India	1/7/2008	−5.00	−0.044	0.775	2.117	9.442
Sundaram Multi Pap	India	1/16/2008	−4.51	0.299	1.358	1.762	2.812
ZEE Entertainment Enterprise	India	6/10/2008	−3.53	−1.808	0.490	0.338	0.129
Aneka Tambang	Indonesia	10/17/2008	−7.85	−4.250	−1.705	−3.523	−11.033
Elnusa	Indonesia	10/8/2008	−13.03	−9.257	−5.957	−7.796	−12.609
Timah	Indonesia	10/6/2008	−31.28	−29.182	−25.012	−13.640	−5.518
Ajinomoto	Japan	10/16/2008	−10.88	−10.801	−4.835	−1.573	−0.595
Ariake Japan	Japan	10/22/2008	−9.95	−6.825	−2.696	−1.365	2.386
Saizeriya	Japan	11/27/2008	−15.56	−14.192	−10.135	−2.068	−1.388
Daewoo Shipbuilding & Marine	Korea	10/16/2008	−12.64	−8.421	−4.570	1.703	−2.973
Han Kwang	Korea	7/2/2008	−21.84	−20.952	−9.745	2.335	7.747
Monami	Korea	7/9/2008	−19.70	−16.210	−12.135	−3.711	−1.399
UJU Electronics	Korea	7/7/2008	−6.70	−2.664	1.429	−1.142	2.970
Alfa	Mexico	10/6/2008	−9.59	−5.765	−3.643	2.777	5.445
Cemex	Mexico	10/1/2008	−7.10	−6.925	−6.070	−2.678	−5.042
Grupo Industrial Saltillo	Mexico	10/8/2008	−13.03	−9.903	−7.503	−21.964	−6.631
Grupo Posadas	Mexico	10/14/2008	−13.33	−10.616	−10.207	−12.298	−1.338
Apator	Poland	10/16/2008	−8.79	−4.853	−1.223	−0.275	0.151
Zelmer	Poland	10/14/2008	−5.53	−5.565	2.680	−0.770	0.557

Table 3 reports cumulative abnormal return (CAR_t) up to the specified day t in event time. Column 1 has each company, followed by the market, the date that the media announced the derivative loss of each company. Column 4 is the stock return on the day of announcement. Event time is days relative to the media announcement of derivative losses. Abnormal returns are computed given the market model parameters which are estimated with the GARCH model $r_{it} = C_i + \beta r_{mt} + \sum \lambda_h r_{i,t-h} + \varepsilon_{it}$ through the period (−190; −10) in event time, where r_{it} is the continuously compounded local return on date t in country i and r_{mt} is the continuously compounded daily market return on index on day t. The sample period runs from 90 trading days before the date in the third column over the horizons in days in columns 5 to 8. Values in bold are statistically significant at 5%. Table is divided in two categories: major distressed companies and non-distressed companies. Major distress is defined as bankruptcy, acquisition by another company, major asset sales or a restructuring of derivative contracts with banks to avoid a default on the contracts.

* The Mexican Stock Exchange froze trading on Gruma until October 30.

$$\varepsilon \,|\, \psi_{it-1} \sim N(0, h_{it}), \quad h_{it} = \alpha_i + \sum \alpha_{ik} \varepsilon^2_{i,t-k} + \sum \theta_{ij} h_{i,t-j} \tag{3}$$

Results are in Table 4. The patterns we can see are: for distressed companies 11 of 14 companies show significant negative abnormal returns in the first day, an effect that is persistent for 10 companies one year later. For the non-distressed companies 21 of 35 companies present abnormal negative returns in the first day, but only 7 companies still present negative returns after one year. There is weak evidence that companies use value-destroying hedging strategies, a result that is persistent

