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Risk Management, Corporate Governance and Firm Value:

Evidence from Euronext Non-Financial Firms

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ABSTRACT

Risk management theories suggest that the use of risk management instruments solely with hedging purposes can enhance firm value through its effect on taxes, financial distress costs, costly external financing, as well as on agency costs. Studies linked to the standard corporate risk management approach have investigated primarily the effect on shareholder value focused on the determinants of hedging and whether the firm's hedging behaviour fits one theory or another. Recently, another strand of research has attempted to examine the direct impact of corporate risk management on firm value, looking for the value premium inherent to hedging activities. Moreover, recent investigation emphasizes the role of risk management in controlling the agency problem, resulting from the separation of ownership and control, and forges a link between corporate hedging and governance structures.

This dissertation is a compilation of three empirical studies that attend to a series of emergent questions regarding corporate risk management and their relation with corporate governance. We accomplish this by generating a firm-level governance index and by conducting an extensive analysis of the general risk management undertaken in a sample of 567 non-financial firms in the four countries with stocks listed in Euronext.

In the first study we investigate whether firms use risk management instruments for hedging or for speculative purposes. Specifically, to identify a firm's hedging or speculative behaviour, we firstly measure the firm's exposure to financial risks and, later, investigate the effect of risk management instruments' usage in the firm's exposures. In addition, we analyse the premise that the hedging decision may be driven by unobserved

elements that are indeed associated with financial price exposure. Building on the results of the first study, we certify the purpose of risk management usage and proceed to the second study, where we examine if a firm's hedging strategy implementation is driven by firm governance structures and by other firm characteristics. In particular, we investigate the idea that a firm's hedging decision is probably undertaken in simultaneity with governance and other financial decisions made by the firm. However, the implementation of a hedging strategy in a company can represent significant costs, despite the potential benefits identified. Explicitly, the ultimate argument for engaging in hedging activities is the one of value creation. Therefore, the third study explores if the use of hedging instruments is consistent with a higher valuation for firms that experience strong firm-level governance structures. Also, in this analysis we seek to control for the existence of possible interrelationships between firm value, hedging behaviour and firm-level corporate governance structures.

Our main conclusions are then threefold: (1) we confirm that the firms in our sample display higher percentages of financial risk in the three categories (exchange rate, interest rate and commodity price risk) of risks analysed. Then, we find that the use of hedging instruments significantly reduces firm's exposure to financial risk. In addition, these results confirm that self-selection is an important issue; (2) we find that strongly governed firms use risk management instruments for hedging purposes. We also confirm the presence of endogeneity in the relationship between firm hedging, corporate governance and investment decisions. In addition, we find evidence showing a link between firm size and the decision to hedge, and finally, (3) after accounting for the possible endogeneity between firm value and hedging, and firm-level governance structures, we find statistical evidence that firms that hedge and are strongly governed have a higher valuation (using Tobin's Q ratio) than firms that do not hedge and are weakly governed. We also find

evidence that firms that are more profitable, that are financially constrained, and that have more investment opportunities are more likely to be associated with a significant value premium. Ultimately, we confirm that firm-level corporate governance has a significant and positive impact on firm value through its impact on firm hedging policy.

Our main contributions are as follows. Firstly, we make use of a hedging variable that accounts for the use of either external (derivatives) and/or internal hedging instruments, which is unusual in the European setting. Secondly, our contribution is also methodological: (1) we expand exposure-based literature by addressing the endogeneity of the hedging decision through a treatment effect methodology; (2) we bring new evidence to the hedging-based literature on the use of instrumental variables probit estimator, and (3) we add to the hedging-value-related literature by explicitly addressing the endogeneity between firm value, hedging and corporate governance choices for the first time. Finally, we add to corporate governance literature by revealing evidence in a specific way by which governance can enhance firm value.

RESUMO

As teorias de gestão do risco sugerem que a utilização de instrumentos de gestão do risco, exclusivamente com o propósito de cobertura, pode promover o aumento do valor da empresa por via do seu efeito ao nível da componente fiscal, custos de insolvência financeira, custos do financiamento externo, assim como nos custos de agência. Numa perspetiva tradicional, os estudos empíricos focalizaram-se na validação, perante as proposições teóricas estabelecidas, das características financeiras das empresas suscetíveis de adotar mecanismos de proteção face ao risco. Uma outra perspetiva de análise, contemporânea à perspetiva dita "tradicional", promove a investigação de forma direta dos efeitos da gestão do risco no valor da empresa, ou seja, quantifica o aumento de valor inerente às atividades de cobertura. Alguns estudos recentes enfatizam o papel da gestão do risco como forma de controlar os custos de agência, sugerindo a existência de uma relação entre os mecanismos de governo das sociedades e a gestão do risco.

Esta dissertação resulta da compilação de três estudos empíricos que analisam questões emergentes relacionadas com o valor da gestão do risco financeiro nas empresas, assim como a sua associação com os mecanismos de governo das sociedades. Para o efeito, foi efetuada uma extensa análise às atividades de gestão do risco e foi construído um índice representativo da qualidade de governo para uma amostra de 567 empresas não financeiras cotadas na Euronext.

Ao nível do primeiro estudo investiga-se se as empresas que utilizam instrumentos de gestão do risco os utilizam de facto para a cobertura de exposições existentes, ou se os

utilizam para fins de especulação. De forma a identificar o procedimento das empresas em relação a esta questão, estima-se o nível de exposição ao risco de cada empresa da nossa amostra e, posteriormente, verifica-se o efeito da utilização de instrumentos de cobertura no nível da exposição ao risco. Considera-se na análise a possibilidade de existência de causalidade reciproca entre a utilização de instrumentos de gestão do risco e o nível de exposição ao mesmo. Em face dos resultados obtidos quanto ao propósito das empresas na utilização de instrumentos de gestão do risco, prossegue-se para o segundo estudo, onde o principal objetivo é a análise das características das empresas que promovem a utilização de instrumentos de cobertura, nomeadamente no que diz respeito ao papel das estruturas de governo das sociedades. Nesta análise considera-se a hipótese de que existem variáveis independentes que são endógenas ao modelo. No entanto, apesar dos benefícios atribuídos à gestão do risco os custos inerentes podem ser significativos, pelo que é necessário investigar se, de facto, as atividades de gestão do risco aumentam o valor da empresa. Assim, o terceiro estudo empírico visa analisar se a utilização de instrumentos de gestão do risco é compatível com o aumento do valor da empresa, nomeadamente quanto esta tem associada uma boa qualidade de governo das sociedades. Também nesta análise se considera a existência de problemas de endogeneidade inerente à relação entre o valor da empresa e as decisões sobre a gestão do risco e sobre o governo das sociedades.

As principais conclusões deste trabalho podem ser sintetizadas da seguinte forma: (1) verificou-se que as empresas da amostra exibem níveis de exposição ao risco significativos em relação aos três tipos de risco em análise (risco de taxa de câmbio, de taxa de juro e de variação do preço das mercadorias) e que a utilização de instrumentos de gestão do risco reduz significativamente o nível de exposição ao risco da empresa. Foram igualmente validados os indícios de existência de causalidade reciproca; (2) concluiu-se que empresas com uma boa qualidade de governo utilizam os instrumentos de gestão do

risco com propósitos de cobertura e que a dimensão da empresa influencia significativamente a tomada de decisões em matéria de gestão do risco, sendo igualmente validada a hipótese de existência de endogeneidade na relação entre decisão de cobertura de risco, estruturas de governo e nível de investimento; finalmente, (3) considerando a existência de endogeneidade na relação entre o valor da empresa e as decisões sobre cobertura de risco e sobre governo das sociedades, conclui-se que as empresas que promovem a cobertura de risco, com uma boa qualidade de governo, com elevadas rentabilidades e mais oportunidades de investimento, mas sujeitas a constrangimentos financeiros, têm maior probabilidade de obter avaliações significativamente mais elevadas. Verifica-se, ainda, que as estruturas de governo implementadas na empresa promovem o aumento de valor da empresa por via do efeito na estratégia de gestão do risco.

Apresentam-se de seguida as principais contribuições deste estudo. Primeiro, foi utilizada uma variável representativa das atividades de gestão do risco que compreende a utilização de instrumentos de cobertura externos (derivados) e/ou internos, situação esta que não é comum no espaço Europeu. Segundo, verificam-se contribuições também em termos metodológicos, nomeadamente: (1) quanto à literatura intrínseca à exposição ao risco, promove-se a aplicação de um modelo que considera o tratamento dos efeitos da endogeneidade das decisões de cobertura (*treatment effect model*); (2) quanto à literatura que contextualiza a gestão do risco financeiro, apresentámos novas evidências mediante a aplicação do método das variáveis instrumentais ao modelo *probit*; finalmente, (3) analisámos de forma explícita a endogeneidade inerente à relação entre o valor da empresa e as decisões sobre a gestão do risco e governo das sociedades. Finalmente, demonstrámos o papel da gestão do risco na relação entre governo das sociedades e valor da empresa, o que se traduz num contributo face ao estado da arte relativo ao governo das sociedades.

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LIST OF ACRONYMS

2SCML	Two-Stage Conditional Maximum Likelihood
2SLS	Two Stage Least Squares
3SLS	Three Stage Least Squares
AGLS	Amemiya's Generalized Least Square Estimator
CEO	Chief Executive Officer
CIA	Central Intelligence Agency
CP	Commodity Price Risk
FAS	Financial Accounting Standard
FASB	Financial Accounting Standards Board
FRS	Financial Reporting Standard
FX	Foreign Exchange Rate Risk
IAS	International Accounting Standard
IASB	International Accounting Standards Board
ICB	Industry Classification Benchmark
IR	Interest Rate Risk
IRRC	Investor Responsibility Research Center
ISS	Institutional Shareholder Services
MSCI	Morgan Stanley Capital International
NOLs	Net Operating Losses
NPV	Net Present Value
OLS	Ordinary Least Squares
PCA	Principal Component Analysis
SUR	Seemingly Unrelated Regressions
UK	United Kingdom

US	United States

CHAPTER 1

Introduction

1.1 Background and motivation

Over the last few decades globalization triggered capital market development and meanwhile the increase in the volatility of the prices of financial and non-financial assets generated a high degree of uncertainty at the corporate segment level. Indeed, the view that the volatility of financial prices affects both the cash flow of a firm's operations and its discount rate employed to value a firm, and therefore, the firm value, is generally recognized (Muller & Verschoor, 2006). In the face of this reality, risk management activities focused on the main variables representing the source of risk (foreign exchange, interest rate, and commodity price) have become standard practice for firms facing financial risks, which seems to highlight the potential that risk management has to increase value.

At first glance, for most non-financial firms risk management tools represent the support to firm value maximization and have become essential in the context of capital market integration. So, it is implicit that the main objective of a risk management programme should consist of hedging against financial risks. However, despite firms' pronouncements in favour of derivatives use for hedging purposes, it is not clear whether this is the case. Actually, when managers include their subjective views about market development when deciding on a risk management programme, they will increase risk, as it is believed to have happened in the much publicized stories of Procter & Gamble,

Metallgesellschaft, Parmalat, Société Générale, among others. Cleary, this situation, which is not expected to benefit investors on average, generates a genuine apprehension for investors and regulators as to what role risk management tools play in a corporation.

A priori, if companies are exposed to financial price risks and if they use risk management tools to manage one or more of those exposures, a change in the sensitivity of their returns to those risks would be evidence that the market reacts to risk management activities. Until recently, little effort has been directed towards analysing whether or not firms are successful at reducing risk pertaining to financial price exposures when hedging instruments are used. To the best of our knowledge, the study by He and Ng (1998) is the first one to suggest that the extent of exchange rate exposure is determined by the firm's hedging activities. In line with this study, other works, such as those from Allayannis and Ofek (2001) and Hagelin and Pramborg (2004), documented a significant reduction in foreign exchange exposure sustained by the use of currency exchange derivatives. In contrast, Bali, Hume and Martell (2007) simultaneously analysed the three categories of financial risks (exchange rate, interest rate, and commodity price risk) and their results do not generally support the hypothesis that derivatives' positions offset risk. Undoubtedly, if firms are not using derivatives to hedge existing exposures and/or firms' financial risk is economically insignificant relative to firms' return, it is possible that derivatives' use at the firm level will not be a value-enhancing exercise.

While the widespread use of hedging instruments seems to be in line with the positive theories that evoke risk management at the firm level as valuable to shareholders in the presence of capital market imperfections, the empirical evidence that numerous studies provide remains controversial, which still leads to in-depth discussions in academic literature concerning the truthful contribution of risk management to firm value.

The first step to gaining an understanding of risk management theories is provided by Smith and Stulz (1985), which applied Modigliani and Miller's (1958) irrelevance proposition to the scope of risk management. However, while Modigliani and Miller's assumptions are relaxed, several arguments in support of corporate risk management proliferate: (i) the reduction of expected corporate taxes (e.g., Smith & Stulz, 1985); (ii) the reduction of the probability of financial distress (e.g., Nance, Smith, & Smithson, 1993), and (iii) the reduction of cash flow uncertainty and reduction of agency conflicts between bondholders and shareholders, thereby decreasing underinvestment costs (e.g., Froot, Scharfstein, & Stein, 1993).

The latter arguments rest on the basis of shareholder's value maximization, but, in the meantime, additional arguments, based on manager's utility maximization (e.g., Stulz, 1984; DeMarzo & Duffie, 1995; Tufano, 1998), have been developed. They postulate that firm value is adversely affected by the degree of managerial agency costs. The theories developed on the basis of shareholder value maximization suppose that risk management activities pursued by the firm align the interests of managers and shareholders. However, if there is no proper control over managers' actions, they may be tempted to pursue these activities looking to maximize their own objectives and not necessarily to benefit their shareholders.

Up to now, it is shown that risk management instruments can be used for hedging, for managers' self-interest, and for speculation. It seems that the ideal situation for the use of risk management instruments arises where there are no agency conflicts between shareholders and managers (Tufano, 1998). In line with this, corporate governance mechanisms[1] can be viewed as a solution for the minimization of the agency conflicts

[1] Corporate governance consists of the mechanisms which insure that shareholders receive a return on their investment (Shleifer & Vishny, 1997). Corporate governance comprises both the firm-level and the country-level mechanisms. For example, executive compensation, ownership concentration, board independence, and market for corporate control.

between shareholders and managers (e.g., La Porta, Lopez-de-Silanes, Shleifer, & Vishny, 2002). From this perspective, a high firm governance level assures effective monitoring of management activities, thereby increasing the likelihood of derivatives' use for hedging purposes (e.g., Lel, 2012).

Over time, researchers have used two main approaches to empirically examine whether hedging increases firm value. The first has tried to uncover which hedging theory best describes firms' use of derivatives (e.g., Bartram, Brown, & Fehle, 2009). While there is some evidence in support of the theoretical predictions in test, in general the results are fairly mixed. For example, empirical evidence on the impact of agency conflicts, which arise from ownership structure, on hedging activities is scarce and it frequently runs counter to predictions (Haushalter, 2000). Recently, another stream of research stated that the key question for shareholders is whether hedging does, in fact, add value to the firm. Empirical studies under this second approach directly test the value implications of corporate risk management; that is to say, if hedger firms have a higher value when compared to their non-hedging counterparts. Whereas Allayannis and Weston (2001) and Carter, Rogers and Simkins (2006) find an economically large and statistical significant value premium associated with hedging, Jin and Jorion (2006) conclude that hedging is not a significant determinant of firm value. Again, the empirical results are misleading.

In the face of the inconclusive evidence on the value premium associated with hedging, Allayannis, Lel and Miller (2012) highlight the idea that the value obtained through risk management could be conditional to corporate governance structures. Specifically, the value inherent in hedging activities potentially depends on firm corporate governance quality. Regardless of the straightforwardness of this prediction, the issue is

rarely addressed in literature. So, it is clear that further research on the corporate governance effect on hedging premium is needed.

Overall, corporate hedging activities appear to be effective, since an extensive exposure-based literature shows only weak evidence on the effect of financial risks on stock returns. In light of this, it is surprising that the motives for and value of corporate hedging are still in doubt. It is likely that part of the inconsistent results reported in previous risk management-based empirical studies is due to methodological aspects (Aretz & Bartram, 2010). One possible explanation could be related to the hedging definition frequently used (Clark & Judge, 2008). Indeed, hedging activities tend to be associated with the use of derivatives, disregarding the fact that hedging can be pursued by other means. This has been documented by several surveys that present evidence concerning the use of non-derivatives hedging instruments (e.g., Bodnar, Hayt, & Marston, 1998). Therefore, firms can be erroneously classified as non-hedgers and that may bias empirical tests.

At the same time, most of the empirical studies do not account for the endogeneity implicit in the value/hedging relationship (e.g., Allayannis *et al.*, 2012) and in several variables describing the different dimensions of corporate hedging, such as investment opportunities (e.g., Lin & Smith, 2008), leverage (e.g., Graham & Rogers, 2002) and corporate governance structures (Lel, 2012). Only a small number of recent studies have tried to address endogeneity concerns by applying simultaneous equations models (e.g., Bartram *et al.*, 2009; Graham & Rogers, 2002; Hagelin, Holmén, Knopf, & Pramborg, 2007) or sample selection criteria (e.g., Jin & Jorion, 2006). Furthermore, the majority of prior studies focus on small industry-specific samples of firms and, mostly, samples from one country. On this matter, we observe that the use of small samples imposed restrictions

on the estimation of effects across several variables simultaneously, which turns out to be a key issue.

It is shown that according to the risk management literature an impressive amount of work has been done. Nevertheless, it seems obvious that certain questions with regard to firms' risk management activities remain unanswered, for example:

(1) Are firms using risk management instruments for hedging or for speculative purposes?

(2) Do corporate governance structures affect a firm's decision to hedge?

(3) Does the strength of governance have power over the value premium achieved through hedging?

In addition, a number of empirical challenges, such as (1) the problem of hedgers' misclassification and (2) the endogeneity implicit in the value-hedging relationship and in other variables that describe the different dimensions of firm value and of corporate hedging, have to be addressed properly.