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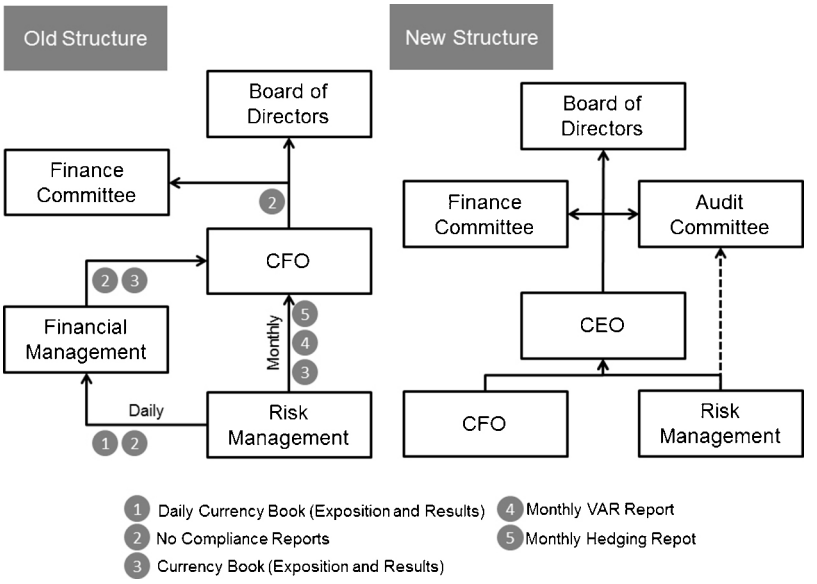

Fig. 2. *Old and new risk management structure of Sadia.* This figure shows the change in structure of Sadia after it lost US$1.29 in currency derivatives in 2008. The old structure allowed too much discretion to the CFO, while the new structure reveals better governance for risk management. Sadia was acquired by its main competitor, Perdigão, in May of 2009. The resulting company is called Brasil Foods. In 2006 Sadia attempted a hostile takeover of Perdigão but was not successful. Source: adapted from Sadia (2008).

over a period of time for most of the distressed companies, but not for the whole sample. A more practical question regards the corporate governance characteristics that lead to such losses in shareholder value in the first place.

This fading abnormal rates of return have interesting implications for the discussion on optimal hedging strategies and the natural occurrence of hedging losses therein. The fact that we can measure significant abnormal returns for most companies in the short term indicates that the market penalizes losses very quickly. Over time stock prices for some companies in our sample recover. Following the theory, there are two possible explanations for that First, it is possible that the company had sub-optimal hedging strategies initially but restructured sufficiently to make up for mismanagement. Alternatively, it could be that there was no mismanagement in the first place and yet the market interpreted natural hedging losses negatively in an initial reaction. Either way, there is evidence that shareholder value of many companies was reduced following the announcements.

3.3. Hypotheses development

We follow a testing strategy similar to what is used by both Cumming and Walz (2010) and Kang and Jin-Mo (2008), using the institutional setting present in Fig. 1 to develop hypotheses that relate corporate governance to failed risk management strategies. In this test there are two major sets of variables for the econometric testing: financial and institutional variables; the financial variables follow Tufano (1996).

Relating the theoretical framework to workable hypotheses is conditional on building variables that are constructible from financial statements and public information on corporate governance structure. Due to this we use previous research and focus on the role of the CFO and the underlying governance structure that precedes misplaced hedging strategies. Unfortunately, unlike Dionne and Triki (2005), we have no data on the background of executives, but a comprehensive study of the companies' governance structure yields other qualitative indicators of the relationship between governance, agency theory and risk management. The following hypotheses are tested in the econometric model:

H1. *No monitoring (MON):* Lack of proper CFO monitoring increases the probability of speculative positions in derivatives.

In many companies the CFO is directly responsible for designing and monitoring risk management strategy, and then presenting the results to the board. Board supervision has shown to be an important deterrent to excessive risk-taking (Wiseman and Gomez-Mejia, 1998). Weak monitoring of the CFO's strategies can have dangerous consequences, as exemplified by the Brazilian company Sadia. The company redesigned its governance structure right after disclosing its losses in 2008. Fig. 2 shows the old and the new governance structure regarding its risk management strategies.

As we can see, the old structure gives considerable discretionary power to the CFO. He is responsible for monitoring the strategy and present the no compliance report to the rest of the board. Agrawal and Chadha (2005) and Agrawal and Cooper (2007) show how internal mechanisms can impact the decision making process of top management. More recently, Johnstone et al. (2011) investigate internal control material weakness and how it relates to corporate governance changes.

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The present hypothesis directly follows Agrawal and Chadha (2005) and Johnstone et al. (2011) in creating a scenario of lack of proper internal control and trying to relate it to a disruptive event—the derivatives losses.

Data for MON are binary and come from the financial statements of the companies. It assumes value 1 for companies in which the CFO is formally responsible for managing and answering for the risk management strategy and 0 otherwise (when the audit committee or the risk committee is responsible for monitoring). This measure focuses on internal monitoring mechanisms; other external monitoring factors (i.e. ownership concentration, leverage) are controlled for in our later model.

H2. *Formal hedging policy (FHP):* Lack of a formal hedging policy increases the probability of speculative positions in derivatives.

Many companies specify formal hedging policies to deter speculative behavior. Data for the binary variable come from financial statements or companies' websites. The variable assumes value 1 when the company has a policy in place and 0 otherwise. Formal policies, which leave substantial leeway and discretion for managers, are ineffective in preventing speculation. Due to data restrictions, we could not assess the stringency of hedging policies.

Hubris is the most difficult agency theory proposition to test for, since it is almost impossible to prove intent and data on personal traits of risk managers are almost impossible to acquire. Hayward and Hambrick (1997) have shown that past success and economic context play a strong role in the development of managerial hubris. We provide two indirect measures that account for the possibility of *hubris* through the creation of an environment conductive to overconfidence, following Ben-David et al. (2006). The first, being a medium-term trend in the risk being hedged.

H3. *Trend of major source of risk (TRE):* A clear trend on the risk being hedged increases the probability of speculative positions in derivatives.

Wiseman and Gomez-Mejia (1998) argue that several market factors outside the company may incite excessive risk taking. Years of currency appreciation, for instance, may build confidence in speculative positions in derivatives to exploit the continuation of the trend; when making predictions about future developments managers use heuristics and anchors (Jacowitz and Kahneman, 1995; Tversky and Kahneman, 1974). The current level of exchange rates and the most recent changes have shown to be the most important anchors in experts' estimations of foreign exchange rates (Bofinger and Schmidt, 2003). Overreliance on recent changes in times of strong trends naturally leads to general expectations of a continuation of this trend to systematic biases in risk perceptions of managers. The variable is designed as the linear trend of the underlying risk in the last 3 years, which means that for Brazilian companies it is the linear trend of the Real, for Korean companies the Won, and for companies that are hedging oil prices it is the trend of oil (Brent) prices.

H4. *Recent financial results (FIN):* recent financial gains increase the probability of speculative positions in derivatives.

Past performance is a major driver of managerial behavior and agency risk (Sheedy, 1999). The second variable pertaining to an indirect indication of *hubris* is a qualitative binary variable that represents the last three quarters of financial results. It indicates if the company posted higher than market-average financial results and assumes value 1 only if the result of the company beat the market in all three previous quarters. The idea is that, following Wiseman and Gomez-Mejia (1998) and Ben-David et al. (2006), positive reinforcement breeds overconfidence. Data come from financial statements.

H5. *Remuneration (REM):* a remuneration package for the CFO that is based on short-term incentives increase the probability of speculative positions in derivatives.

The variable relates to the design of the remuneration of the CFO. There is evidence that incentives for CFOs matter in earnings and risk management policies (Indjejikian and Matejka, 2009; Sheedy, 1999; Wiseman and Gomez-Mejia, 1998). In the present context we have a defined event in which short-term incentives for CFOs may play a role in the design of speculative positions in derivatives. To test this, and following Indjejikian and Matejka (2009), if remuneration is tied to medium-term performance, it assumes value 0, otherwise it assumes value 1, representing the hypothesis that short-term incentives are tied to excessive risk-taking. Data come from companies' websites and corporate governance reports.

3.4. Probit cross-sectional model

Tracing the antecedents of corporate hedging losses is a difficult task for three reasons. First, the controversy surrounding the bankruptcy of Metallgesellschaft AG (Edwards and Canter, 1995; Mello and Parsons, 1995; Culp and Miller, 1995) shows the difficulty of the ex-post diagnosis of hedging failures. Our sampling strategy relied on media reports of losses from derivatives trading. This requires very detailed knowledge about actual and forecasted cash-flows, quantities, hedging transactions and most importantly the a-priory motives of hedging. Without such access we are limited to secondary indicators of inefficient hedging. Using just these media reports would be a very weak measure of hedging effectiveness and certainly no indication of corporate governance failure. More credibly, however, our event study provides support that the majority of firm in our sample incurred abnormal returns following the announcements. If the losses in derivatives trading were matched sufficiently by transaction or quantity gains – a hedging requirement that should hold true (to different degrees) for both variance minimization and lower-tail hedging strategies – we do not expect to find strong abnormal returns, especially in the long term. Nevertheless, we must stress that we are using a market-based indicator of hedging (in)efficiency

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rather than a direct cash-flow based measure that would actually allow us to make causal inferences in terms of hedging failures or successes.