1.2 Objectives and research method

Our main objective is to address a series of questions regarding corporate risk management and their relation to corporate governance, in the hope of being able to answer some of the puzzling issues in this field of knowledge. Specifically, we analyse if the firm uses risk management instruments with hedging purposes, and if so, if the implementation of strong firm-level governance structures is regarded as an active move in the pursuit of valuable hedging activities. This is accomplished with a collection of three empirical studies that are based on a sample of 567 non-financial firms in the four countries with stocks traded in Euronext – Belgium, France, The Netherlands, and Portugal – during the period 2006-2008.

A deductive approach is adopted as a research method in all the three empirical studies. In the first study we begin with a time series data analysis (linear regression model) and then we perform a cross-sectional multivariate analysis (ordinary least squares and sample selection models, namely treatment effect models). The studies that follow use also cross-sectional multivariate analysis, being the focus the simultaneous equations models. In the second study we make use of instrumental variable probit estimators and in the third study we apply the Seemingly Unrelated Regression (SUR) estimator.

Specifically, in the first empirical study we analyse whether firms use risk management instruments for hedging or for speculative purposes. We put together the work of Jorion (1990) and Bali *et al.* (2007) and follow a two stage procedure:

- Firstly, we analyse if our sample firms are indeed significantly affected by financial risk factor movements. To this end, a time-series analysis is conducted to measure a firm's exchange rate, interest rate, and commodity price exposure as the sensitivity of the value of the firm, *proxied* by the firm's stock returns, to unanticipated changes in financial risk factors;
- Secondly, in order to identify a firm's hedging or speculative behaviour, we use a cross-sectional estimation to analyse the effect of firms' hedging activities and operating profiles on financial price exposures estimated in the first stage.

However, there are economic reasons to believe that firms do not randomly select their hedging policy (Carter, Pantzalis, & Simkins, 2003). Accordingly, in the second stage analysis, we also take into account the possibility that firms that hedge have higher levels of exposure, which means that firms with a higher level of exposure self-select themselves into the group of firms that hedge. To clearly investigate this point, we proceed with a two-step treatment effect model, where the hedging decision will depend on the level of managerial agency costs and other firm's incentives to hedge in accordance

with optimal hedging theory. We measure the level of managerial agency costs by using an innovative methodology: the Lel (2012) firm-level governance index that was built based on two dimensions considered important by the literature to access corporate governance quality.

The second study, based on an extensive review of the hedging and corporate governance literature, focuses strictly on the issue of what motivates the use of hedging instruments. In particular, the core of this study is the re-examination of the hypothesis that a high governance quality increases the likelihood of hedging instruments' usage in a way consistent with shareholder maximization. Clearly, the motivation of this study stems from the fact that this prediction is economically justifiable and it is rarely addressed in the literature.

As stated before, if firms are not using derivatives to hedge existing exposures and/or firms' financial risk is economically insignificant, it is possible that hedging strategies will not be valuable? Preceding risk management-based studies are plagued by the fact that they frequently take for granted that firms use risk management instruments solely for hedging purposes. In this second study we overcome this potential concern following the first study results.

Likewise in the prior empirical study, our premier approach relies on the fact that corporate governance and other firms' characteristics affect firm decision to hedge. However, we have economic reasons to believe that some of the regressors of our model are interrelated. Along this line, we have adjusted our estimation methodology to account for the fact that several explanatory variables are endogenous and the endogenous variable of interest is dichotomous. Hence, in this investigation we expand the existing literature by using instrumental variables probit estimation, namely the Amemiya's Generalized Least Squares (AGLS) and the Two-Stage Conditional Maximum Likelihood (2SCML)

estimators, to provide consistent estimates of hedging behaviour. In addition, to obtain second-stage consistent estimates for the other endogenous variables in examination, we apply the SUR estimator.

The purpose of the third empirical study is to look at the effect of the decision to hedge on firm value conditional on the quality of internal governance structures. To accomplish this we consider in our baseline model that the firm value, *proxied* by Tobin's Q ratio, is driven by firm hedging behaviour, the firm-level governance structure and several other firms' characteristics. In addition, following the view of Allayannis *et al.* (2012), we hypothesize that governance also affects the implementation of valuable hedging strategies. By looking into the impact of corporate governance on the value derived from the implementation of a hedging programme, this study seeks to contribute to the increasing literature that argues that improving corporate governance structures is essential to control managers' actions, specifically when it reveals a direct mechanism by which governance can enhance firm value. To be exact, through its potential impact on the firm hedging behaviour, good governance might also impact firm value.

Finally, in the third empirical study we further assume that it is highly likely that firms with higher value engage more often in hedging (e.g., Hagelin *et al*., 2007). Moreover, a number of empirical works questioned if it is good governance that causes higher firm valuations, or alternatively, if firms with higher market value chose better governance structures (e.g., Beiner, Drobetz, Schmid, & Zimmermann, 2006). Clearly, if simultaneity exists between firm value, its hedging decision and corporate governance structure, we could not make an assessment of the causal connection when we estimate our baseline model. Therefore, in subsequent analysis we ought to control for the possible interrelationships between firm value, hedging, and corporate governance policies with

the development of a comprehensive system of simultaneous equations where we apply the SUR estimation method.

1.3 Contributions

Our three empirical studies contribute to the existing literature in several ways. First, in contrast with the bulk of empirical literature that commonly focuses on no more than one type of risk and on small industry-specific samples, we begin our analysis by focusing on financial risk as a whole and make use of a broader sample of non-financial firms across all industries.

Second, most of the previous studies used US and UK data to analyse hedging matters and only a few published papers enclose these matters by means of data from Continental Europe, namely with data based on the International Accounting Standards 32 and 39 that require detailed reporting on derivatives,[2] and none that we know of use data on a sample formed by the four selected countries.

Third, in parallel with Judge (2006) we make use of a *full hedging* variable. While previous studies frequently employ derivatives' use as a proxy for hedging activities, we use a dummy variable that accounts simultaneously for the use/non-use of internal and external hedging instruments.

Finally, in the three studies our contribution is also methodological in nature. To the best of our knowledge, our first study is one of the few studies that explicitly incorporate the wide range of financial risks in Jorion's (1990) augmented market model. Besides, in the first study we explicitly address the endogeneity of a firm's hedging decision by means of a treatment effect methodology, which is unusual in the exposure-based

[2] IAS 32, *Financial Instruments: Disclosure and Presentation*, and IAS 39, *Financial Instruments: Recognition and Measurement*, both issued by the International Accounting Standards Board (IASB), have been mandatory in the European Community since 2005.

literature. In the second study, we expand the existing literature by using the AGLS and the 2SCML estimators, two simultaneous equations systems that involve limited and discrete dependent variables and that are commonly used in the economics, sociology and political sciences literature, but rarely applied in the context of hedging literature. Further, in the third empirical study, in order to analyse the impact of hedging on firm value depending on the strength of governance, we redesign the model proposed by Allayannis *et al.* (2012) to also take into account the potential endogeneity implicit in the relationship among firm value and its corporate governance structure.

1.4 Structure of the dissertation

The remainder of this dissertation consists of six more chapters. The purpose of chapter 2 is twofold. First of all, it provides a critical overview of the theoretical literature on the link between hedging, corporate governance, and firm value which have been briefly introduced in section 1.1. Secondly, it serves as a background for the analytical studies in chapters 4, 5, and 6. Specifically, we identify the instruments used for corporate hedging and describe the most popular variables used for representing corporate hedging. Then we provide a description of the different theories of corporate risk management with a review of the empirical evidence on these theories, highlighting the major points of consensus and disagreement. After that we review the relevant empirical studies relating to the effect of hedging in firm value, present the pertinent literature concerning corporate governance and firm value, and finally, focus in the analysis of risk management as a channel by which good governance improves value.

Chapter 3 provides a comprehensive description of the sample selection procedure and data that will serve as the basis for all the three empirical studies. At this time, we will explain exhaustively the hedging proxy and the corporate governance index construction.

In chapter 4, we analyse whether the firms use risk management instruments for hedging or for speculation. First, we review the empirical evidence related to the financial price exposures, namely exchange rate, interest rate and commodity price exposures, and explore the determinants of these exposures. Then we present the research framework of this study, which includes the development of the hypotheses and the definition of statistical modelling. We proceed to an interpretation of the (1) time series analysis results, where stock price exposure is measured, (2) cross-sectional analysis results, where we test the determinants of financial price exposure, and, finally, (3) the cross-sectional analysis results, where we test for the determinants of financial price exposure controlling for the potential endogeneity in hedging decisions.

Chapter 5 presents a broad analysis of the characteristics of the Euronext non-financial firms that engage in hedging, emphasizing the need to control for firms' governance structures. In the research framework of this study we hypothesize that hedging decisions must be modelled simultaneously with governance and investment decision, which means that we have to define a set of instrumental variables that proxy for each of the endogenous explanatory variables. To carry on with this analysis we validate our instruments via several specification tests and finally proceed with AGLS and 2SCML estimation.

In chapter 6, we investigate if the use of hedging instruments is consistent with a higher valuation for firms that experience strong governance structures. By means of the same sample used for the two preceding studies, we first modelled the Tobin's Q ratio as driven by firm hedging behaviour, firm-level governance structure, and several other firms' characteristics from prior literature. Further, we proceed with a model employing an interaction variable in order to investigate if any indirect effect of hedging on firm value exists by means of governance structures. Finally, we control for the existence of

potential interrelationships between firm value and hedging, and corporate governance policies. Thereby, we advance with the interpretation of the simultaneous equations model that seeks to deal with the potential endogeneity among firm value and hedging, and firm-level governance policies.

Finally, chapter 7 concludes and summarizes the research. In this chapter, we review the results from the former chapters, discuss the relationships, and describe the contributions of this study to the exposure-based, hedging, and corporate governance literature. Furthermore, we discuss the limitations of the study and the extensions for future research.

CHAPTER 2

Theoretical background

2.1 Introduction

Financial risk management theory, which stems from market imperfections and violations of the perfect world assumptions of Modigliani and Miller (1958), argues that risk management can add value if it supports the reduction of expected tax liabilities (Smith & Stulz, 1985), the reduction of the probability of financial distress (e.g., Nance *et al.*, 1993), and the reduction of underinvestment costs (e.g., Froot *et al.*, 1993).

Tufano (1996) classified these positive theories of corporate risk management under the scope of the shareholder value-maximizing theories, since they focus on hedging as a means to maximize shareholder value. Meanwhile, another group of theories – manager utility-maximizing theories – postulate that firms engage in hedging activities for managerial reasons, such as reducing managers' personal risk (Stulz, 1984), signalling managerial ability (DeMarzo & Duffie, 1995), and avoiding capital market disciplining (Tufano, 1998). In light of this, recent investigation suggests that the managerial agency conflicts forge a link between corporate hedging activities and governance mechanisms (e.g., Allayannis *et al.*, 2012; Lel, 2012)

Many studies have tried to uncover which theory of hedging best describes firms' use of derivatives (e.g., Bartram *et al.*, 2009; Haushalter, 2000; Tufano, 1996), however, they ignored real-side factors behind risk management. The notion that the conception and implementation of a hedging strategy requires a commitment of financial, physical and

human resources that can represent significant costs for the firm, and that these costs should not exceed the potential benefits of risk management is well-known (Smith & Stulz, 1985). Therefore, the key question for shareholders is whether hedging does, in fact, add value to the firm. In light of this, a second group of recent studies directly test the impact of risk management activities on firm value (e.g., Allayannis & Weston, 2001; Guay & Kothari, 2003; Jin & Jorion, 2006). But also in this strand of analysis, the control of managers' actions must be a central issue. Accordingly, Allayannis *et al.* (2012) suggest that a firm's high governance level increases the likelihood of the use of derivatives for hedging purposes, thereby leading to more valuable hedging activities.

In this context, this chapter aims to present a critical overview of the theoretical literature on the link between risk management, corporate governance, and firm value. In addition, we analyse the related empirical studies, highlighting the major points of consensus and disagreement. From the analysis we point out the limited number of studies using data for non-US firms and conclude that certain areas are unexplored, in particular, the specification of the variables used to represent the implementation of hedging strategies and the investigation of the link between governance mechanisms and hedging premium. It is worth noting that empirical studies on these matters frequently fail to account for the endogeneity of the variables that describe different dimensions of corporate financial policy. So, in order to properly capture these effects, a thorough understanding about the causal structures is required.

Indeed, previous empirical tests on corporate hedging theories have presented evidence that is consistent with some of the theoretical predictions. Among the most remarkable findings is the avoidance of financial distress as a key objective of the users of derivatives (e.g., Berkman & Bradbury, 1996). It has also been documented that the size of firms is related to the propensity to use derivatives (Bartram *et al.*, 2009). Nevertheless,

the most notable aspect of prior empirical research is the absence of consistent evidence on other reasonable and well-regarded hypothesized determinants of the decision to hedge. For example, empirical evidence on the impact of agency conflicts, which arise from ownership structure and from executive compensation policies, on hedging activities is scarce and it frequently runs counter to predictions (Haushalter, 2000). Moreover, empirical evidence concerning the influence of a firm's quality of governance on the way the firm uses hedging instruments is also still scarce.

Similarly, in several empirical studies on the value effects of hedging there are references to the mixed, and often contradictory, results. It is likely that part of the inconsistency of previous empirical results is due to methodological aspects (Aretz & Bartram, 2010). Clark and Judge (2008) mentioned the misclassification problem of hedging activities as a potential source of empirical bias. Most studies tend to associate hedging activities solely with the use of derivatives (e.g., Allayannis *et al*., 2012; Marsden & Prevost, 2005; Mian, 1996). However, hedging can be pursued by other means, such as foreign currency debt, leading and lagging, contract pass-through clauses, among others. Furthermore, the majority of prior studies focus on small industry-specific samples of firms (e.g., Haushalter, 2000; Jin & Jorion, 2006) and, mostly, samples from one country (e.g., Davies, Eckberg, & Marshall, 2006; Joseph, 2000). On this matter, we observe that the use of small samples imposed restrictions on the estimation of effects across several variables simultaneously, which turns out to be a key issue. We uphold that hedging decisions must be considered simultaneous with governance and other financial decisions of firms (Lel, 2012). Undoubtedly, the hedging definition frequently used and endogeneity issues are the main subjects that only a few recent studies have tried to address.

The remainder of this chapter is organized into five more sections. Section 2.2 identifies the instruments used for corporate hedging and describes the most accepted

variables used to represent corporate hedging. Section 2.3 provides a description of the different theories of corporate risk management and the related empirical evidence. Section 2.4 reviews the relevant empirical studies relating to the effect of hedging in firm value. Section 2.5 presents, first the review of the pertinent literature regarding corporate governance; then, it focuses on good governance as a means by which hedging improves value. Section 2.6 summarizes and concludes the chapter.

2.2 Corporate risk management instruments and their proxy variables

Providing an adequate measure for corporate hedging is a necessary element to the success of empirical tests. However, hedging activities tend to be systematically associated with the use of derivatives, disregarding the fact that hedging can be pursued by other means. As we will show, this has been documented by several works that present evidence concerning the use of non-derivatives hedging instruments. Consequently, the number of hedgers can be underestimated and that might bias empirical tests.

It is worth noting that the usage of one or other of the previously mentioned variables is conditioned to data availability. This is quite clear, when we refer to the limited number of studies using data for non-US firms, mainly in Continental Europe. Conveniently, this situation tends to improve, mainly because of mandatory disclosure requirements set by regulators.

2.2.1 Corporate risk management instruments

Survey evidence indicates that firms actively handle their financial price exposures using off-balance-sheet techniques and/or on-balance-sheet techniques (e.g., Bodnar *et al.*, 1998). Similarly, these techniques also can be named as external hedging techniques and internal hedging techniques (e.g., Davies *et al.*, 2006; Joseph, 2000). In Joseph's (2000)

view, market risks like exchange rate, interest rate, and commodity price can be reduced through the use of external hedging instruments, such as derivatives (forwards, futures, swaps, and options), foreign currency borrowing/lending, factoring bills receivable, among others. Alternatively, when firms manage their risks through the use of instruments that they have internally available; in other words, instruments that do not require transactions or services from financial institutions, which involve the implementation of operational and financial strategies, they are making use of internal hedging instruments. Within a related point of view, Davies *et al.* (2006) propose only derivatives as external hedging techniques and all the other on-balance-sheet techniques as internal hedging techniques. Similarly to this, Judge (2006) defines hedgers as firms that use derivative and non-derivative hedging methods.[3]

If firms hedge their exposures through on-balance-sheet operating strategies, this can establish the so-called natural hedge, which is in essence an operational hedge. The straightest form of natural hedge is asset/liability management (Joseph, 2000). Asset/liability management is a technique that allows a company to minimize its exposure to financial price risk by means of holding the right combination of on-balance-sheet assets and on-balance-sheet liabilities. This technique attempts to match the maturity, prices or currency of cash inflows from assets with cash outflows from liabilities. The most used form of asset/liability management is the structuring of a firm's debt profile: debt maturity combination, debt fixed-floating interest rate combination and/or debt currency combination. For example, a firm with the majority of its debt service payments attached to a floating rate index is not necessarily exposed to interest rate risk. To determine the level of exposition, we must analyse the correlation between a firm's operating cash flows and interest rates. As a result, if operating cash flows is positively

[3] Later on we adopt the segmentation proposed by Davies *et al.* (2006) and Judge (2006).

correlated with short-term rates, the firm will have the motivation to use more short-term debt. Also, foreign currency-denominated debt (foreign debt hereafter) acts as a natural hedge of foreign revenues. Foreign currency debt service payments represent a cash outflow in a foreign currency and consequently can be used to match foreign currency revenues, which represent a cash inflow in foreign currency.

Furthermore, we can refer to the existence of short-term operational hedging strategies and long-term operational hedging strategies. Examples of short-term strategies are matching and netting, leading and lagging, domestic currency invoicing, adjustment clauses in sales contract, and transfer pricing agreements (Joseph, 2000). In respect to the long-term operational hedging strategies, we can point out, for example, the expansion of a firm's operations into new geographic areas.[4]

If the company chooses the adoption of strategies related to its financial activity, it possibly used the so-called structured or hybrid instruments (Smith, 1995). A hybrid instrument is shaped by combining two types of securities: typically a standard debt or equity security and an over the counter (OTC) derivative, such as a forward contract, a swap or an option. For example, convertible bond – formed by adding equity options to straight debt; convertible preferred – the combination of a standard preferred share with an embedded call option, or debt with caps – the combination of standard debt with a call option.