Second, as with many diseases, the ex-post diagnosis of hedging losses makes it impossible to carry out a-priori randomized experiments, waiting for some companies to engage in speculation. Third, the rare nature of corporate hedging scandals makes it impossible to generate a sample that is large enough to run models that account for sample selection statistically (Heckman, 1979; Heckman et al., 1998).

In order to study a rare ex-post treatment effect like corporate hedging losses, we are unfortunately limited to epidemiological case-control methodology (Song and Chung, 2010). Essentially, our aim is to statistically compare differences in governance between companies which have experienced hedging losses and similar companies which have not. The assignment of companies to the control group inevitably carries the danger of sample selection bias (Dehejia and Wahba, 2002). As a result, we need to be cautious about generalizing our findings or making out-of sample predictions. However, using case-control methodology allows us to identify and report statistically significant differences between our treatment and control group. Therefore, a matched case-control study is the closest possible approximation of a randomized experiment and the only way detect potential causes of corporate mismanagement, even if the differences we find are not generalizable (Garey, 2004).

The dependent variable of the model that tests the relationship between corporate governance and risk management is a binary variable, which assumes value 1 for the companies that experience derivatives losses and value 0 for companies that do not. The selection process of companies for the test is simple: public companies from the same market and industry as the companies that experienced losses, restricted by data availability. As an example, for the Brazilian market the selection comprises 30 companies from petrochemical, steel, food, pulp, and textile industries. For the 10 international markets the total of selected companies is 346. Since the dependent variable is binary, the resulting model is a probit cross-sectional model. The general model is given by Eq. (1), in which C is the vector of controls and D the vector of sector dummies:

$$Y_i = 1\left\{\beta_1 MON + +\beta_2 FHP + \beta_3 TRE + \beta_4 FIN + \beta_5 REM + \nabla' C + \nabla' D - \varepsilon_i\right\} \geq 0 \quad (4)$$

The resulting control vector (after iterations of the model with other financial variables) captures several other firm specific characteristics related to external monitoring and is composed of:

Disclosure (*DIS*): We build a qualitative binary variable on the quality of disclosure of derivatives information. We compare the quality of information on derivatives provided by each company with the benchmark of its' market. We follow Solomon et al. (2000) and Zhang (2009). DIS assumes value 1 if a company does not disclose more information than it is required and 0 otherwise. Data is hand collected from the notes of the financial statements of the companies.

Shares in the American market (*USA*): If a company has shares in the American market it has to disclose its derivatives dealings, which provides more opportunities for shareholders' monitoring. USA is a binary variable, assuming value 1 when the company does not have shares in the American market. Data come from the companies' websites.

Ownership concentration (*CON*): is a standard variable in empirical corporate governance studies. Burkart et al. (1997), De Miguel et al. (2004) and Parigi and Pelizzon (2008) show the relevance of concentrated ownership for monitoring, with the flipside that it allows for expropriating minority shareholders. The variable here is defined as the proportion of shares in the hands of the three major shareholders; hence it is a continuous variable in the (0,1) interval. Data come from Datastream and Compustat Global.

Institutional investors (*IIN*): We follow Bhojraj and Sengupta (2003) and Aggarwal et al. (2011) in considering that the participation of institutional investors on the board should help monitoring of financial management. Data for the binary variable that assumes value 1, if there is a representative for an institutional investor on the board, come from the financial statements or companies' websites.

Management stake (*MAN*): following Tufano (1996), this control is a continuous variable that is the average of the management stake in the previous three years.

Family-owned (*FAM*): Is a hand-collected binary variable.

Age (*AGE*): Is a continuous variable with data coming from the companies' websites.

Leverage (*LEV*): Is a continuous variable based on the average financial debt ratio for the last three years. Data come from financial statements.

As for dummies, we use market dummies (MKT) in the first round of estimation, one for each international market, but none improved the models. We drop it in presenting the final results.

The error term should capture all variation that is not explained by the selected variables. It is impossible to perfectly model risk management decisions. As Bartram et al. (2009) observe, a wide range of factors is likely to determine the use of derivatives by non-financial firms. In the present context we cannot expect that the constructed variables can capture all the decision making process regarding the losses in derivatives. Considering factors are omitted, sufficient controls are included such that the residuals are i.i.d. conditional on all the regressors (so that the ML estimator is consistent).

4. Results and analysis

We divide the results in two, one in which the dependent variable assumes value 1 for the 49 companies with losses in derivatives and one for the distressed sample composed of 13 companies. For both samples the dependent variable assumes value 0 for the companies that did not post losses in derivatives. The main diagnostic test is the cross-dependence (CD) test

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Table 5
Results from the probit model.

	Whole Sample		Distressed Companies	
	β	σ	β	σ
H1 No monitoring (MON)	0.429*	0.08	0.232	0.07
H2 Formal hedging policy (FHP)	−0.558*	0.22	−0.780*	0.30
H3 Trend of source of risk (TRE)	0.754*	0.26	0.785*	0.32
H4 Recent financial results (FIN)	0.234	0.62	0.059	0.64
H5 Remuneration (REM)	0.861*	0.22	0.338*	0.14
N obs	346	310		
LR χ^2	97.56	89.35		
Prob > χ^2	0.000	0.001		
Log likelih.	−239	−208		
Pseudo-R^2	0.34	0.32		
Cross-dep (H_0: R = IN)	0.015	0.018		

Table 4 relates corporate governance and other variables to risk management through a probit panel data model. Dependent variable is 1 for companies that posted losses in derivatives for the year 2008, and 0 for other companies. H1 represents lack of monitoring (value 1 for companies in which the CFO is responsible for managing and answering for the risk management strategy and 0 otherwise); H2 the existence of a formal hedging policy (value 1 when the company has a policy in place and 0 otherwise); H3 is the trend of major source of risk (the linear trend of the underlying risk in the last 3 years, which means that for Brazilian companies it is the linear trend of the Real, for Korean companies the Won, and for companies that are hedging oil prices it is the trend of oil (Brent) prices); H4 recent financial results (value 1 only if the result of the company beat the market in all three previous quarters); and H5 represents remuneration incentives for the CFO (value 0 if remuneration is tied to medium-term performance, otherwise it assumes value 1). Total number of companies is 346, and the last column represent only distressed companies, i.e., companies in which derivative losses resulted in bankruptcy, acquisition by another company of major restructuration. Omitted controls are: age of each company, average financial debt ratio; disclosure; shares in the American market; ownership concentration; management stake; and a binary variable for family-owned company.

* Variable significant at 5%.

Table 6
Average marginal effect—probit model.

	Whole sample		Distressed companies	
	β	σ	β	σ
H1 No monitoring (MON)	0.023*	0.010	0.002	0.010
H2 Formal hedging policy (FHP)	−0.012*	0.005	−0.020*	0.007
H3 Trend of source of risk (TRE)	0.036*	0.012	0.021*	0.003
H4 Recent financial results (FIN)	0.002	0.003	0.009	0.021
H_9 Remuneration (REM)	0.037*	0.012	0.016*	0.005
Mg effect	0.1987	0.2140		
N obs	346	310		

Table 5 is the marginal effect of the probit mode that relates corporate governance and other variables to risk management. Dependent variable is 1 for companies that posted losses in derivatives for the year 2008, and 0 for other companies. H1 represents lack of monitoring (value 1 for companies in which the CFO is responsible for managing and answering for the risk management strategy and 0 otherwise); H2 the existence of a formal hedging policy (value 1 when the company has a policy in place and 0 otherwise); H3 is the trend of major source of risk (the linear trend of the underlying risk in the last 3 years, which means that for Brazilian companies it is the linear trend of the Real, for Korean companies the Won, and for companies that are hedging oil prices it is the trend of oil (Brent) prices); H4 recent financial results (value 1 only if the result of the company beat the market in all three previous quarters); and H5 represents remuneration incentives for the CFO (value 0 if remuneration is tied to medium-term performance, otherwise it assumes value 1). Total number of companies is 346, and the last column represent only distressed companies, i.e., companies in which derivative losses resulted in bankruptcy, acquisition by another company of major restructuration. Omitted controls are: age of each company, average financial debt ratio; disclosure; shares in the American market; ownership concentration; management stake; and a binary variable for family-owned company.

* Variable significant at 5%.

based on Pesaran (2004) and Hsiao et al. (2007) that indicates independence across the sample (it is based on the Lagrange Multiplier, and the null hypothesis is for cross-section independence—H_0: R = IN). We cannot reject the null, which helps validate the current empirical application of a panel data specification.

The probit econometric model is run using STATA 10.0 and is based on Eq. (1). Standard errors are robust and there is no heteroskedasticity in the model. We also tried to overcome issues with omitted variable bias by running different models with variables like log of total assets, leverage and others as controls. Results do not change much but results should be analyzed with some caution, as our variables cannot capture all the dimensions regarding hedging decisions. Table 5 presents the econometric results and Table 6 the marginal effects of the probit model. Controls are omitted for brevity, but no control other than financial leverage is negative and marginally significant for distressed companies. This indicates that leverage may be used to restrict risk manager's room for opportunistic behavior.