2.2.2 Measures of corporate risk management

2.2.2.1 Measures of external hedging

[4] Diversification will reduce risk because combining cash flows that are not perfectly correlated will, in general, reduce the overall variance of the combined firm cash flows. We can point out three types of diversification: product diversification (when a firm expands its product lines), geographic diversification (when a firm expands its operations into new geographic areas), and pure diversification (when a firm expands into unrelated business activities).

Concerning empirical studies that define hedgers and non-hedgers on the basis of derivatives and non-derivatives' usage, it is important to note that, over time, they have been plagued by the unavailability, or even the lack of quality, on data related to corporate derivatives' use. So, the construction of meaningful hedging variables is strongly affected.

Within this context, it should be mentioned that the majority of prior work concerning risk management is based on samples of US firms or samples of non-US firms that are cross-listed in US financial markets (New York Stock Exchange – NYSE, National Association of Securities Dealers Automated Listing – NASDAQ, and American Stock Exchange – AMEX). Undoubtedly, it is at the Financial Accounting Standards Board (FASB hereafter) level that the greatest effort for improvement in terms of accounting and disclosure of financial instruments, namely derivatives, takes place.[5] As a result, with the exception of firms with American Depositary Receipts,[6] corporate hedging activities' disclosures outside the US are mainly voluntary.

While disclosure of corporate hedging activities in financial statements has been mandatory in the US since December, 1994 (FAS 119), for example in UK this requirement only occurred in March, 1999 (FRS 13[7]) and in the European Community in January, 2005, with the adoption of International Accounting Standards (IAS), namely IAS 32 and IAS 39.

[5] The FASB issued a series of standards intended to improve transparency of derivatives use. For example, Financial Accounting Standard (FAS) 105, *Disclosure of Information about Financial Instruments with Off-Balance-Sheet and Financial Instruments with Concentrations of Credit Risk*; FAS 107, *Disclosures about Fair Value of Financial Instruments*; FAS 119, *Disclosure about Derivative Financial Instruments and Fair Value of Financial Instruments*, and FAS 133, *Accounting for Derivative Instruments and Hedging Activities*.

[6] In order to be able to reach American Investors, a foreign company can choose to set up a direct ordinary listing or an American Depositary Receipts programme. These firms are required to file periodically with the Security Exchange Commission and reconcile with Generally Accepted Accounting Principles in United States and the FASB rules in their annual reports.

[7] In September 1998, the Accounting Standards Board in UK issued a Financial Reporting Standard No. 13, entitled *Derivatives and other financial instruments: Disclosures.* Non-financial listed companies in UK are required to comply with FRS 13 with effect from 23 March 1999.

Several measures of derivatives' use were proposed in the literature, but we will present only the four most popular: (1) the dummy variable representing derivatives' usage (discrete measure); (2) the total notional value of derivative contracts; (3) the net notional value of derivative contracts, and (4) the fair value of derivative contracts. All the variables concern derivatives held by each firm for non-trading purposes. In Table 2.1 we present an extensive description of the variables that proxy for external hedging methods and the specific reviewed paper that uses each variable. Panel A lists discrete measures and the Panel B lists continuous measures of corporate hedging. Note that the use of more than one measure of corporate hedging is frequent when performing empirical tests in each study.

Table 2.1: **Summary of variables used in studies that define hedgers on the basis of external hedging techniques**

Panel A. Discrete measures of external hedging techniques		
Variable used	**Risk hedged[a]**	**References[b]**
Dummy = 1, if derivatives are used; 0 otherwise.	All	Bartram, Brown and Conrad (2011); Belghitar, Clark and Judge (2008); Berkman, Bradbury, Hancock, Innes (2002); Fok, Carroll and Chiou (1997); Mian (1996); Nance *et al.* (1993); Nelson, Moffit and Affleck-Graves (2005); Marsden and Prevost (2005)
	FX	Allayannis *et al.* (2012); Allayannis and Weston (2001); Clark and Mefteh (2010); Géczy *et al*. (1997); Lel (2012); Purnanandam (2008)
	CP	Purnanandam (2008)
	FX; IR	Deshmukh and Vogt (2005); Graham and Rogers (2002); Purnanandam (2008); Whidbee and Wohar (1999)
Dummy = 1, if the extent of hedging with derivatives is above its sample median value; 0 otherwise.	FX; IR	Deshmukh and Vogt (2005)

Table 2.1: **Summary of variables used in studies that define hedgers on the basis of external hedging techniques** *(cont.)*

Panel A. Discrete measures of external hedging techniques		
Variable used	**Risk hedged[a]**	**References[b]**
Dummy = 1, if the percentage of the next year's fuel requirements hedged is greater than zero; 0 otherwise.	CP	Carter *et al.* (2006)
Dummy = 1, if the firm hedges committed transaction foreign currency exposure; 0 otherwise.	CP	Hagelin *et al.* (2007)
Dummy = 0, if the firm does not disclose the use of derivatives; Dummy = 1, if the firm discloses using swaps either alone or swap combinations; Dummy = 2, if the firm discloses using forwards either alone or forwards combinations.	FX; IR	Géczy *et al.* (2007)
Hedging intensity = stands for the number of different types of derivatives a firm is using (between 0 and 12).	All	Bartram *et al.* (2011)
Panel B. Continuous measures of external hedging techniques		
Variable used	**Risk hedged[a]**	**References[b]**
The value of notional amount of derivatives outstanding at balance date scaled by the market value of the firm.	All	Berkman and Bradbury (1996); Howton and Perfect (1998); Marsden and Prevost (2005)
	FX; IR	Graham and Rogers (2002)
The value of notional amount of derivatives outstanding at balance date scaled by total assets.	All	Gay and Nam (1998); Guay and Kothari (2003)
	FX	Clark and Mefteh (2010); Lel (2012)
The value of notional amount of derivatives scaled by total sales of the firm.	FX	Purnanandam (2008)
	IR	Borokhovich, Brunarski, Crutchley and Simkins (2004)
The fair value of the derivatives outstanding at balance date scaled by the market value of the firm.	All	Berkman and Bradbury (1996); Howton and Perfect (1998); Marsden and Prevost (2005)
The absolute value of net derivative positions.	FX; IR	Graham and Rogers (2002)
The percentage of the next year's fuel requirements hedged.	CP	Carter *et al.* (2006)

Table 2.1: **Summary of variables used in studies that define hedgers on the basis of external hedging techniques** *(cont.)*

Panel B. Continuous measures of external hedging techniques		
Variable used	**Risk hedged**[a]	**References**[b]
The fraction of committed transaction foreign currency exposure.	FX	Hagelin *et al.* (2007)
The cash flow sensitivity of a firm's derivatives position.	All	Guay and Kothari (2003)
The market value sensitivity of a firm's derivatives position.	All	Guay and Kothari (2003)
The delta of the firm that hedges with currency or interest rate derivatives = firm's outstanding notional amount of currency or interest rate derivatives scaled by either foreign sales, total sales or total debt.	FX; IR	Nelson *et al.* (2005)

Note. This table lists the corporate risk management proxies used in empirical studies that define hedgers solely on the basis of external hedging instrument usage. Several papers combine the use of a dummy variable indicating derivatives' usage and a continuous variable, usually the total notional value of derivative contracts. Panel A lists discrete measures and Panel B lists continuous measures of corporate hedging.

[a] All stands for all categories of risks, FX for foreign exchange risk, IR for interest rate risk and CP for commodity price risk. [b] Whereas most studies focus on samples of US and UK firms, a few studies have also focused on samples of other countries, such as Australia (Berkman *et al.*, 2002), France (Clark & Mefteh, 2010), New Zealand (Berkman & Bradbury, 1996; Marsden & Prevost, 2005), Norway (Davies *et al.*, 2006), Sweden (Hagelin *et al.*, 2007) and a broad sample of countries (Bartram *et al.*, 2011; Lel, 2012).

The most common variable used to measure corporate hedging is, undoubtedly, a dummy variable representing whether the firm uses derivatives. Yet, several versions of this dummy can be found in reviewed papers. For example, Nance *et al.* (1993) and Marsden and Prevost (2005) define hedgers as firms that use any type of derivatives. Other works, like Géczy *et al.* (1997) and Allayannis and Weston (2001), confine hedgers to firms that use foreign exchange derivatives.

Another group of works propose the total notional value of derivative contracts (usually scaled by firm size) as a measure for corporate hedging (e.g., Berkman & Bradbury, 1996; Howton & Perfect, 1998; Lel, 2012; Marsden & Prevost, 2005). In fact, the total notional value has some advantage over the dummy variable. It provides information about the level of risk management, whereas the dummy variable provides

information solely about the decision to hedge. For computing this variable we sum up the notional value of each derivative contract held by the firm despite the position taken (short or long position).[8] So, if a firm holds offsetting contracts, the total notional value may overvalue risk management activities (Graham & Rogers, 2002). A few reviewed papers use in addition the fair value of the derivative contracts held (Berkman & Bradbury, 1996; Howton & Perfect, 1998; Marsden & Prevost, 2005). The fair value is defined as the absolute value of the net gain or loss on derivatives positions.

Graham and Rogers (2002), trying to avoid the identified limitation of total notional value, calculate the absolute value of net derivative positions in each category of derivative contracts. The net position is the difference between each firm's long and short position. However, they conclude that using net position, as opposed to total position, has only a marginally significance in the identification of firm's characteristics that determine corporate hedging decisions.

Several works combine the analysis of which factors could be associated with the probability that a firm hedges and the analysis of the factors that are associated with the extent of hedging (e.g., Allayannis & Ofek, 2001; Graham & Rogers, 2002; Lel, 2012; Marsden & Prevost, 2005). These works combine the use of a dummy variable indicating derivatives' usage and a continuous variable, usually the total notional value of derivative contracts.

2.2.2.2 Measures of internal and external hedging

The vast majority of empirical studies define hedgers and non-hedgers based on the use or non-use of derivatives, ignoring the fact that hedging can be pursued by other

[8] A long position is the one that benefits from price increases. Conversely, a short position is the one that benefits with prices decreases.

means.[9] In general, these studies have assumed the use of derivatives as an image of the adoption of risk management policies, mostly because derivatives are considered the most valuable tool for hedging. In addition, the unavailability of data about non-derivative hedging methods has imposed strong limitations on the use of the variables that seek to represent the existence of internal hedging strategies. According to Mackay and Moeller (2007), this is one of the restrictions concerning the construction of hedging variables. They collected information about risk management activities on a sample of 34 US oil refiners, between 1985 and 2004, and put out scarce references to the use of derivatives prior to 1996. Even in later years, they verify that hedging disclosures are still limited to information required by FASB rules, that is, disclosures concern only conventional derivatives and do not include non-derivative hedging methods.

Contemporary studies recognize the importance of internal hedging techniques and put forward the inadequate specification of existing variables that proxy for the implementation of hedging strategies, as a source of empirical tests bias (Clark & Judge, 2008; Davies *et al.*, 2006; Joseph, 2000; Judge, 2006; Mackay & Moeller, 2007). The argument above rests on the basis of several studies that have investigated various aspects related to derivatives' use. They always present evidence concerning the use of non-derivatives instruments for hedging.[10] Also, another group of studies has documented the use of foreign debt for hedging a firm's foreign currency exposure. While Bartram *et al.* (2009), Géczy *et al.* (1997) and Lel (2012) investigated whether foreign debt acts as a substitute or a complement to hedging with derivatives, Allayannis and Ofek (2001),

[9] It should be noted that over the empirical papers we reviewed, only fourteen papers employed proxies variables concerning internal and external hedging techniques.

[10] See, for example, Wharton studies on US non-financial firms (Bodnar *et al.*, 1996 and 1998); for non-US firms studies include Bodnar and Gebhardt (1999) on Germany, De Ceuster, Durinck, Laveren and Lodewyckx (2000) on Belgium, Bodnar, Jong and Macrae (2003) on the Netherlands, Alkebäck, Hagelin and Pramborg (2006), and Mallin, Ow-Yong and Reynolds (2001) on the UK.

Clark and Judge (2008), and Kedia and Mozumdar (2003) investigated the determinants of the choice of foreign debt issuance.

The most frequent approach to measuring corporate hedging with internal and external methods consists of using a dummy variable that points out the use/non-use of hedging instruments. For example, Judge (2006) provides empirical evidence on the determinants of corporate hedging using survey and non-survey data for UK companies. He analyses all type of risks (foreign exchange risk, interest rate risk and commodity price risk) and defines hedgers as firms that use derivatives or non-derivatives hedging methods. As non-derivatives hedging methods Judge (2006) considers the use of foreign debt, the issuing of fixed rate debt and the use of internal hedging techniques such as leading and lagging. In the case of Joseph (2000), the investigation is restricted to foreign exchange exposure and hedgers are defined as firms that occasionally and frequently use hedging instruments. Several other versions of the dummy variable were introduced by reviewed papers. Those variables are summarized in Table 2.2. Panel A lists discrete measures and Panel B lists continuous measures of corporate hedging with internal and external hedging techniques.

Table 2.2: **Summary of variables used in studies that define hedgers on the basis of internal and external hedging techniques**

Panel A. Discrete measures of internal and/or external hedging techniques		
Variable used	**Risk hedged[a]**	**References[b]**
Dummy = 1, if derivatives are used; 0 otherwise.	All	Bartram *et al.* (2009)
	IR	Kim, Mathur and Nam (2006)
	FX	Allayannis and Ofek (2001)
	CP	Haushalter (2000)
Dummy = 1, if the firm uses hedging instruments; 0 otherwise.	CP	Jin and Jorion (2006)

Table 2.2: **Summary of variables used in studies that define hedgers on the basis of internal and external hedging techniques** *(cont.)*

Panel A. Discrete measures of internal and/or external hedging techniques		
Variable used	**Risk hedged[a]**	**References[b]**
Dummy = 1, if the firm occasionally and frequently uses hedging instruments;[c] 0 otherwise.	FX	Joseph (2000)
Dummy = 1, if the firm uses either external or internal hedging instruments;[d] 0 otherwise.	All	Judge (2006);
	FX	Davies *et al.* (2006)
Dummy = 1, if the firm usually hedges with derivatives; 0 if the firm rarely or sometimes hedges (hedging intensity).	CP	Mackay and Moeller (2007)
Dummy = 1, if the firm only hedges financial risks with derivatives; 0 if the firm hedges operating risks.	All	Mackay and Moeller (2007)
Dummy = 1, if the firm hedges with derivatives or foreign currency debt; 0 otherwise.	FX	Allayannis, Ihrig and Weston (2001)
Dummy = 1, if the firm hedges only with foreign currency debt; 0 = otherwise.	FX	Clark and Judge (2009)
Dummy = 1, if foreign debt is used; 0 otherwise.	FX	Allayannis and Ofek (2001); Bartram *et al.* (2009); Kedia and Mozumdar (2003); Kim *et al.* (2006)
Dummy = 1, if the firm hedges only with short-term derivatives (forwards, futures and options); 0 otherwise.	FX	Clark and Judge (2009)
Dummy = 1, if the firm hedges with both derivatives (short and long-term) and foreign currency debt; 0 otherwise.	FX	Clark and Judge (2009)
Dummy = 1, if the firm hedges with swaps to convert foreign currency debt into domestic debt to create synthetic domestic debt; 0 otherwise.	FX	Clark and Judge (2009)
Dummy = 1, if the firm uses only synthetic foreign currency debt by swapping domestic debt into foreign currency debt and has no direct foreign debt; 0 otherwise.	FX	Clark and Judge (2009)

Table 2.2: **Summary of variables used in studies that define hedgers on the basis of internal and external hedging techniques** *(cont.)*

Panel A. Discrete measures of internal and/or external hedging techniques		
Variable used	**Risk hedged[a]**	**References[b]**
Dummy = 0, if the firm does not disclose the use of hedging instruments; 1, if it discloses only the use of internal instruments; 2, if it discloses the use of internal and external instruments.	FX	Davies *et al.* (2006)
Dummy = 1, if the firm discloses the use of derivatives and foreign currency debt; dummy = 2, if the firm discloses only the use of foreign currency debt; dummy = 3, if the firm discloses only the use of derivatives.	FX	Clark and Judge (2008)
Dummy = 1, if only derivatives are used; dummy = 0 if only foreign debt is used.	FX	Allayannis and Ofek (2001)
Panel B. Continuous measures of internal and/or external hedging techniques		
Variable used	**Risk hedged[a]**	**References**
The value of a notional amount of derivatives outstanding at balance date scaled by total assets.	FX	Allayannis and Ofek (2001)
The value of a notional amount of derivatives scaled by total sales of the firm.	FX	Allayannis and Ofek (2001)
The value of a notional amount of derivatives scaled by the sum of foreign sales and export sales.	FX	Kim *et al.* (2006)
The percentage of estimated production hedged (delta percentage).	CP	Haushalter (2000); Jin and Jorion (2006); Lookman (2004); Tufano (1996)
The percentage of current reserves hedged.	CP	Jin and Jorion (2006)
The difference between the percent of sales that are foreign and the percent of assets that are foreign, i.e., the net foreign currency exposure (operational hedging).	All	Bartram *et al.* (2009)
The number of countries in which a firm operates (operational hedging).	FX	Allayannis *et al.* (2001); Kim *et al.* (2006)
The number of broad regions in which a firm has subsidiaries (operational hedging).	FX	Allayannis *et al.* (2001); Kim *et al.* (2006)

Table 2.2: **Summary of variables used in studies that define hedgers on the basis of internal and external hedging techniques** *(cont.)*

Panel B. Continuous measures of internal and/or external hedging techniques		
Variable used	**Risk hedged**[a]	**References**[b]
The geographic dispersion of its subsidiaries across different countries (operational hedging).	FX	Allayannis *et al.* (2001); Kim *et al.* (2006)
The geographic dispersion of its subsidiaries across different regions (operational hedging).	FX	Allayannis *et al.* (2001); Kim *et al.* (2006)
Sales-based and cost-based hedge ratio (endogenously hedge rates).	CP	Mackay and Moeller (2007)
Measure of real optionality.	CP	Mackay and Moeller (2007)
Vertical integration (diversification) = one minus Herfindahl of a firm's business segments related (unrelated) to oil refining (proxies for natural hedge).	CP	Mackay and Moeller (2007)

Note. This table lists the corporate risk management proxies used in empirical studies that define hedgers on the basis of internal and external hedging instruments' usage. Some studies make use of one variable to represent the use of external hedging techniques and an additional (or more than one) variable to represent the use of internal hedging techniques. A few papers combine the use of a dummy variable indicating derivatives' usage and a continuous variable, usually the total notional value of derivative contracts. Panel A lists discrete measures and Panel B lists continuous measures of corporate hedging with internal and external hedging techniques.

[a] All stands for all categories of risks, FX for foreign exchange risk, IR for interest rate risk and CP for commodity price risk. [b] Whereas most studies focus on samples of US and UK firms, a few studies have also focused on samples of other countries, such as Canada (Tufano, 1996), Norway (Davies *et al.*, 2006), and a broad sample of countries (Bartram *et al.*, 2009). [c] The internal hedging techniques considered are: leads and lags, matching inflows and outflows with respect to time of settlement, inter-company netting of foreign receipts and payments, domestic currency invoicing, adjustment clause in sales contract, asset/liability management and transfer pricing agreements. The external techniques analysed include: foreign currency borrowing/lending, forward exchange contracts, foreign exchange options, foreign exchange futures, factoring bills receivable, cross-currency interest rate swaps, foreign currency swaps, European currency unit, special drawing rights, other currency blocs and government exchange risk guarantee. [d] Judge (2006) classifies firms as hedgers when they make any reference to hedging their financial price exposure in their annual reports. This hedging may comprise the use of derivatives and/or non-derivative hedging methods. The non-derivatives hedging methods include the use of foreign currency debt, the issuing of fixed rate debt, netting, matching and leading and lagging. Davies *et al.* (2006) classify firms as foreign currency hedgers either if they use derivatives instruments (external hedging methods) or any of the following internal methods: matching/netting, leading/lagging, pricing considerations, foreign borrowing, foreign bank accounts and/or balance sheet hedging.

Another possibility for representing the use of internal and external hedging methods was provided by Allayannis *et al.* (2001) and Kim *et al.* (2006). They use several variables as proxies for the existence of several risk management strategies, namely financial and operational hedging strategies, e.g., in Allayannis *et al.* (2001), a dummy variable indicates the use of foreign currency derivatives or foreign debt. In addition, four other variables representing a firm's operational hedging strategies are used: (1) the number of countries in which it operates, (2) the number of broad regions in which it is

located, (3) the geographic dispersion of its subsidiaries across different countries, and (4) the geographic dispersion of its subsidiaries across regions.

The third approach proposed in the literature to represent the use of internal and external hedging strategies is the delta percentage. The delta percentage is defined as the delta of the firm risk management portfolio held by the firm divided by its expected production. This variable was first introduced by Tufano (1996) and more recently used by Jin and Jorion (2006), and it is appropriate to proxy for the level of exposure to commodity price risk that is hedged. Unfortunately, computing the delta percentage requires very detailed data on derivatives' use, which is available only for a few industries, such as in North American gold mining (Tufano, 1996) or the US oil and gas industry (Haushalter, 2000; Jin & Jorion, 2006; Lookman, 2004).

Lookman (2004) goes further in the specification of the delta percentage. He disaggregates the risk exposure into primary risks that have a significant impact on a firm's financial condition and secondary risks that have only a small impact. As a consequence, he constructs proxies for primary and secondary risk hedged by interacting delta percentage with a function that classifies commodity price as a primary or secondary risk for the firm.

Recent work on "selective hedging" (Mackay & Moeller, 2007) confirms that the use of derivatives does not tell the whole risk management story. Mackay and Moeller (2007) use several measures of risk management activities. Firstly, they estimated a sales-based and a cost-based hedge ratio. The model that creates these estimates is developed on the basis of a discriminating risk management programme that hedges concave revenues (conditional hedging) and leaves concave costs exposed (conditional exposure). Secondly, they use two binary variables that stand for "hedging intensity" and "financial hedging".

Further, they control for “real optionality”, vertical integration and diversification. Vertical integration and diversification provide indication for natural hedge.

2.3 Arguments for corporate risk management

According to classical propositions proposed by Modigliani and Miller (1958), the capital structure of a firm has no impact on its value, since shareholders can replicate corporate financing policies by themselves, with their own transactions on capital markets. Smith and Stulz (1985) apply the logic of Modigliani and Miller to corporate risk management and suggest the extension of the irrelevance proposition of capital structure through corporate risk management. According to these authors, corporate risk management as a financial activity would not increase shareholder value, since the firm’s owners could perform the management of financial risks better than managers due to the effect of portfolio diversification.

A closer analysis, however, reveals that the assumptions of Modigliani and Miller (1958) do not hold in reality, because of the existence of capital market imperfections, such as taxes, financial distress costs, agency costs or asymmetric information. Stulz (1984), Smith and Stulz (1985), Froot *et al.* (1993), DeMarzo and Duffie (1995), Breeden and Viswanathan (1998), among others, demonstrated that the existence of capital market imperfections can create higher market values for firms that engage in hedging activities. So, in the first place, the rationale behind risk management is that it adds value to the firm in ways shareholders cannot achieve on their own.

Some theories have been developed supporting corporate risk management in terms of its impact on firm value. Tufano (1996) classified these theories under two main classes: shareholder value-maximizing theories and managerial utility-maximizing theories. The first one focuses on hedging as a means to maximize shareholder value.

Hedging is, therefore, beneficial to shareholders because it can mitigate costs associated with market imperfections. In this case, hedging is used for reducing expected tax costs, the probability of financial distress and to avoid underinvestment. In the second group of theories, firms engage in hedging activities for managerial reasons, such as reducing managers' personal risk, signalling managerial ability and avoiding capital market disciplining. The remainder of this section reviews both groups of theories and presents the theoretical results that are empirically testable. Subsequently, the empirical evidence is provided. In addition, we also discuss other hypotheses justifying corporate hedging, such as firm size, substitutes of hedging with derivatives and firm exposure to risk.

As we will show later, in general the empirical evidence concerning theoretical predictions is mixed. The hypotheses that present more supportive evidence are related to the agency costs of debt, the size of the firm and the exposure to financial risk. Despite the vast number of studies presented, it is worth noting once again that prior works are mainly based in samples of US firms.

2.3.1 Shareholder value-maximizing theories

2.3.1.1 Tax argument

Smith and Stulz (1985) provide an analysis of the determinants of corporate risk management policies among large widely-held firms. They suggest that if pre-tax income is subject to a convex tax function, then the volatility of pre-tax income is costly to the firm. In this case, hedging taxable income by reducing the variability of pre-tax income reduces a firm's expected tax liability and consequently increases the expected post-tax value of the firm, as long as hedging costs do not exceed its benefits.

Smith (1995) considered three general sources of effective tax function convexity for firms: tax rate progressivity, the existence of a minimum tax, as the alternative

minimum tax,[11] and limitations on the use of tax credits, the so-called tax preference items, such as limitations on carrying losses backward or forward and on investment tax credits.

When firms face tax regimes where a higher rate applies as income increases (tax rate progressivity[12]), unexpected changes in pre-tax income over several periods lead to a higher corporate tax liability, rather than to a more stable income. So, firms with more of the range of their income in the progressive region of the tax schedule have a greater tax-based incentive to hedge.

Regarding the matter of tax preference items, we can observe that investment tax credits offset a fixed maximum fraction of a firm's tax liability. So, the major effect of investment tax credits is to shift the effective tax structure down to reflect the value of the tax credit. Instead, tax losses carry back[13] and tax losses carry forward[14] decrease the tax liability because profits in one year can be offset by losses in another year.

These tax code features induce the marginal tax schedule to become convex over a larger region. It is worth noting that this conclusion is mainly based on the US tax structure, since existing empirical studies that extensively analyse these matters are mostly based on the tax structure of the US. To minimize its taxes, a firm needs to take full

[11] Under the current US tax law, a firm must calculate its taxes in two different ways and then pay the higher of both. First, the firm calculates taxes due using net income and the deductions and credits available under the "regular" tax. Then, it must do a separate calculation, requiring a different set of records – this alternative calculation is called Alternative Minimum Tax (AMT). The original idea behind this alternative taxation was to tax firms that had substantial economic income, but paid little or no "regular" tax, because of tax preferences or because of net operating losses or credit carry forwards.

[12] Concerning the structure of corporate tax income, the dominant feature in the US is progressivity of tax rates. In contrast, in other OECD countries the proportionality of corporate tax rates is predominant.

[13] Tax losses carry back is a technique that permits present net amount of losses to be carried back and applied to previous pre-tax earnings, i.e., the term "carrying back" a loss means that you refigure the last year's taxable income and taxes. As a result, you may obtain a refund, partially or completely, of taxes you paid in that earlier year.

[14] Tax losses carry forward is a technique that permits losses to be carried forward and applied to future earnings, i.e., a carry forward can be used to reduce future income, thereby reducing future tax payments.

advantage of its tax preferences, and it maximizes the likelihood of doing so by reducing the variability in the pre-tax income.

The tax hypotheses suggest that benefits of hedging should be greater: i) the higher the probability of the firm's pre-tax income being in the progressive region of the tax schedule; ii) the greater the firm's tax losses carry forward, and iii) the greater the firm's others tax credits.

2.3.1.2 Financial distress costs argument

The larger the debt relative to firm value and the variability of cash flows, the higher the probability of financial distress, as both factors increase the probability of winding up in bankruptcy in the future. Indeed, since the future cash flows of the firm are subject to uncertainty, situations can arise where a firm cannot, or is expected not, to meet its fixed payment obligations fully and timely (e.g., wages and interest payment on debt). This illiquidity condition originates transaction costs of financial distress (Warner, 1977).

Under this assumption, hedging by reducing the volatility of cash flows, and thus lowering the likelihood of financial distress and the related deadweight costs that arise between bondholders and shareholders, can contribute to maximize a firm's value (Smith & Stulz, 1985). Nance *et al.* (1993) note that the magnitude of cost reduction depends upon two factors: i) the probability that the firm will encounter financial distress, if it does not hedge, and ii) the cost the firm incurs if it does encounter financial distress.

Furthermore, the increase in firm value can also come from the increase in debt capacity. That is, if debt presence in the capital structure allows for fiscal advantages, then hedging enables a firm to increase its debt capacity and therefore tax benefits of debt, which ultimately increase firm value (Graham & Rogers, 2002; Leland, 1998; Ross, 1996; Stulz, 1996).

The costs of financial distress can be substantial, not only because of the direct costs of bankruptcy (legal cost of lawyers and other legal expenses), but most of all because of the indirect costs, even when a firm does not experience bankruptcy. First of all, firm suppliers will offer less attractive payment conditions if a firm is labouring under financial difficulties. Secondly, signs of liquidity problems will lead to decreases in sales since this is an indication to customers that service and warranties may not be available with certainty in the future. Thirdly, employees may require a premium for the risk of losing their job. Situations of financial distress can thus lead to a permanent loss of reputation and of human capital.

Altman (1984), among others, finds that direct costs of bankruptcy are not directly proportional to the firm size. Smith and Stulz (1985) argue that if hedging costs are proportional to firm size, the reduction in expected direct bankruptcy costs is greater for small firms, implying that small firms are more likely to hedge. On the other hand, hedging programmes exhibit informational scale economies and derivative markets also exhibit significant scale economies in their structure of transaction costs. In this sense, larger firms are more likely to have the necessary resources and potential trading capacity to permit the use of derivatives.

From the preceding theoretical analysis, it is now clear that hedging can lower the expected costs of financial distress, as long as hedging costs are not too high. Since the probability of entering into financial distress is larger when firms have more fixed payment obligations, firms with higher leverage (Nance *et al.*, 1993), higher volatility of cash flows (Joseph, 2000), shorter debt maturity (Bartram *et al.*, 2009), lower interest coverage ratio (Nance *et al.*, 1993), and lower credit ratings (Carter *et al.*, 2006) are more likely to hedge. By contrast, in the case of very distressed firms (that is firms with

negative book equity), Graham and Rogers (2002) predicted that hedging is unlikely because it may reduce the option value of equity.

Also, the probability of encountering a situation of financial distress is lower in firms with high profitability (Allayannis & Ofek, 2001), with high liquidity (Carter *et al.*, 2006), with a larger fraction of tangible assets (Howton & Perfect, 1998), and with higher dividends (Bartram *et al.*, 2009). Since these firms probably have stable cash flows and lower financial constraints, they are less likely to hedge. Finally, smaller firms deal with relatively high costs of financial distress which implies, from a theoretical point of view, that they are more likely to hedge. However, if smaller firms face higher costs of hedging, then they may be less apt to hedge. There is no clear prediction whether or not smaller firms should hedge more or less than larger firms. Thus, the relation between hedging and firm size is an empirical question.

2.3.1.3 Agency costs of debt argument

When a firm has high financial leverage and its cash flows are volatile, suboptimal investment behaviour can arise – the so-called problem of underinvestment. Myers (1977) and Bessembinder (1991) argue that managers acting in the interest of shareholders may have an incentive to reject projects with positive net present value (NPV), since shareholders have to pay for the whole investment, whereas the returns from the investment accrue first to bondholders. From this point of view, the return of a positive NPV project may be in fact negative for shareholders. This situation leads to overall firm value decline.

In the presence of financial risks causing volatility of corporate cash flows that, by consequence, induce volatility to the investment programmes, corporate hedging can create value to shareholders. This can be achieved by shifting cash flows from states in

which cash flows are sufficient to states where cash flows are insufficient to meet the firm obligations; then the number of future states in which shareholders are the residual claimants increases. This will make shareholders less inclined to underinvest. Hedging, also, allows negotiating better contract terms in the form of lower borrowing costs (Bessembinder, 1991).

Froot *et al.* (1993) provide an alternative explanation for the underinvestment problem, in which hedging can increase shareholder value through harmonization of financing and investment policies. They suggest that, due to cash flow volatility imposed by financial risks, a shortfall in internal funds induces firms to reject positive NPV projects in order to avoid a very costly visit to the capital market. Since hedging can reduce cash flow volatility, it enables the firm to control the need for and the availability of internal funds to pursue optimal investment projects, thus avoiding underinvestment. Therefore, Froot *et al.* (1993) venture that firms with planned investment programmes and with more costly external funds would be more likely to benefit from risk management activities.

An additional problem can be recognized when shareholders of leveraged firms have a strong interest in taking very risky investment projects – the so-called asset substitution problem or risk shifting problem (Jensen & Meckling, 1976). This situation can be explained on the basis that the residual claims of shareholders can be viewed as a call option on the assets of the firm. In addition, as a general rule, we verify a positive correlation between the value of an option and the volatility of the underlying asset. Within this context, following risky investment projects, even with a negative NPV, increases the option value of shareholders. Whereas potential gains accrue to shareholders, the potential losses are in fact supported by bondholders.

Rational bondholders will try to block *ex ante* these opportunistic shareholder behaviours. Firstly, they will require a higher rate of return for debt financing. Secondly, they can impose debt covenants, which can limit the degree of freedom for future investment; therefore, these debt covenants are value-reducing. In this case, if firms are able to credibly pre-commit on a hedging strategy, the agency costs of debt described above can be reduced or even avoided (Smith & Stulz, 1985). If hedging reduces the bondholders' expected loss conditions, it will reduce the required rate of return of debt financing and the existence of restrictive bond covenants.

According to Bessembinder (1991) and Froot *et al.* (1993), firms with high growth potential may find it more difficult to raise external capital because their (mainly intangible) assets may not constitute good warranty. From the Bessembinder (1991) analysis we can also observe that a greater probability of financial distress can result in rejection of value-increasing projects, which is determined by the level of debt and the volatility of cash flows. Within this context, firms with high levels of debt and with a large proportion of growth options are expected to hedge most. Froot *et al.*'s (1993) model predicts also that firms with a high level of asymmetric information will have more costly external finance. Hence, hedging is more likely for firms with high expected growth, with costly external finance and small firms. Finally, the model also predicts that firms with low levels of internal finance (low liquidity) are more prone to hedge.

Furthermore, firms that spend large amounts on research and development are expected to get more growth options in the future (Nance *et al.*, 1993). On the other hand, theory predicts a positive relation between investment spending in general and hedging (Haushalter, 2000). It is expected that those firms engage in more hedging activities.

Other works provide several other empirical predictions. Firms with higher needs of internal financing for assets growth (Berkman & Bradbury, 1996), firms that pay low

dividends (Haushalter, 2000) and firms with an abnormal positive movement in the firm's stock price (Gay & Nam, 1998), are more likely to engage in risk management activities. Conversely, firms in the regulated industries tend to face lower asymmetric information, thus have less incentive to hedge (Mian, 1996).

2.3.2 Managerial utility-maximizing theories

The three points of view discussed above are based on maximizing shareholder value. Those theories assume the absence of agency costs of equity, so hedging is always in the interest of shareholders. However, when there is a conflict of interests between shareholders and managers, the objective surrounding risk management activities can significantly differ.

Stulz (1984) and Smith and Stulz (1985) focus on managerial risk aversion as a justification for risk management. They argue that risk adverse managers tend to use hedging if they have relatively undiversified financial and human capital, and if it is costly to hedge on their own account. As a result, managers may be particularly interested in maximizing their personal utility instead of creating shareholder value.

As Smith and Stulz (1985) show, the greater the managers' equity investment and human capital investment in the firm the greater their incentive to reduce risk. Managers' risk aversion can lead them to hedge, but it does not necessarily do so. If the compensation package of the manager is such that his income is a convex function of the value of the firm, it can be the case that the manager is better off if the firm does not hedge. Hence, if managers have large option or bonus components in their compensation structure, it is likely that the firm will not hedge. Yet, if the manager owns a large fraction of the firm's equity, one would expect the firm to hedge more, as in this case

compensation plans lead to a linear function between the manager's income and the firm's value.