Results for the whole sample suggest that corporate governance plays a role facilitating mismanagement of derivatives, as does the trend of the source of risk and the remuneration incentives of the CFO. For the whole sample two hypotheses relating to corporate governance are statistically significant: lack of formal monitoring structures (MON); and formal hedging policy

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Table 7
Robustness check with financial variables.

	Whole sample		Distressed companies	
	β	σ	β	σ
ROA	0.765	0.981	0.563	0.657
GRO	0.310	0.403	0.352	0.283
TOB	0.017	0.031	0.012	0.017
DEB	−0.005	0.010	0.003	0.009
DIV	−0.001	0.005	−0.015**	0.008
LDR	0.048	0.062	0.012	0.021
SIZ	0.023	0.031	0.007	0.018
BMR	0.035	0.016**	0.005	0.006
N obs	346	310		
LR χ^2	67.33	61.75		
Prob > χ^2	0.058	0.067		
Log likelih.	−198	−175		
Pseudo-R^2	0.06	0.07		
Cross-dep (H_0: R = IN)	0.005	0.003		

Table 6 presents some results on the relationship between financial variables and the losses in derivatives for our sample of 346 companies. Dependent variable is 1 for companies that posted losses in derivatives, and 0 for other companies. ROA is return on assets; GRO is capital expenditures/sales; TOB is Tobin's *Q*, DEB is Debt to equity ratio; DIV is a dividend dummy; LDR is Long-term debt ratio; SIZ is the log of plant, property, equipment investment expenditures; BMR is book to market ratio. Total number of companies is 346, and the last column represent only distressed companies, i.e., companies in which derivative losses resulted in bankruptcy, acquisition by another company of major restructuration. Data are for the year 2008.

** Variable significant at 10%.

(FHP). All post the expected sign, with lax monitoring resulting in higher probability of speculation with derivatives, and formal hedging policy acting as deterrent to mismanagement of such instruments. The marginal probabilities are not particularly high, but are significant nevertheless. Absence of monitoring structure enhances the probability of mismanagement of derivatives, in the present model, by 2.3%, while a formal hedging policy decreases the probability by 1.2%. Hypothesis 3 (H3), the trend of source of risk, brings an interesting result. It is an indicative of overconfidence by building strategies based on previous results. It is certainly used as an explanation in the media by executives—in an interview, the CFO of Companhia Siderúrgica Nacional of Brazil dismissed the hefty losses by arguing that the derivatives strategies have netted sufficient gains in the past to make it worthwhile, even if shares drop heavily after the company's losses are announced. As for hypothesis 5 (H5), remuneration, it shows that there is an incentive for CFOs to hedge more if their compensation is tied to short-term performance. There is no indication that hypothesis 4 (H4), recent financial results, is significant. There is a potential danger of sample selection biasing our results. However, based on in depth qualitative analysis of many cases (following Zeidan and Rodrigues, 2013), we are confident that corporate governance indeed is a powerful driver of corporate mismanagement.

Results change little when we consider the sample with distressed companies. Monitoring is not significant anymore, while all other variables maintain significance and the same sign.

4.1. Robustness checks

Eq. (4) cannot capture all the subtleties in the decision to speculate or hedge with derivatives. There are two main alternative stories to Eqs. (3) to (5): regular corporate finance theory and other institutional variables. As discussed earlier and in Fig. 1, considerations from bankruptcy and distress to tax disbursements can influence the decision to hedge. For the purpose of testing whether financial consideration have an impact in the decision of companies to overhedge or speculate with derivatives we test different models with financial variables. Table 7 presents results for different financial measures; from performance indicators to cash flow variables. Géczy et al. (1997) conclude, in a seminal paper on the usage of derivatives by non-financial firms, that firms with greater growth opportunities, economies of scale in hedging activities and tighter financial constraints are more likely to use currency derivatives. Growth opportunities in Géczy et al. (1997) are measured with two variables: ratios of research and development expenditures to sales, and book-to-market ratios. Data are only available for the second measure and come from Compustat.

We consider a case-control probit model for all these versions as the decision to overhedge is still best estimated though a cross-sectional probit model given our sample restrictions.

Results seem to indicate that there is no measure of financial performance that increases or decreases the probability of companies to pursue dangerous hedging strategies, other than book-to-market ratio for the whole sample, and dividends for the distressed sample. In both cases, introducing these variables in the main estimations does not improve results.