Divergent risk preferences between managers and shareholders may not, at all times, have a negative impact on firm value. This is because managerial risk preferences in the end aim at reducing corporate risk, in order to prevent bankruptcy. Consequently, managerial hedging strategies can lead to increases in firm value. To assure this situation, managerial utility-maximization must be linked to shareholder value-maximization through proper management compensation plans.

Also, in this context, DeMarzo and Duffie (1995) and Breeden and Viswanathan (1998) link corporate hedging to managerial career and reputation concerns. Hedging can decrease the noise associated with performance measures by reducing the firm's cash flow volatility. In this sense, managers with superior abilities may engage in hedging activities to better communicate their skills to the labour market. Therefore, hedging can also be viewed as a tool to reduce the degree of informational asymmetry among managers, shareholders, and also the labour market.

Finally, risk management activities can potentially intensify the agency conflicts between managers and shareholders, leading firms to poorer investment decisions. Tufano (1998) argues that managers might hedge to avoid scrutiny of negative NPV pet projects by external markets. As providers of external capital would not finance these projects, if managers use hedging to guarantee the availability of internal funds, then these projects can be followed. As a result, Tufano (1998) suggests that hedging can lead to a situation of overinvestment. Indeed, by easing the protection of managers' pet projects, hedging can reduce shareholder value.

For the most part, the previous discussion argues that a manager's incentive to reduce a firm's cash flow volatility may vary according to management compensation

structure and to performance measures. If the manager is compensated in such a way that his income linearly depends on the value of the firm, one may expect the firm to hedge. That is, by linking the compensation and evaluation of managers appropriately to the stock price, it is expected that managers' strategies of corporate risk management take shareholder value into account. On the other hand, components of management compensation with call-option features, such as stock options, can lower managers' risk aversion and thus the firm is not expected to hedge. Thus, managers holding a significant fraction of the firm's shares should engage more actively in hedging activities; on the contrary, a managerial stock option programme mitigates the managers' incentive to engage in hedging activities (Tufano, 1996).

However, stock options have two opposing effects on managerial incentives to hedging (Carpenter, 2000). The first effect comes from the sensitivity of options to stock return volatility. Since options have a convex payoff structure, the value of the stock option increases with the volatility of the firm's stock returns. This effect should incite managers to hedge less. A second effect of managerial stock option arises because the payoff of the stock option is directly linked to stock price. In this respect, managerial stock options tie the manager's wealth to the stock price in a similar way to stock holdings. This effect should incite risk adverse managers to hedge. Summing up, when the option is out of the money they tend to hedge less; conversely, when the option is in the money they tend to hedge more (Hagelin *et al.*, 2007).

By establishing an adequate compensation contract, shareholders may provide effective incentives for the proper risk-taking behaviour of management, which results in value-maximizing decision-making. However, due to information asymmetry and incomplete contracting, this might be a difficult mission. According to Stulz (1990), corporate hedging could reduce either the overinvestment or underinvestment costs

resulting from non-observable managerial actions. In this subject, the theory predicted that the higher the level of information asymmetry, the greater the benefits of hedging.

2.3.3 Empirical evidence on corporate risk management theories

Most cited arguments justifying corporate risk management are based on the reduction of tax liabilities, on the financial distress costs, on the underinvestment costs, as well as on managerial risk aversion. Several recent articles present empirical evidence for this. In Tables 2.3, 2.4, 2.5 and 2.6, we summarize all the empirical evidence reviewed.

2.3.3.1 Evidence concerning tax argument

In section 2.3.1.1 it is suggested that the benefits of hedging should be greater: i) the higher the probability the firm's pre-tax income is in the progressive region of the tax schedule; ii) the greater the firm's tax losses carry forward is, and iii) the greater the firm's other tax credits are. The existing empirical literature has used different variables to measure tax function convexity and to analyse the tax hypotheses outlined in Table 2.3. The most popular variable is, undoubtedly, the amount reported on tax losses to carry forward (e.g., Géczy *et al.*, 1997; Nance *et al.*, 1993; Tufano, 1996) or a dummy variable indicating the instance of tax losses in the firm's balance sheet (e.g., Berkman & Bradbury, 1996; Howton & Perfect, 1998; Marsden & Prevost, 2005; Mian, 1996). The variables used try always to measure the convexity of the tax schedule and therefore quantifying tax advantage. However, the results of the empirical evidence reveal a different story. It seems that they recurrently fail to quantify the tax advantage.

Table 2.3: **Empirical evidence on tax argument**

Theoretical Prediction	Empirical Evidence
Hedging:	
Increases with the probability of more of the range of a firm's pre-tax income being in the progressive region of the tax schedule.	**Yes**: Howton and Perfect (1998); Haushalter (2000); Nance *et al.* (1993) **No evidence**: Mian (1996)
Increases with the convexity of tax function.	**No evidence**: Graham and Rogers (2002); Purnanandam (2008)
Increases for firms with higher tax losses carry forward.	**Yes**: Berkman and Bradbury (1996) **No evidence**: Berkman *et al.* (2002); Fok *et al.* (1997); Gay and Nam (1998); Géczy *et al.* (1997); Howton and Perfect (1998); Lel (2012); Marsden and Prevost (2005); Mian (1996); Nance *et al.* (1993); Tufano (1996);
Increases for firms with a higher level of income tax credits.	**Yes**: Bartram *et al.* (2009); Mian (1996); Nance *et al.* (1993) **No evidence**: Fok *et al.* (1997)
Increases for firms with a higher tax loss carry forward or a higher level of investment tax credits.	**No evidence**: Allayannis and Ofek (2001)

Note. The table lists the theoretical predictions and the corresponding empirical evidence on corporate risk management, specifically when we focus on tax argument. Those empirical studies whose findings provide significant evidence for the theoretical prediction appear after the word "Yes"; those whose findings provide significant evidence but are contrary to the theoretical prediction appear after the word "No"; those studies that do not support the theoretical prediction appear after the words "No evidence".

Rather than using a variable based on net operating losses (NOLs), Graham and Smith (1999) propose a Monte Carlo simulation approach to quantify the tax advantage resulting from a decrease in the volatility of the taxable income when the firms use risk management instruments. The authors find that the considered tax provisions have only a modest effect on the convexity of the tax function. Nevertheless, they characterize firms with a higher probability of facing convex tax function as: (1) small firms with their expected taxable incomes near zero; (2) firms with volatiles incomes, and (3) firms where incomes shift between profits and losses.

Using an identical approach, Graham and Rogers (2002) and Purnanandam (2008) do not find evidence that firms hedge to reduce expected tax liability when their tax

functions are convex. Graham and Rogers (2002) demonstrate that firms do not hedge in response to convexity, because the incentive is smaller when compared to other hedging incentives. Instead, by hedging firms seek to increase their debt capacity, thereby increasing the tax shields of debt and in consequence increasing firm value.

To summarize, as we can see in Table 2.3, there is no general consensus regarding the validity of corporate tax hedging theory. On one hand, there is evidence in support of a positive correlation between tax system features and valuable risk management. On the other hand, the results of empirical studies do not give a clear picture regarding the role of tax motive.

2.3.3.2 Evidence concerning financial distress costs argument

In section 2.3.1.2, it is shown that firm value can be improved if hedging can reduce the probability of encountering financial distress, thus lowering the expected costs of financial distress. The two most popular measures used are financial leverage and interest coverage ratio. Theoretical analysis makes it clear that firms with higher leverage and lower interest coverage ratio should benefit more from hedging. Most studies stated that higher leverage leads to higher probabilities of encountering financial distress and thus interpret a positive leverage coefficient as evidence that greater leverage causes greater hedging or increases the likelihood of hedging. Whereas a lower interest coverage ratio can be interpreted as evidence that the firm might not generate enough cash from the operations to honour the promised payments on their debt, therefore, a negative coefficient on this variable brings evidence that lesser interest coverage ratio causes greater hedging or increases the likelihood of hedging. Table 2.4 exhibits these and other empirical predictions related to the financial distress argument. As can be observed, in many of the studies a positive and statistically significant relationship between hedging

and leverage is found. However, the evidence is still mixed for some other studies (e.g., Allayannis & Ofek, 2001; Hagelin *et al.*, 2007; Nance *et al.*, 1993).

Table 2.4: **Empirical evidence on financial distress costs argument**

Theoretical Prediction	Empirical Evidence
Hedging:	
Increases for firms with higher leverage.	**Yes**: Bartram *et al.*(2009); Berkman and Bradbury (1996); Berkman *et al.* (2002); Borokhovich *et al.* (2004); Gay and Nam (1998); Graham and Rogers (2002); Haushalter (2000); Howton and Perfect (1998); Judge (2006); Lel (2012); Marsden and Prevost (2005); Purnanandam (2008) **No**: Allayannis and Ofek (2001); Carter *et al.* (2006); Hagelin *et al.* (2007) **No evidence**: Clark and Judge (2008); Fok *et al.* (1997); Géczy *et al.* (1997); Guay and Kothari (2003); Nance *et al.* (1993); Tufano (1996)
Increases for firms with high leverage and higher costs of distress.	**Yes:** Graham and Rogers (2002)
Increases with the level of cash costs.	**No evidence:** Tufano (1996)
Increases with the level of investment expenditure.	**No evidence:** Haushalter (2000)
Increases for firms with lower interest coverage.	**Yes**: Bartram *et al.*(2009); Berkman and Bradbury (1996); Fok *et al.* (1997); Judge (2006)
	No evidence: Berkman *et al.* (2002); Clark and Judge (2008); Davies *et al.* (2006); Gay and Nam (1998); Howton and Perfect (1998); Nance *et al.* (1993)
Increases for firms with lower credit rating.	**Yes**: Carter *et al.* (2006); Judge (2006)
Increases for firms with lower qui-score.	**Yes**: Clark and Judge (2008)
Decreases for firms with high liquidity.	**Yes**: Bartram *et al.*(2009); Clark and Judge (2008) **No evidence**: Carter *et al.* (2006); Hagelin *et al.* (2007);
Decreases for firms with high dividend yield.	**Yes**: Bartram *et al.*(2009) **No evidence**: Hagelin *et al.* (2007)
Decreases for firms with high profitability.	**No**: Bartram *et al.*(2009); Carter *et al.* (2006) **No evidence**: Allayannis and Ofek (2001)

Table 2.4: **Empirical evidence on financial distress costs argument** *(cont.)*

Theoretical Prediction	Empirical Evidence
Hedging:	
Decreases for firms with a larger fraction of intangibles assets.	**No evidence**: Howton and Perfect (1998)
Is positively / negatively correlated with firm size.	**Yes**: Bartram *et al.*(2009); Berkman and Bradbury (1996); Borokhovich *et al.* (2004); Carter *et al.* (2006); Mian (1996); Nance *et al.* (1993) **No evidence**: Fok *et al.* (1997)
Is likely for firms that recently accumulate losses.	**Yes**: Clark and Judge (2008); Judge (2006) **No**: Graham and Rogers (2002)
Is unlikely for very distressed firms (those with negative book value of equity).	**Yes**: Graham and Rogers (2002)
Is unlikely for firms that are a net receiver of interest.	**Yes**: Clark and Judge (2008); Judge (2006)

Note. The table lists the theoretical predictions and the corresponding empirical evidence on corporate risk management, specifically when we focus on the financial distress argument. Those empirical studies whose findings provide significant evidence for the theoretical prediction appear after the word "Yes"; those whose findings provide significant evidence but are contrary to the theoretical prediction appear after the word "No"; those studies that do not support the theoretical prediction appear after the words "No evidence".

Clark and Judge (2008) discuss two main reasons for the mixed results. First, they refer to a misclassification problem concerning hedging definition. Second, they suggest that leverage may not be indicative of a company's financial distress. On one hand, the firms that do not use derivatives, but hedge with foreign currency debt are included in the sample of non-hedgers. Thus, that might potentially bias empirical tests concerning financial distress costs. On the other hand, the usage of leverage to proxy for financial distress when in fact the value of the variable is not related to financial distress, can also bias empirical tests.

As we can see in Table 2.4 alternative variables are presented by several studies. For example, Clark and Judge (2008) propose proxying financial distress with non-debt variables such as qui (credit) score, tax losses carry forward and liquidity ratios (cash ratio and net interest receivable). Yet, in Graham and Rogers (2002), the tax losses variable is

used to identify firms that might have recently suffered from distress, or are currently experiencing distress or could potentially in the near future fall into distress. Another example is credit rating, which can also be used to proxy for the possibility of encountering financial distress.

From the analysis of Table 2.4 it can be concluded that empirical evidence does not provide very strong results for the hypothesis that managers try to increase firm value by hedging in order to minimize the expected costs of financial distress.

2.3.3.3 Evidence concerning agency costs of debt argument

The theoretical analysis presented in section 2.3.1.3 has revealed that hedging can enhance firm value if it can decrease the agency costs of debt. It was predicted that these agency costs of debt are more evident in firms with more growth options, as these firms could have a high probability of underinvestment or asset substitution. In general, to control for this last argument, studies include variables representing firms' available growth opportunities. Also, the coordinating financing and investment rationale is frequently tested along the same lines as the underinvestment or the asset substitution hypotheses, as it also significantly depends on available growth opportunities.

As Table 2.5 shows, the most popular measure of a firm's growth options is the firm's research and development expenditures (R&D) usually scaled by either the firm's book value of assets or the firm's sales. This variable provides information about the development of future projects. Almost all papers report a positive and significant coefficient for this variable, except for Borokhovich *et al.* (2004) that find a positive but insignificant relation with hedging. Conversely, Graham and Rogers (2002) report a negative coefficient for the variable, although it is statistically significant.

Table 2.5: **Empirical evidence on agency costs of debt arguments**

Theoretical Prediction	Empirical Evidence
Hedging:	
Increases for firms with higher market-to-book-ratio.	**Yes**: Davies *et al.* (2006); Gay and Nam (1998); Lel (2012); Purnanandam (2008); **No**: Bartram *et al.* (2009); Mian (1996) **No evidence**: Allayannis and Ofek (2001); Clark and Judge (2008); Guay and Kothari (2003)
Increases for firms with higher Tobin's Q.	**Yes**: Carter *et al.* (2006); Gay and Nam (1998) **No**: Marsden and Prevost (2005)
Increases for firms with higher expenditures on R&D.	**Yes**: Allayannis and Ofek (2001); Clark and Judge (2008); Fok *et al.* (1997); Gay and Nam (1998); Géczy *et al.* (1997); Howton and Perfect (1998); Nance *et al.* (1993); Purnanandam (2008) **No**: Graham and Rogers (2002) **No evidence**: Borokhovich *et al.* (2004)
Increases with the level of investment expenditure.	**Yes:** Lin and Smith (2008) **No**: Bartram *et al.* (2009); Clark and Judge (2008) **No evidence**: Carter *et al.* (2006); Haushalter (2000)
Increases for firms with higher acquisition expenditures.	**No evidence**: Tufano (1996)
Increases for firms with long-term debt maturity.	**Yes:** Clark and Judge (2008)
Increases for firms with low level of liquidity.	**No evidence**: Borokhovich *et al.* (2004); Howton and Perfect (1998); Purnanandam (2008)
Increases for firms with higher needs of internal financing for assets growth.	**No evidence**: Berkman and Bradbury (1996); Berkman *et al.* (2002)
Increases for firms with higher price-to-earnings ratio.	**Yes**: Gay and Nam (1998) **No evidence**: Clark and Judge (2008)
Increases for firms with abnormal positive movement in the firm's stock price.	**Yes**: Gay and Nam (1998)
Increases for firms with debt constraints.	**Yes**: Haushalter (2000)
Increases for firms that pay small or no dividends.	**No evidence**: Allayannis and Ofek (2001); Haushalter (2000)

Table 2.5: **Empirical evidence on agency costs of debt arguments** *(cont.)*

Theoretical Prediction	Empirical Evidence
Hedging:	
Increases for firms that have higher costs of accessing external financing.	**No evidence**: Davies *et al.* (2006)
Increases for firms with higher leverage.	**Yes**: Clark and Judge (2008); Haushalter (2000); Judge (2006)
Decreases for firms with higher book-to-market ratio.	**Yes**: Borokhovich *et al.* (2004) **No**: Fok *et al.* (1997); Graham and Rogers (2002) **No evidence**: Géczy *et al.* (1997); Nance *et al.* (1993)
Decreases for firms with high profitability.	**Yes**: Clark and Judge (2008)
Decreases for firms with higher earning price ratio.	**No evidence**: Berkman and Bradbury (1996); Berkman *et al.* (2002)
Decreases for firms with debt rated.	**Yes**: Haushalter (2000)
Is predicted to be negatively correlated with firm size.	**No evidence**: Clark and Judge (2008); Haushalter (2000); Tufano (1996)
Is more likely in firms with higher growth and higher debt levels.	**Yes:** Bartram *et al.* (2009); Géczy *et al.* (1997); Lel (2012)
Is more likely for firms that recently accumulate losses.	**Yes:** Judge (2006)
Is unlikely for firms in the regulated industries.	**Yes**: Mian (1996)

Note. The table lists the theoretical predictions and the corresponding empirical evidence on corporate risk management, specifically when we focus on the agency costs of debt argument. Those empirical studies whose findings provide significant evidence for the theoretical prediction appear after the word "Yes"; those whose findings provide significant evidence but are contrary to the theoretical prediction appear after the word "No"; those studies that do not support the theoretical prediction appear after the words "No evidence".

The second most popular measure of a firm's growth options is a firm's market-to-book ratio or its inverse book-to-market ratio. The justification for using the market to book ratio is that the market value of the firm represents both the value of a firm's assets in place and future growth options. Then, when we scale a firm's market value by the value of its assets in place (book value of assets), we get a good idea of the value of the firm's growth options. In the same spirit, Tufano (1996) uses the exploration and acquisition expenditures, while Carter *et al.* (2006), Haushalter (2000), and Marsden and

Prevost (2005) use the investment expenditures to measure the firm's growth opportunities. From the analysis of Table 2.5 it can be concluded that empirical evidence does not provide very strong results for this variable.