We now turn to other institutional variables as drivers of risky hedging strategies. Additional variables include: CEO duality, industry concentration, active analysts following the companies, accounting restatements, and geographical dispersion.

Agrawal and Cooper (2007) find strong evidence of greater turnover for CEOs, top management and CFOs of restating firms. In this sense, restatements can also provide incentives to higher speculative positions in derivatives and is included

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Table 8
Robustness check with institutional variables.

	Whole sample		Distressed companies	
	β	σ	β	σ
CEO	0.004	0.003	0.009	0.012
HHI	0.021	0.037	0.036	0.026
ANA	0.005	0.011	−0.004	0.016
RES	0.001	0.001	−0.012	0.023
GEO	0.452	0.657	0.213	0.147
N obs	346	310		
LR χ^2	102.24	89.88		
Prob > χ^2	0.000	0.000		
Log likelih.	−176	−202		
Pseudo-R^2	0.24	0.22		
Cross-dep (H_0: R = IN)	0.006	0.010		

Table 6 presents some results on the relationship between other institutional variables and the losses in derivatives for our sample of 346 companies. Dependent variable is 1 for companies that posted losses in derivatives, and 0 for other companies. CEO assumes value 1 for CEO duality and 0 otherwise; HHI is industry concentration in market *j*; ANA is a dummy variable for analysts' reports on the companies, with value 1 if 3 or more analysts are dedicated to the company and 0 otherwise; RES is related to account restatements and assume value 1 if a company posted a restatement in the last 5 years; GEO measures the number of foreign markets in which the firm sells its product. Total number of companies is 346, and the last column represent only distressed companies, i.e., companies in which derivative losses resulted in bankruptcy, acquisition by another company of major restructuration. Data are for the year 2008.

in the sample as a binary variable, if a company posted any accounting restatement in the 2005–2009 period. Data are hand collected.

Allayannis et al. (2001), Allayannis and Ofek (2001) and Allayannis and Weston (2001) investigate more aspects of the usage of derivatives instruments: geographic dispersion, credit quality and a dividend dummy. We do not have data for credit quality but the other two are defined exactly as in the cited papers. Data are hand collected for geographic dispersion and come from Compustat for the dividend dummy.

Purnanandam (2008) shows how financially distressed companies in more concentrated industries have higher incentives to hedge, and how higher bank monitoring and more active analyst followings may have a reduced impact in hedging. We used financial leverage as a proxy for bank monitoring. For analysts' reports we create a dummy variable: if a company presents more than 3 reports it gets value 1 and 0 otherwise. We also use industry HHI as another variable. Data are hand collected for the analyst reports and from the respective national statistics bureaus for the HHI.

Results indicate that no variable is statistically significant. Some more sensitivity analyses are also performed. In particular, many other controls are used in first trials of the model, such as liquidity, price/earnings ratio, and other financial variables. Market dummies are also dropped due to poor performance—most variables became non-significant. It is likely that there is heterogeneity across countries and that this is the result of the poor performance when inserting market dummies. Alternative combinations of variables are considered, but do not materially impact the results presented.

Also, inputting those financial and non-financials variables in the models in Tables 7 and 8 do not improve the results and a general model with all controls show no statistical significance for any variable. That is to be expected, given the low number of degrees of freedom. In any case, results should be viewed with caution, given the many different specifications possible in the present empirical application. Finally, we have carried out extensive qualitative analysis of the sample of distressed companies which gives us confidence in the results of our quantitative model.

5. Conclusion

This paper makes an important contribution to point out corporate governance structures that antecede large derivatives losses. We build a sample of 346 companies from 10 international markets, including Latin America, Europe, Asia and Oceania, 49 of which experience large derivatives losses. The losses of these 49 companies are a combined US$18.9 billion, with a subsample of 14 companies that went into bankruptcy or suffered heavy restructuring.

First we carry out an event study to confirm that the sampled companies have suffered abnormal returns following the derivatives losses. Results indicate that for distressed companies 11 of 14 companies show significant negative abnormal returns in the first day, an effect that is persistent for 10 companies one year later. For the non-distressed sample 21 of 35 companies present abnormal negative returns in the first day, but only 7 companies still present negative returns after one year. While we cannot attribute this to hedging failure, we have statistical support that the companies' investors have responded negatively to the derivative losses.