Several other alternative measures are used to test the underinvestment and asset substitution hypotheses, for example, liquidity measures. The assumption behind these liquidity-based variables is that firms are more likely to pass by positive NPV projects when their cash holdings are low. However, the results of liquidity-based measures are not conclusive.

It is worth noting that Froot *et al.*'s (1993) model emphasizes not the existence of growth opportunities, but the costly external financing as a potential determinant of hedging. In that sense, a few studies used variables that try to represent the ability of the firm to undertake positive NPV projects. For example, one of the moves towards the test of this argument is provided by Bartram *et al.* (2009), Géczy *et al.* (1997), and Lel (2012). They suggest that firms with greater growth opportunities should hedge more and those with greater expected financial distress costs should hedge even more. For the empirical test, they used a variable of interaction between growth opportunities (market-to-book value) and external cost of financing (leverage).

Despite the inconclusive results of some predictions, overall the empirical evidence presented in Table 2.5 reasonably supports hypotheses related to agency costs of debt.

2.3.3.4 Evidence concerning managerial-utility maximization theories

In section 2.3.2 it is shown that managers holding a significant proportion of the firm shares should engage more actively in hedging activities; on the contrary, a managerial stock option programme mitigates the managers' incentive to engage in

hedging activities. A few researchers include stock based-compensation and options based-compensation in the scope of hedging incentives.

The most popular variables measuring stock-based compensation are: i) the value of common shares held by the firm's directors and officers (Gay & Nam, 1998; Géczy *et al.*, 1997; Tufano, 1996), and ii) the proportion of common shares held by the firm's directors and officers (Allayannis & Ofek, 2001; Berkman & Bradbury, 1996; Berkman *et al.*, 2002; Carter *et al.*, 2006; Fok *et al.*, 1997; Haushalter, 2000; Marsden and Prevost, 2005). As we can see in Table 2.6, despite the results of some papers supporting the theoretical prediction, the overall evidence is still inconclusive.

Table 2.6: **Empirical evidence on managerial-utility maximization arguments**

Theoretical Prediction	Empirical Evidence
Hedging:	
Is more likely for firms with managers that have greater stock ownership.	**Yes**: Carter *et al.* (2006); Graham and Rogers (2002); Guay and Kothari (2003); Hagelin *et al.* (2007); Tufano (1996) **No**: Fok *et al.* (1997) **No evidence**: Allayannis and Ofek (2001); Berkman and Bradbury (1996); Berkman *et al.* (2002); Gay and Nam (1998); Géczy *et al.* (1997); Haushalter (2000); Lel (2012); Marsden and Prevost (2005)
Is more likely for firms with larger institutional ownership.	**No evidence**: Fok *et al.* (1997)
Is more likely for firms where the CEO receives a higher cash bonus.	**No evidence**: Guay and Kothari (2003); Lel (2012)
Is positively related to the existence of multiple share classes.	**Yes**: Bartram *et al.* (2011)
Is unlikely for firms with managers that have a greater number of stock options.	**Yes**: Haushalter (2000); Tufano (1996) **No**: Gay and Nam (1998); Géczy *et al.* (1997); Haushalter (2000) **No evidence**: Allayannis and Ofek (2001); Bartram *et al.* (2009); Borokhovich *et al.* (2004); Graham and Rogers (2002); Hagelin *et al.* (2007); Lel (2012)

Table 2.6: **Empirical evidence on managerial-utility maximization arguments** *(cont.)*

Theoretical Prediction	Empirical Evidence
Hedging:	
Should be negatively associated with greater large non-managerial blockholders.	**Yes**: Tufano (1996) **No evidence**: Davies *et al.* (2006); Haushalter (2000);
Decreases with increases in shareholdings by managers.	**Yes**: Whidbee and Wohar (1999)
Decreases for firms with a larger analyst following the firm.	**No**: Géczy *et al.* (1997); Purnanandam (2008)
Decreases for firms with greater institutional shareholdings.	**Yes**: Graham and Rogers (2002) **No**: Purnanandam (2008)

Note. The table lists the theoretical predictions and the corresponding empirical evidence on corporate risk management, specifically when we focus on the managerial agency costs argument. Those empirical studies whose findings provide significant evidence for the theoretical prediction appear after the word "Yes"; those whose findings provide significant evidence but are contrary to the theoretical prediction appear after the word "No"; those studies that do not support the theoretical prediction appear after the words "No evidence".

Regarding the variables used to measure options-based compensation, several papers used the number of options held by insiders (Gay & Nam, 1998; Haushalter, 2000; Tufano, 1996). Allayannis and Ofek (2001) and Carter *et al.* (2006) use a scaled version of this variable (the scaling denominator is the total number of the firm's shares outstanding). As shown in Table 2.6, empirical evidence regarding managerial option ownership is also mixed.

We finished making a reference to the "*delta*" (sensitivity of the stock and option portfolio to changes in the price of the firm's stock) and the "*vega*" (sensitivity of the option portfolio to changes in the volatility of the firm's stock) variables. The *delta* provides managers an exposure similar to holding stocks and/or in the money options, whereas the *vega* provides an exposure similar to option-based compensation holdings, namely when options are out of the money. This would lead to a positive relation between *delta* and corporate hedging, and to a negative relation between *vega* and corporate

hedging. The few studies that used these variables report that the coefficient on *vega* is insignificant. In contrast, the coefficient on the *delta* is positively related to hedging.

2.3.3.5 Other arguments

All empirical studies examine the relationship between hedging and firm size, but there are competing arguments for either a positive or negative relation between firm size and hedging. Nance *et al.* (1993) argue that corporate risk management may be positively related to firm size because economies of scale may apply to operative and transaction costs of hedging. However, standard theory on hedging (financial distress hypothesis) tend to predict that smaller firms deal with the relatively high costs of financial distress, so it is also possible that they are more likely to hedge (e.g., Mian, 1996; Nance *et al.*, 1993). Also, the tax motivation hypothesis predicts a negative relation between size and hedging, on the assumption that smaller firms are more likely to have taxable income in the progressive region of the tax schedule (Graham & Smith, 1999). In general, empirical studies documented a positive and significant relation between corporate hedging and firm size (e.g., Davies *et al.*, 2006; Géczy *et al.*, 1997; Graham & Rogers, 2002; Marsden & Prevost, 2005; Mian, 1996; Purnanandam, 2008).

Several empirical studies on the determinants of hedging have also explored alternative ways of hedging to reduce risk exposure other than with derivatives. The three fundamental substitutes of hedging with derivatives are: (1) risk management through financing activities; (2) risk management through operational activities, and, finally, (3) the existence of liquid assets. Risk management through financing activities is frequently represented by the use of preferred stock or convertible debt. These instruments seem to reduce the probability of financial distress and the need for hedging with derivatives, although there is little research to support this prediction (e.g. Lel, 2012). Another

possibility is the use of foreign debt, namely in studies that analysed the risk management of foreign currency exposure. For example, this is the case in studies by Géczy *et al.* (1997) and Bartram *et al.* (2009).

As for risk management through operational activities, several studies make use of diversification measures of the firm's activities. The idea behind this is that well diversified firms are less exposed to risk, so they are less likely to hedge. The evidence concerning this argument is not very strong. Fok *et al.* (1997) find a significant positive relation between diversification and hedging, while Tufano (1996) finds no significant relation.

The presence of liquid assets could also reduce the need for hedging with derivatives. The common approach consists of using measures of liquidity or the dividend yield. In fact, holding cash or other liquid assets allows firms to cover temporary shortfalls in revenues and to fulfil short-term liabilities. As a result, the probability of encountering financial distress is reduced. Also, low dividend payouts could provide more liquidity. The empirical implication of this argument is that firms with higher cash holdings and lower dividend payouts are less likely to hedge. Several papers support at least one of the liquidity-based arguments, such as Davies *et al.* (2006), Géczy *et al.* (1997), Marsden and Prevost (2005), Nance *et al.* (1993) and Tufano (1996).

Finally, firms with greater variation in cash flows or a greater proportion of their revenues exposed to the risk considered, have greater potential benefits from hedging. For the most part, the risk exposure is included as a determinant for hedging activities in studies which focus on foreign exchange risk. This is an argument that usually provides strong empirical evidence as we can see in Géczy *et al.* (1997), Hagelin *et al.* (2007), and Purnanandam (2008), among others.

2.4 Value creation through corporate risk management

As we analysed in the preceding section, previous empirical research has tried to uncover which theory of hedging best describes a firm's use of risk management instruments. More recently, another stream has examined directly the impact of hedging on firm value. Explicitly, the central question is whether or not hedging does add value to the firm. This approach recognizes that corporate risk management might be ineffective, by failing to add firm value, or even counterproductive, by destroying value. This is consistent with the view that the conception and implementation of a hedging strategy can represent significant costs for the firm, despite the potential risk management benefits identified in the literature.

The first piece of evidence concerning the direct impact of hedging on firm value is provided by Allayannis and Weston (2001). The authors examined a large sample of domestic and multinational US firms during the period 1990-1995, and documented the existence of a hedging premium that is statistically and economically significant for firms with exposure to exchange rates. The hedging premium represents, on average, 4.87% of firm value. They use Tobin's Q as a proxy for a firm's market value and investigated whether the obtained hedging premium can be explained by other factors that the theory suggests may affect firm value.[15] Also, in line with this, Allayannis *et al.* (2001) investigate both financial and operational exchange-rate risk management strategies of US multinational firms. They find that operational hedges alone are not significantly related to value. However, when used in conjunction with financial hedges, operational hedges are significantly and positively related to value.

[15] The other factors that have been commonly used to explain firm value are: size, profitability, leverage, growth opportunities, ability to access financial markets, geographic and industrial diversification, credit quality, industry classification, and time effects.

Similarly to Allayannis *et al.* (2001), Kim *et al.* (2006) have compared and contrasted the value effect of financial hedging versus operational hedging. Their results reveal that financial hedging improves, on average, 5.4% of firm value and operational hedging increases firm value in the range of 4.8-17.9%, which could represent up to five times more than financial hedging.

Also, Carter *et al.* (2006), Mackay and Moeller (2007), Clark and Mefteh (2010), and Bartram *et al.* (2011) corroborate the existence of a hedging premium. Carter *et al.* (2006) look into the relation between hedging and firm value in the US airline industry. They find evidence that the hedging premium ranges between 5% and 10%. Mackay and Moeller (2007) control for the potential endogeneity of hedging with respect to firm value and show that a discriminating risk management programme can enhance firm value by 2% to 3% on average, namely hedging concave revenues, leaving concave costs unhedged. Clark and Mefteh (2010), using a sample of 176 of the largest French non-financial firms, provide evidence that foreign currency derivatives' use is a significant determinant of firm value and that this effect is more intense in the larger and highly exposed firms. Finally, Bartram *et al.* (2011), using a broad sample of non-financial firms from 47 countries, only find a weak statistical significance for hedging premium.

Clark and Judge (2009), using a sample of UK firms with foreign operations, draw the distinction between short- and long-term foreign currency derivatives and examine whether the use of these derivatives increases firm value. Unlike the previous studies presented above, they also consider the value effect of foreign debt hedging. Their results indicate that foreign currency derivatives' use increases firm value, but there is no hedging premium associated with foreign debt hedging, except when combined with foreign currency derivatives. In addition, they find that long-term derivatives generate more value than short-term derivatives.

Recently, Allayannis *et al.* (2012) found that, on average, the use of foreign currency derivatives for foreign firms with exchange rate exposure yield a hedging premium around 10.7% in OLS specification. Further the authors found that this premium is mainly associated with firms that have strong governance (see section 2.5).

Introducing changes to the "standard" methodological approach, Nelson *et al.* (2005) look directly at the stock performance of a sample of US non-financial firms. They found evidence that firms that hedge outperform other firms by 4.3% on average. However, when they augmented the Fama and French three factor model with an additional risk factor related to intangible assets, they found no statistically abnormal returns to hedgers.

By contrast, Guay and Kothari (2003) estimate the cash flow implications from hedging programmes for 234 large US non-financial firms and found that the economic significance of the cash flows, and as a consequence the potential increase in market value, is small. Also, Lookman (2004) and Jin and Jorion (2006) found no significant relation between hedging and firm value. Lookman (2004), using a sample of US oil and gas firms, shows that hedging "big" risk is associated with a significant discount of about 17%, while hedging "small" risk is associated with a premium of about 27%. They suggest that hedging *per se* does not increase firm value; instead, hedging big (small) risk is a noisy proxy for high (low) agency problems and/or low (high) management skills. Jin and Jorion (2006) also examine the US oil and gas industry and found that the effect of hedging on market value is not statistically significant, suggesting that the hedging premium possibly will depend on the types of risks to which the firm is exposed.

Finally, under a different approach, Hagelin *et al.* (2007) investigate the impact on firm value for a specific factor – managerial stock option plans – that encourages hedging,

namely “bad” hedging, in a sample of Swedish firms. They confirm that foreign exchange hedging that satisfies managerial self-interest reduces firm value.

Summing up, in light of the reviewed evidence, we verify that the existence of a value premium associated with hedging is still unclear. It is likely that part of the inconsistency in previous empirical results is due to methodological aspects, namely, endogeneity problems which often plagued the empirical tests in corporate finance. While some papers deal with this issue by applying simultaneous equations models (e.g., Bartram *et al.*, 2009) or sample selection criteria (Jin & Jorion, 2006), most of the empirical studies outlined above do not account for the endogeneity implicit in the value/hedging relationship; that is to say, firm value determines the hedging choice, rather than hedging determining the value. Unquestionably, this important question of hedging premium must be subject to further empirical research.

2.5 Corporate governance and the value-increasing use of hedging instruments

Section 2.3 points out that hedging can be a value-increasing strategy because it reduces cash flow volatility, thereby reducing the expected taxes, likelihood of financial distress or agency costs of debt. In contrast, the use of risk management instruments as a result of managerial risk aversion should not lead to an increase in firm value, essentially because it can follow, solely, managers’ self-interest. Hence, the effective value-increasing of derivatives’ use documented by Allayannis and Weston (2001), and analysed by some other authors (see section 2.4), should be observed in a scenario of risk management instruments’ use for hedging purposes. In contrast, hedging as a result of managerial risk preferences should not lead to an increase in value. In light of this, theory states that a firm with a high governance level assures effective monitoring of management activities, which in turn increases the likelihood of derivatives’ use for

hedging purposes. This builds on the recent body of literature that acknowledges the role of governance structures on hedging policies (e.g., Allayannis *et al.*, 2012; Lel, 2012).

While prior work presented in section 2.4 has focused on whether or not risk management adds value, the main goal of this section is to examine the governance conditions by which firms engage in valuable hedging activities. First, we present the theoretical and empirical main issues regarding the effects of corporate governance on firm value. Then, we summarize empirical evidence on the effect of quality of corporate governance on the value of risk management. As we will see, the review on prior studies showed that the empirical evidence regarding this matter is extremely limited.

2.5.1 Firm value and quality of governance: theory and empirical evidence

Shleifer and Vishny (1997) define corporate governance "as the ways in which suppliers of finance to corporations assure themselves of getting a return on their investment" (p. 737). Taking a more precise perspective, Denis and McConnell (2003) define corporate governance as the set of mechanisms that induce the self-interested controllers of a firm to make decisions that maximize the value of the firm for its owners. In line with this, a number of corporate governance mechanisms have been proposed to control managers' actions. The governance mechanisms that have been widely studied can be generally categorized as either being internal or external to the firm. The internal mechanisms commonly considered are the board of directors (board composition and board size) and the ownership structure (ownership concentration, managerial ownership, and the identity of controlling owners) of the firm. The most cited external mechanisms are the market for corporate control and the legal system.

As summarized below, empirical studies conducted to date have generally come in one of two forms. The vast majority of the studies on the matter have focused upon some

specific mechanism of corporate governance. Frequently they tried to capture the influence of the considered mechanism on the performance of the firm. More recent research has concentrated on corporate governance practices as a whole, that is, they examine simultaneously multiple governance mechanisms making use of corporate governance indexes. Within this last context, the primary objective is to assess whether the quality of corporate governance drives performance.

2.5.1.1 Firm ownership structure

The idea that ownership structure is one of the corporate governance mechanisms influencing the extent of firm agency costs and consequently firm value is widely accepted (e.g., Jensen & Meckling, 1976). Firm ownership structure is discussed in the literature in terms of the actual identities of the shareholders, as well as percentages of shareholding by these shareholders (ownership concentration).

The simplest way to align cash flow and control rights of outside shareholders is to concentrate on shareholdings. This can signify that one or several shareholders in the firm have substantial ownership stakes, such as 10 or 20%. In this case shareholders have the motivation to monitor management, thus avoiding the free-rider problem related with ownership dispersion. Certainly, ownership concentration can be viewed as a proxy for shareholder control over managers. Shleifer and Vishny (1986) demonstrated the important role played by large shareholders, and show how the share price increases as the proportion of shares held by these large shareholders rises.

However, the positive effect of large shareholders on firm value is not so straightforward. In the literature, ownership concentration refers to cash flow rights, that is to say, the right to claim for dividends, and to voting rights, that is the right to vote. The largest shareholders may use mechanisms to enhance their voting control, such as dual-

class shares[16] or pyramidal structures,[17] which create a wedge between control rights and cash flow rights. Therefore, the control rights of the largest shareholders are often greater than their corresponding cash flow rights. The potential problem is that large shareholders represent their own interests, which does not necessarily match with the interests of the minority shareholders (La Porta *et al*., 2002). In fact, the described control enhancing mechanisms seek to decrease the alignment of incentives between controlling and minority shareholders, increasing the managerial entrenchment and intensifying the risk of expropriation. In line of this, Shleifer and Vishny (1997) discuss several potential costs of having large shareholders (private benefits of control), namely the straightforward expropriation of other shareholders, managers, employees and creditors.

In table 2.7 it is shown that while there is little evidence that large shareholders positively affected the observed value of firms, several studies revealed that large shareholders can obtain significant private benefits of control.

Table 2.7: **Empirical evidence on ownership concentration and firm performance**

Theoretical Prediction	Empirical Evidence
More concentrated shareholdings by outside blockholders increases firm value. - or The value of the firm increases with the existence of large shareholders.	**Yes**: Black, Jang and Kim (2006); Claessens (1997); Mínguez-Vera and Martín-Ugedo (2007)[a]; Mitton (2002) **No**: Davies, Hillier and McColgan (2005) **No evidence**: Agrawal and Knoeber (1996); Beiner *et al.* (2006); Demsetz and Villalonga (2001); Hagelin *et al.* (2007); Mínguez-Vera and Martín-Ugedo (2007)[a]
Company performance is a bell shaped (first increasing, then decreasing) function of the share of the largest owner.	**Yes**: Thomsen and Pedersen (2000)

[16] Dual-class shares occur when there are two or more share classes with different voting rights, as opposed to the one-share-one vote principle.

[17] A pyramidal ownership structure occurs when a blockholder controls a top firm or holding company that has control stakes in a related group or a sequence of firms.

Table 2.7: **Empirical evidence on ownership concentration and firm performance** *(cont.)*

Theoretical Prediction	Empirical Evidence
The lower the dispersion of ownership, the higher the share price.	**Yes**: Claessens (1997) **No**: Lehmann and Weigand (2000) **No evidence**: Mínguez-Vera and Martín-Ugedo (2007)
Firms in which the largest shareholders' voting rights exceed their cash flow rights are likely to have lower returns.	**Yes**: Mitton (2002)
The voting premium[b] should be higher when voting power is more concentrated.	**Yes**: Doidge (2004)
Firms with pyramidal ownership structures are likely to have lower returns.	**Yes**: Mitton (2002)
The value of the firm increases with higher values of ownership parity (which means a low level of control from the largest shareholder when compared with all affiliated shareholders).	**Yes**: Black *et al.* (2006)

Note. The table lists the general theoretical predictions concerning ownership concentration and firm performance, and corresponding empirical evidence. Those empirical studies whose findings provide significant evidence for the theoretical prediction appear after the word "Yes"; those whose findings provide significant evidence but are contrary to the theoretical prediction appear after the word "No"; those studies that do not support the theoretical prediction appear after the words "No evidence".

[a] The evidence reveals a nonlinear relationship. The authors suggest that, at low levels of managerial ownership, an increase in managerial ownership more closely aligns the interest of managers and shareholders, thereby increasing firm value. However, at high levels of managerial ownership, an increase in managerial ownership makes management more entrenched and less subject to market discipline, thereby reducing corporate value. [b] When a firm has two classes of shares that are differentiated by their voting rights, the percentage difference between the prices of high voting shares and low voting shares is the voting premium, which can be used as a proxy for the private benefits of control.

The existing literature has used different variables to measure ownership concentration, for example, the ownership percentage of all shareholders that own 5% or more of the stock (e.g., Agrawal & Knoeber, 1996; Mitton, 2002); the ownership percentage of the largest shareholder in the firm (e.g., Black *et al.*, 2006; Minguez-Vera & Martin-Ugedo, 2007); the ownership percentage of the largest non-management shareholder (Mitton, 2002); a dummy variable that takes the value of 1 if the second largest shareholder holds more than 10% of the voting rights, 0 otherwise, and a dummy

variable that takes the value of 1 if the firm has a divergence between the cash flow rights and voting rights of the largest owner (Mitton, 2002), 0 otherwise.

Thomsen and Pedersen (2000) posit that the relationship between ownership and firm performance depends on the identity of large (controlling) shareholders. One possible interpretation of this assertion is that shareholders with different identities differ in terms of investment priorities, and preferences in dealing with managers' agency conflicts. To the extent that shareholders have other economic dealings with the firm, divergence of interests may arise. For example, managers may play a dual role as employees and shareholders, financial institutions may play a dual role as lenders and shareholders, states may play a dual role as regulators and shareholders. In fact, the objective function of these stakeholders may differ from the one of shareholder value maximization. The implication is that it is important, not only what percentage a shareholder owns, but also if the shareholder is a manager, an institution, the state, a private person or a family.

Among the different types of owner identity, managerial ownership appears to be the most controversial as it has ambiguous effects on firm value. At first, as managers' stock ownership increases, managers' interests become more closely aligned with those of shareholders, which leads to agency costs decreasing and consequently to an increase in firm value. However, high ownership by managers may result in a greater degree of managerial control. These arguments give rise to the entrenchment hypothesis, according to which managerial ownership has rather a negative impact on firm value (Morck, Shleifer, & Vishny, 1988).

The existing literature on managerial ownership has examined the relationship between the proportion of shares owned by managers and firm value. For example Davies *et al.* (2005), Hermalin and Weisbach (1991), McConnell and Servaes (1990), and Morck *et al.* (1988) found a nonlinear relationship between managerial ownership and firm value,

as can be observed in Table 2.8, Panel A. These studies assumed managerial ownership to be an exogenous variable. However, several authors have questioned the Morck *et al.* (1988) results on the grounds that managerial ownership may not be an exogenous variable. Cho (1998), Demsetz and Villalonga (2001), and Loderer and Martin (1997) have examined endogeneity between managerial ownership and firm value, and find that managerial ownership does not affect value (see Table 2.8, Panel A).

Table 2.8: **Empirical evidence on the identity of the major shareholder and firm performance**

Panel A. Insider Ownership	
Theoretical Prediction	**Empirical Evidence**
The value of the firm increases with higher levels of managerial ownership.	**Yes**: Beiner *et al.* (2006); Davies *et al.* (2005);[a] Han and Suk (1998);[a] Hermalin and Weisbach (1991);[a] Himmelberg, Hubbard and Palia (1999);[a] Lins (2003);[a] McConnell and Servaes (1990);[a] Morck *et al.* (1988);[a] Short and Keasey (1999);[a] Yermack (1996) **No**: Himmelberg *et al.* (1999);[a] Lehmann and Weigand (2000) **No evidence**: Agrawal and Knoeber (1996); Cho (1998); Demsetz and Villalonga (2001); Loderer and Martin (1997); Mitton (2002)
Higher cash flow rights and lower voting rights by the controlling managerial shareholder improve valuation.	**Yes**: La Porta *et al.* (2002)
Panel B. Institutional Ownership	
Theoretical Prediction	**Empirical Evidence**
More concentrated shareholdings by institutions increases firm value.	**Yes**: Cremers and Nair (2005); Han and Suk (1998); Thomsen and Pedersen (2000) **No evidence**: Agrawal and Knoeber (1996); Black *et al.* (2006); Mínguez-Vera and Martín-Ugedo (2007);

Table 2.8: **Empirical evidence on the identity of the major shareholder and firm performance** *(cont.)*

Panel C. State Ownership	
Theoretical Prediction	**Empirical Evidence**
It is expected that state-owned firms are significantly less profitable.	**Yes**: DeWenter and Malatesta (2001); Megginson, Nash and Randenborgh (1994) ; Thomsen and Pedersen (2000)
It is expected that state-owned and mixed firms are significantly less profitable when compared with private firms.	**Yes**: Boardman and Vining (1989)
Panel D. Family Ownership	
Theoretical Prediction	**Empirical Evidence**
It is expected that family-owned firms are significantly less profitable.	**Yes**: Thomsen and Pedersen (2000); Yermack (1996)
An individual or a family group, as major investor, would intuitively have more incentive to exercise control over a company, which possibly will increase firm value.	**Yes**: Anderson and Reeb (2003);[b] Mínguez-Vera and Martín-Ugedo (2007); Villalonga and Amit (2006) **No**: Faccio, Lang and Young (2001)

Note. The table lists the general theoretical predictions concerning the identity of controlling shareholders and firm performance, and corresponding empirical evidence. Panel A relates to inside ownership, Panel B to institutional ownership, Panel C to state ownership, and finally Panel D to family ownership. Those empirical studies whose findings provide significant evidence for the theoretical prediction appear after the word "Yes"; those whose findings provide significant evidence but are contrary to the theoretical prediction appear after the word "No"; those studies that do not support the theoretical prediction appear after the words "No evidence".

[a] The evidence reveals a nonlinear relationship. The authors suggest that, at low levels of managerial ownership, an increase in managerial ownership more closely aligns the interest of managers and shareholders, thereby increasing firm value. However, at high levels of managerial ownership, an increase in managerial ownership makes management more entrenched and less subject to market discipline, thereby reducing corporate value. [b] The authors find that the positive effect associated with family ownership starts to decrease at around 30% ownership.

Institutional investors are large investors, other than a private person, who exercise discretion over the investment of others. They could be insurance companies, pension funds, financial institutions and investment companies. These investors have the opportunity, resources and ability to monitor, discipline and use their "voice" to influence managerial decisions. In the literature, there is evidence on the role played by institutional investors in monitoring corporate decisions, thereby affecting performance. Despite the straightforwardness of the argument, prior studies that we give evidence for in Table 2.8, Panel B, have produced mixed results. Cremers and Nair (2005), Han and Suk (1998), and Thomsen and Pedersen (2000) support the above statement and report a significant

relationship between the value of the firm and the percentage of shares owned by institutional investor. By contrast, Agrawal and Knoeber (1996), Black *et al.* (2006), and Mínguez-Vera and Martín-Ugedo (2007) found no evidence that institutional ownership is correlated with firm performance.

Pound (1988) examines differences among various types of institutions based on their ability to influence firm actions and provides a possible explanation for the inconsistent results found. The author proposes three hypotheses on the relation between institutional investor and firm performance: (1) the efficient-monitoring hypothesis that assumes only an investment relationship between the institutional investor and the firm, and posits that the institutional investor has greater knowledge and capability to effectively monitor managers at lower costs than the small investors; (2) the conflict-of-interest hypothesis that considers also the existence of ongoing business relations between the institutional investor and the firm, and argues that this duality of activities could create a conflict of interests for the institutional investor, and, finally, (3) the strategic-alignment hypothesis states that institutional investors and managers find it jointly beneficial to cooperate, which could reduce the power inherent in the monitoring by institutional investors. Clearly, because the institution's ability to influence the firm may be limited by the extent to which it depends on the firm for business, the author predicts a negative relation between institutional ownership and the firm value in the last two hypotheses.

Regarding state ownership, a common-sense view is that state-owned firms are less productively efficient than their private sector counterparts operating in similar situations. Under state ownership, the shareholders, that is to say the national citizens, have no direct claim over their residual income and are not able to exercise their ownership rights. Instead the firm is run by bureaucrats who have the incentive to maximize social welfare

and his/her personal interests, but not the firm performance. Yet, under private ownership the firm is run for the maximization of shareholder value.

As we can see in Table 2.8, Panel C, there is conformity in the results of analysed studies. In fact, comparing the performance of state-owned to privately-owned firms is one method through which the impact of state ownership on firm performance can be analysed. Boardman and Vining (1989) follow this approach and examine the economic performance of 500 of the biggest non-US (both private and state-owned) industrial corporations as of 1983. The authors divide the firms into three groups according to their ownership: state-owned, private and mixed ownership. They conclude that state-owned and mixed firms are significantly less profitable when compared with private firms. DeWenter and Malatesta (2001) chose a similar approach and conclude that the average profitability of the private companies was twice the profitability of the state-owned companies. Megginson *et al.* (1994), adopting a different view, compare the pre- and post-privatization financial and operating performance of 61 firms from 18 countries. They document strong evidence that their sample become more profitable following privatization.

Finally, concerning family-owned firms, the empirical studies reported in Table 2.8, Panel D, also produced mixed results. On the one hand, family ownership and control are beneficial in mitigating the principal agent conflicts that arise in firms managed by professionals (e.g., Anderson & Reeb, 2003; Minguez-Vera & Martin-Ugedo, 2007; Villalonga & Amit, 2006). On the other hand, it is also mentioned that family owners are often more entrenched in comparison to non-family blockholders, which may introduce difficulties in the substitution of family shareholders by better qualified professionals among the management positions of the firm (e.g., Faccio *et al.*, 2001; Thomsen and Pedersen, 2000; Yermack, 1996).

2.5.1.2 Board of directors

The composition of the board of directors is one of the several corporate governance mechanisms that may help to control agency costs. The primary responsibilities of the board of directors are the approval of management decisions and the monitoring of management performance (Fama & Jensen, 1983). In that sense, the quality of monitoring by the board of directors is usually attributed to its structure and size, i.e., the proportion of the directors that are outsiders, and the number of directors that comprise the board.

The structure of the board is determined by the type of members that comprise the board. Members of the board can be classified as insiders if directors are also employees of the firm. Non-employee directors are classified as outside or affiliated (grey) directors. Outside directors are often respected leaders from the business or academic community, whose reputations suffer when they are associated with failing companies. So, Jensen (1993) suggests that a board dominated by independent directors is effective in controlling the value reducing activities of managers, because outside directors have incentives to make corporate decisions that signal their abilities as efficient decision-makers. While Beiner *et al.* (2006) support this hypothesis, Agrawal and Knoeber (1996) conclude that outsiders in the board are negatively related to performance. Table 2.9 lists the general theoretical predictions concerning the structure of the board of directors and its relationship with firm performance. Panel A presents the theoretical prediction and the correspondingly empirical evidence regarding the directors' independence, Panel B shows the prediction concerning the matter of the separation of chairmanship and chief executive (CEO) position, and, finally, Panel C lists the prediction on board size.

Table 2.9: **Empirical evidence on the board structure and firm performance**

Panel A. Directors' independence	
Theoretical Prediction	**Empirical Evidence**
The value of the firm increases with the number of outside directors on the board.	**Yes**: Black *et al.* (2006) **No**: Agrawal and Knoeber (1996); Yermack (1996) **No evidence**: Beiner *et al.* (2006); Bhagat and Black (1999); Hermalin and Weisbach (1991)
Panel B. Separation of chairman and CEO position	
Theoretical Prediction	**Empirical Evidence**
Firms are more highly valued and board more effective monitors when CEO and chairman positions are separated.	**Yes**: Lel (2012); Yermack (1996)
Panel C. Board Size	
Theoretical Prediction	**Empirical Evidence**
The value of the firm decreases when the number of directors on the board increases.	**Yes**: Yermack (1996) **No evidence**: Beiner *et al.* (2006); Black *et al.* (2006)

Note. The table lists the general theoretical predictions concerning the board of directors' structure and firm performance, and corresponding empirical evidence. Those empirical studies whose findings provide significant evidence for the theoretical prediction appear after the word "Yes"; those whose findings provide significant evidence but are contrary to the theoretical prediction appear after the word "No"; those studies that do not support the theoretical prediction appear after the words "No evidence".

In addition, Jensen (1993) recommends that companies should separate the functions of CEO and chairman of the board. Therefore, the presence of a dual CEO-chairperson is assumed to corrode the independence of the board of directors. While we can argue that this situation helps to alleviate communication problems between the CEO and the board of directors, it obviously cannot guarantee independent monitoring by the board of directors. Lel (2012) and Yermack (1996) argue that a dual CEO-chairperson leads to a concentration of power that can be adverse to the firm valuation (see Table 2.9, Panel B).

Jensen (1993) also focuses his arguments on the inefficiencies that arise when work groups are large; specifically he argues that small boards may be more effective than large boards. Jensen (1993) suggests an optimal board size of seven or eight directors.

Empirical research on the importance of board size is unusual. The first to investigate this hypothesis empirically is Yermack (1996). As we can see in Table 2.9, Panel C, he supports the existence of an inverse relation between board size and firm value.

2.5.1.3 The market for corporate control and the legal system

When internal corporate control mechanisms are insufficient for controlling firm managers and the firm managers fail to operate in the best interests of the current shareholders, there is incentive for outside investors to initiate a hostile takeover of the firm. Usually, changes in the control of firms occur at a premium, thereby creating value for the target firm's shareholders. Indeed, the simple threat of takeover can provide managers with an incentive to pursue the interests of shareholders.

Jensen (1993) considers takeovers in the US as an essential corporate governance mechanism to control managers' actions. That is because the takeover market in the US is very active. In contrast, in most of the world (e.g., Continental Europe), with the exception of the UK, hostile takeovers are rare and other aspects of governance are more important.

Agrawal and Knoeber (1996) analyse the relationship between firm performance and several mechanisms to control agency problems, namely corporate control activity. They find that those hostile takeovers are more likely in poorly performing industries. Also, several recent works examine corporate market control, but in association with other aspects of governance. For example, Gompers, Ishii and Metrick (2003) integrated the possibility of company takeover into their measure of shareholder rights, and classify those rights to be either weak or strong, which depend on the number of protection mechanisms established by the company against the takeover threat. They find that buying

firms with the strongest shareholder rights and selling firms with the weakest shareholder rights earned in the long run returns in excess of 8.5% per year.

Another external factor that can influence corporate governance is the legal system. La Porta, Lopez-de-Silanes, Shleifer and Vishny (1998) refer the degree to which the country's laws protect investor rights and the degree to which those laws are enforced as fundamental determinants in the way corporate governance progresses in that country. Indeed, when outside investor rights are better protected by law, outside investors are willing to pay more for financial assets. So, theory predicts that firms in more protective legal regimes should have higher valuation. Within this context, La Porta *et al.* (2002) find that firms in countries with better investor protection have a higher Tobin's Q ratio.

2.5.1.4 The construction of indexes as a proxy for the quality of governance

Instead of concentrating the analysis on one or two separate mechanisms of governance, in the last decade there have been an increasing number of studies that focus on corporate governance indexes as a comprehensive measure of managerial agency costs. The empirical literature on the relationship between corporate governance indexes and firm value typically analyses either inter-firm variations within a country or inter-country differences. Table 2.10 shows the most cited corporate governance indexes that seek to measure inter-firm variations within a country, and the corresponding empirical evidence. Specifically, Panel A illustrates governance indexes that put together in only one measure several internal governance mechanisms. Panel B describes governance indexes that represent solely external governance mechanisms. Finally, Panel C describes indexes that represent simultaneously internal and external governance mechanisms.