For the purpose of relating corporate governance and risk management, we first build a comprehensive theoretical framework that encompasses regular finance models, institutional context and agency theoretical concepts. To test hypotheses concerning this theoretical framework, we hand-collect data on many qualitative indicators of corporate governance, proxies for *hubris* and other management characteristics, such as the remuneration scheme and the stake of management in the companies. The empirical testing through a probit cross-sectional model reveals that some corporate governance

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characteristics, such as the inexistence of formal hedging policy, lax monitoring of the risk management department and the trend of source of risk can contribute significantly to the mismanagement of derivatives instruments. Results show that variables relating to overconfidence and incentives to executives are also relevant.

There are numerous practical implications of this study. First, our results show that independent committees monitoring CFO risk management reduce the likelihood of mismanagement. The hedging process should involve actors from different departments within a company (Aabo et al., 2012). Second, companies should make sure that CFO remuneration does not provide short-term incentives for risky behavior. Compensation and performance evaluation must be based on risk and profit considerations. Third, our study has found indications that capital structure can help shape CFO incentives. Finally, the study highlighted the dangers of relying on past trends in corporate hedging. Such technical strategies can lead to severely underestimated risks. Ideally, risk management should be independent of expectation or forecasts. This is also underlined by recent research on the quality of professional exchange rate forecasts (Bofinger and Schmidt, 2003). Risk monitoring mechanisms, such as value at risk, must be based on stochastic rather than historical trends in order to avoid dangerous overconfidence and hubris.

On a macro level, another implication is related to the regulation of stock markets–our study shows that hedging losses are due to reasons not only related to transparency. In fact, the first response by market regulators to the distress of many companies is to change disclosure policies regarding derivatives instruments. While better disclosure policies are probably effective in allowing shareholders better monitoring, we can see from the results that the losses experienced by the selected companies resulted from more complex issues than that. Also, our study stresses the need to ensure ex-post accountability and define clear corporate governance rules within companies. Without the definition of a primary hedging goal, it is impossible to determine if hedging policies indeed were optimal and if management is to be held accountable. Also, our study does not rule out for the possibility that hedging losses may occur despite optimal hedging policies and that financial markets may falsely interpret announcements.

It is important to stress several limitations of the study. First, we rely on a combination of media reports and abnormal stock returns as an indirect indicator that hedging strategies were interpreted as value destroying without the possibility to test if the losses were related to actual hedging failures. On the positive side, our event study allows us to test if companies were penalized for the hedging losses. Even if losses were not strictly due to hedging failure, a shareholder value maximizing company should adapt its hedging strategy accordingly to avoid inculpable losses. In particular, a firm could follow the recommendations of Stulz (1996) and Aabo (2015) and apply hedging strategies that do not aim at variance minimization but at eliminating lower-tail outcomes, a strategy that has shown to have lower maximum hedging losses. Alternatively, it should improve investor relations to communicate more efficiently, that in fact hedging losses are the result of a perfectly sound risk management given the particular motives.

The quasi-experimental methodology used is based on non-random sampling. All results must be interpreted with possible endogeneity and sample selection bias in mind. However, we believe that our hand collected sample is particularly useful for the problem at hand, as it shows how spread out internationally losses regarding derivatives were and the impact of corporate governance in hedging decisions in many different markets, but with similar results.

Relying on media reported losses and financial statements may also cause potential reporting biases, but we have little reason to suspect that this drives any of our results. The measures for our model were hand collected and despite this effort there are natural limits to what can be captured. Our comprehensive framework allows us to control for a number of factors, however, omitted variables (especially on the level of individual managers and regarding the content of hedging policies) cannot be fully ruled out. Also, it is difficult to account for differences in accounting standards across countries which means that firms from certain countries may be systematically left out and the generalizability of our results is reduced to the countries we have observations on.

Our sample is deliberately skewed, intentionally including corporate crises. It is thus important to stress that our results must not be misinterpreted as a case against the use of derivatives per se. Rather, we look at corporate governance factors that may have contributed to value destruction in a lower-tail event. Also, we cannot determine whether this misuse was intentional or the result of negligence.

Several avenues of research remain. This study only analyzed a sample of 346 companies in a cross-sectional study. Future research should complement the present one by focusing on the evolution of risk management strategies. On a managerial side, they should differentiate between types of instruments, hedging policies and find more elaborate measures of hedging efficiency which allow the diagnosis of actual hedging failure. Also, with the data available, we cannot disentangle the dynamics within top management teams and between top management team and the board. Future, studies should go deeper into the configuration of governance by looking at board composition, incentives, experience and personality. Finally, the inclusion of further country level institutions promises equally valuable insights for policymakers.

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