Table 2.10: **Empirical evidence on the use of firm-level corporate governance indexes**

Panel A. Governance indexes measuring internal governance mechanisms	
Governance Index	**Empirical Evidence**
CLSA corporate governance ranking: the *Credit Lyonnais Securities Asia* builds the index based on 57 binary questions, covering seven dimensions: management discipline, transparency, independence, accountability, responsibility, fairness, and social awareness. The index is calculated by taking a simple average of the first six dimensions.	Durnev and Kim (2005); Klapper and Love (2004)
The index comprises seven alternative governance rules and ranges from 0 (weak governance) to 7 (strong governance). A firm earns one additional point for each of the following: (1) the absence of an inside blockholder, (2) the presence of an outside blockholder, (3) the presence of an institutional investor as a blockholder, (4) if the role of the CEO and chairman are separated, (5) if cash flow rights of the largest managerial blockholder are greater than their median value, (6) if voting rights of the largest managerial blockholder are lower than their median value, and (7) if there is no discrepancy between the cash flow rights and voting rights of the largest blockholder.	Allayannis *et al.* (2012)
The composition of this index is as follows: a firm earns one additional point if the role of CEO and chairman are separated, if there is no wedge between cash flow and voting rights of the largest managerial shareholder, if there are no stocks with differential voting rights, and if there are at least one non-managerial and non-institutional large shareholder, one institutional large shareholder, no family large shareholder, and finally no state ownership. Large shareholders are defined as those with at least 10% of outstanding shares. This index ranges from 0 to 7. It should be noted that this index makes use of ownership concentration and board structures.	Lel (2012)
Panel B. Governance indexes measuring external governance mechanisms	
Governance Index	**Empirical Evidence**
G- Index: the G-Index is constructed from data compiled by the IRRC. The index considers 24 different provisions in five categories – tactics for delaying hostile bidders, voting rights, director/office protection, other takeover defences, and state laws. The index is formed by adding one point if the firm has a specific defensive provision in place and zero otherwise, leading to values between 0 and 24. A high G-Score is associated with weak shareholder rights.	Cremers and Nair (2005); Bebchuk, Cohen and Ferrell (2009); Gompers *et al.* (2003)

Table 2.10: **Empirical evidence on the use of firm-level corporate governance indexes** *(cont.)*

Panel B. Governance indexes measuring external governance mechanisms	
Governance Index	**Empirical Evidence**
The Alternative Takeover Index (ATI) uses only three components incorporated in the G-Index that have shown to be critical to takeover: blank check preferred stock (poison pills), staggered boards, and restrictions on calling special meetings or acting by written consent. ATI is formed considering all the three components and deducting a point for the existence of each provision. Firms with ATI = 0 are classified as having low takeover vulnerability (poor external governance) and those with ATI = 3 are classified as having the highest external governance and are most vulnerable for takeovers.	Cremers and Nair (2005)
Entrenchment index: this index is constructed from IRRC data. It uses a six-provision subset of the G-Index that is correlated with firm value and stockholder returns. The index comprises four "constitutional" provisions that prevent a majority of shareholders from having their way (staggered boards, bylaw and charter amendment limitations, supermajority requirements for approval of mergers, and supermajority requirements for charter amendments), and two "takeover readiness" provisions that boards put in place to be ready for a hostile takeover (poison pills and golden parachutes). The index ranges from a feasible low of 0 to a high of 6.	Bebchuk *et al*. (2009)
Panel C. Governance indexes measuring internal and external governance mechanisms	
Governance Index	**Empirical Evidence**
Corporate governance ranking created by the *Brunswick Warburg Investment Bank*: The 21 major Russian firms were rated on a 0-60 scale, with high numbers indicating worse quality of governance. The risk elements that influence the ranking can be divided in four categories: behaviour, governance characteristics, rule, and non-governance characteristics.	Black (2001)
Deminor's corporate governance rating: the index is based on 300 different criteria, which can be attributed to four broader categories: rights and duties of shareholders, range of takeover defences, disclosure on corporate governance, and board structure and functioning.	Bauer, Guenster and Otten (2004)

Table 2.10: **Empirical evidence on the use of firm-level corporate governance indexes** *(cont.)*

Panel C. Governance indexes measuring internal and external governance mechanisms	
Governance Index	**Empirical Evidence**
German corporate governance rating: the index is based on responses to objective survey questions. The index comprises 30 governance proxies divided into five categories: corporate governance commitment, shareholder rights, transparency, management and supervisory board matters, and auditing.	Beiner *et al*. (2006);[a] Drobetz, Schillhofer and Zimmermann (2004)
Korean Corporate Governance Index (KCGI): this index is based primarily on a 2001 survey of corporate governance practices by the Korea Exchange, and supplemented by hand collection of data for some governance elements. The index is based on 38 governance elements divided into four categories: shareholder rights, board structure, board procedure, and disclosure.	Black *et al.* (2006)
Gov-Score: this index is constructed from data compiled by the ISS. It uses 51 firm provisions to assign a score to each firm. The feasible range of score is from 0 to 51. The 51 governance provisions are classified into eight ISS categories: audit, board of directors, charter/bylaws, director education, executive and director compensation, ownership, progressive practices, and state of incorporation.	Brown and Caylor (2006)
Gov-7: Brown and Caylor (2006) identify seven governance measures that are key drivers of the link between corporate governance and firm valuation: (1) board members are elected annually; (2) company either has no poison pill or one approved by shareholders; (3) option re-pricing did not occur within the last three years; (4) average options granted in the past three years as a percentage of basic shares outstanding did not exceed 3%; (5) all directors attended at least 75% of board meetings or had a valid excuse for non-attendance; (6) board guidelines are in each proxy statement; and (7) directors are subject to stock ownership guidelines. The first two measures represent external governance and are part of the Bebchuk *et al.* (2009) entrenchment index. The other five are internal governance factors, none of which have been considered by prior literature linking governance to firm value. The authors developed a parsimonious index based on these seven factors.	Brown and Caylor (2006)

Note. The table lists the most cited corporate governance indexes that seek to measure inter-firm variations within a country, and the corresponding empirical evidence. Panel A indicates governance indexes that represent internal governance mechanisms. Panel B describes governance indexes that represent external governance mechanisms. Finally, Panel C describes indexes that represent simultaneously internal and external governance mechanisms.

[a] The index is quite similar to that used by Drobetz *et al.* (2004). The survey on the basis of the index was sent to all Swiss firms quoted at the Swiss Stock Exchange and comprises 38 governance attributes.

To the best of our knowledge, Black (2001) was the first one to publish a work relating firm value with an aggregate measure of firm-level governance structures. He examines the relationship between corporate governance behaviour and market value from a sample of 21 Russian firms. His results must be interpreted with caution because of the small dimension of the sample. Nevertheless, his results suggest that the governance behaviour of Russian firms, *proxied* with a corporate governance index developed by a Russian investment bank (see Table 2.10, Panel A), has a powerful effect on market value.

As already noted, Gompers *et al.* (2003) study the correlation between firm value and shareholder rights provisions in the aggregate, compiled by the Investor Responsibility Research Center (IRRC). Mainly, the authors study takeover defence provisions for US firms, such as antigreenmail laws, blank check preferred stocks (poison pills), golden parachutes, and others. They find that the decile of firms with the strongest takeover defences have lower share prices, when compared with the decile of firms with the weakest defences. Indeed, this work started a line of substantial research using their governance index and their index-based methodology. However, it is not without criticism. For example, Black *et al.* (2006) disapprove of the sole use of hostile takeovers. The authors argue that hostile takeovers are scarce in most of the world, and that other aspects of governance are more prominent. Also, Brown and Caylor (2006) consider that the studies using IRRC data (hereafter G-Index) can only examine external governance in spite of the fact that effective corporate governance comprises both internal and external mechanisms. In Table 2.10, Panel B, we give a brief description of this index.

Bebchuk *et al.* (2009) and Cremers and Nair (2005), also US-based studies, adopt the same approach as Gompers *et al.* (2003) and support the findings documented by prior research. They find that the IRRC provision in the aggregate is correlated with Tobin's Q, as well as returns during the 1990s. Cremers and Nair (2005) show that the results about

the importance of corporate governance, such as presented by Gompers *et al.* (2003), are strengthened when the role of shareholder activism (ownership structure), that is an internal governance mechanism, is also considered. Furthermore, their findings suggest that takeover vulnerability alone (the aggregation of external governance mechanisms considered in this study) does not contribute to strong operating performance; rather, substantial institutional ownership is also required for higher operational performance. Summing up, they conclude that internal and external governance mechanisms interact in being associated with long-term abnormal returns.

Bebchuk *et al.* (2009) investigate which of the 24 governance provisions compiled by the IRRC (G-Index) are correlated with firm value and stock returns. At the end they construct an entrenchment index based only on six provisions underlying the G-Index. They find that firms with a higher level of their parsimonious index were associated with lower firm valuation.

Drobetz *et al.* (2004), using German data and a broader governance index than Gompers *et al.* (2003), considered five dimensions that comprise internal and external governance: (1) corporate governance commitment, (2) shareholder rights, (3) transparency, (4) management and supervisory board matters, and (5) auditing. The authors support the US findings that a higher quality of governance affects firms' Tobin's Q positively.

Black *et al.* (2006) examine governance practices at 515 Korean firms. The authors construct a Korean Corporate Governance Index based in several different dimensions of governance, including shareholder rights, board structure, board procedures, disclosure practices, and ownership structure. They find that Korean firms' corporate governance practices are important in explaining the market value of these firms.

Brown and Caylor (2006) construct a governance index (hereafter Gov-Score) using Institutional Shareholder Services (ISS) governance factors. ISS provides information about internal and external governance mechanisms. The authors conclude that Gov-Score is significantly and positively related to firm valuation. Following the approach of Bebchuk *et al.* (2009), Brown and Caylor (2006) create a parsimonious index based on seven factors underlying Gov-Score and show that it fully drives the relation between Gov-Score and firm value. Also, Beiner *et al.* (2006), using Swiss data and a broad governance index, report a positive correlation between the quality of corporate governance and firm value.

Among the studies investigating inter-firm variation, but with a cross-country approach, are Klapper and Love (2004) for 14 emerging countries, Durnev and Kim (2005) for 27 countries, and Bauer *et al.* (2004) for Europe and the UK. Klapper and Love (2004), and Durnev and Kim (2005) both rely on the use of the CLSA corporate governance index and conclude that firms with better governance enjoy higher valuation. Moreover, Klapper and Love (2004), and Durnev and Kim (2005) analyse the interaction between firm-level governance and the legal environment. They conclude that firm-level governance provisions matter more in countries that have poor legal environments to establish efficient governance practices.

In contrast, results from Europe, namely the UK, reported by Bauer *et al.* (2004) do not support the existence of a positive relation between firm value and strong firm-level corporate governance. In addition, Entugrul and Hedge (2009), examining the corporate governance ratings supplied by three premier US rating agencies – The Corporate Library (TLC), Institutional Shareholder Services (ISS), and Governance Metrics International (GMI) – found that summary scores are generally poor predictors of future firm performance. In general, all other works described above and shown in Table 2.10

confirm the existence of a positive relation between the firm-level quality of governance and firm valuation.

Three of the above papers (Black *et al*., 2006; Drobetz *et al*., 2004; Durnev & Kim, 2005) directly attempt to deal with the endogeneity issue by using an instrumental variables approach. However the instruments used are possible weakly correlated with corporate governance, thereby leading to inefficient instrumental variables estimates.

Recent literature finds that cross-country differences in the extent of legal protection of investors and in the structure of laws and their enforcement (such as the historical origin of laws), affect ownership structure, dividend payout, availability and cost of external finance, thereby also affecting corporate valuation. The most preeminent example of governance studies on inter-country differences is by La Porta *et al.* (1998). Subsequently, several other studies worked in this issue, for example, Berkowitz, Pistor and Richard (2003), Kaufmann, Kraay and Mastruzzi (2008), Djankov, McLiesh and Shleifer (2007), and Djankov, La Porta, Lopez-de-Silanes and Shleifer (2008). Table 2.11 provides an extensive description of the indexes used in prior literature to measure the effect of country-level quality of governance on firm value.

Table 2.11: **Empirical evidence on the use of country-level corporate governance indexes**

Governance index	Empirical Evidence
Antidirector rights: this index is constructed by the sum of dummies identifying one-share/one-vote, proxy by mail, unblocked shares, cumulative vote/proportional representation, preemptive rights, oppressed minority, and percentage of shares needed to call a shareholders' meeting. The index range from 0 to 6. Source: Company Law or Commercial Code and La Porta *et al*. (1998)	Allayannis et al. (2012); Bartram *et al*. (2009); Durnev and Kim (2005); Klapper and Love (2004); La Porta *et al.* (2002)
Creditor rights: this index is formed by adding one point when: (1) the country imposes restrictions, such as creditors' consent or minimum dividend, to file for reorganization; (2) secured creditors are able to gain possession of their security once the reorganization petition has been approved (no automatic stay); (3) the debtor does not retain the administration of its property pending the resolution of the reorganization; (4) secured creditors are ranked first in the distribution of the proceeds that result from the disposition of the assets of a bankrupt firm. The index ranges from 0 to 4. Source: Company law and La Porta *et al*. (1998).	Allayannis *et al*. (2012); Bartram *et al*. (2009); La Porta *et al.* (2002)
Judicial efficiency index: this index is constructed by the *International Country Risk Guide* (2000).	Klapper and Love (2004)
Efficiency of legal system: assessment of the "efficiency and integrity of the legal environment as it affects business, particularly foreign firms" produced by the country risk rating agency *International Country Risk* (ICR). High scores represent higher efficiency levels. Source: La Porta *et al*. (1998).	Allayannis *et al.* (2012)
Index of effective legal institutions: this is an aggregate index of the strength of the legal system and institutional environment constructed as a weighted average of five components: judicial efficiency, rule of law, corruption, risk of expropriation, and risk of contract repudiation. Source: Berkowitz *et al.* (2003).	Allayannis *et al.* (2012); Bartram *et al.* (2009); Klapper and Love (2004)

Table 2.11: **Empirical evidence on the use of country-level corporate governance indexes** *(cont.)*

Governance Index	Empirical Evidence
Public enforcement: this index of public enforcement equals the arithmetic mean of: (1) supervisor characteristics index; (2) investigative powers index; (3) orders index; and (4) criminal index. Source: La Porta, Lopez-de-Silanes and Shleifer (2006).	Allayannis *et al*. (2012)
Private enforcement: this index of private enforcement equals the arithmetic mean of: (1) disclosure index; and (2) burden of proof index. Source: La Porta *et al*. (2006).	Allayannis *et al*. (2012)
Rule-of-law index: this index provides the assessment of the law and order tradition from the *International Country Risk Guide*. The index assesses the law and order tradition of a country on a scale from 0 to 10.	Bartram *et al.* (2009); Durnev and Kim (2005)

Note. The table lists the most cited corporate governance indexes that seek to measure inter-country variations, and the corresponding empirical evidence.

2.5.2 Corporate risk management and the quality of governance structures

To ensure the proper risk-taking behaviour of management, which results in value-maximizing decisions, shareholders use ex-ante governance mechanisms (e.g., executive compensation) and ex-post governance mechanisms (e.g., monitoring managers). In this section we focus largely on ex-post governance mechanisms.

As supported by theory, firms characterized by a high ownership concentration are less likely to experience agency conflicts and, as a consequence, would hedge mainly in order to maximize shareholders' value. Indeed, large shareholders have the resources and motivations to monitor (via the governance process) managers more intensively than small shareholders. Several hedging-based empirical works control for the firm's ownership structure, either with variables representing blockholder ownership (Bartram *et al.*, 2009; Borokhovich *et al.*, 2004; Hagelin *et al.*, 2007; Lel, 2012; Marsden & Prevost, 2005) or with specific types of blockholders, such as institutional investors (Borokhovich *et al.*, 2004; Fok *et al.*, 1997; Lel, 2012; Whidbee & Wohar, 1999), family investors (Hagelin *et al.*, 2007; Lel, 2012), and the state (Lel, 2012).

Despite the theoretical argumentation presented, only Bartram *et al.* (2009) have found support for the relationship between blockholder ownership and corporate risk management. They predict that multiple classes of shares often have a controlling group with superior voting rights, which is consistent with a greater use of derivatives. In the case of institutional shareholding, Fok *et al.* (1997) and Lel (2012) find significant evidence that firms with an institutional investor as an outside blockholder engage in valuable risk management activities. These results suggest that an institutional investor has a stronger financial incentive to monitor management. In contrast, a family investor as an undiversified shareholder could undertake investment decisions that pursue objectives that are diverse to the ones of the other shareholders. Consistent with that view, Hagelin

et al. (2007) find some evidence that family ownership is associated with shareholder wealth expropriation. In the same spirit, risk management of firms that are not state-owned should be rewarded with a premium, suggesting that state-owned firms have effectively dispersed ownership amongst taxpayers in the country. Lel (2012) do not achieve significant results in this matter.

Another aspect of ownership structure that should be mentioned is insider blockholder. Lel (2012) argue that the severity of agency costs is greater when managerial blockholders exist. So, he does not expect that hedging is value-adding in the presence of an insider blockholder. In line with this, Hagelin *et al.* (2007) analyse the impact of CEO shareholdings on hedging decisions, namely when the CEO is the largest shareholder or when he/she comes from the family which is the largest shareholder in the firm. They find that hedging activities are not driven by management entrenchment. It should be noted that the existence of an insider blockholder is frequently evoked as a proxy for managerial risk aversion (e.g., Fok *et al.*, 1997; Marsden & Prevost, 2005; Tufano, 1996).

As discussed earlier, the agency theory attributes a particularly important monitoring role to outside disinterested members of the board who are probably less aligned to management. For that reason, outsiders on the board should have a significant role in monitoring and controlling the use of derivatives. Borokhovich *et al.* (2004), analysing a sample of 284 firms in the S&P 500 in 1995, argue that in boards dominated by outsiders that make greater use of interest rate derivatives, the evidence would be consistent with a derivative policy that benefits shareholders. Whidbee and Wohar (1999) and Marsden and Prevost (2005) also examined this issue. While Whidbee and Wohar (1999) find that when insiders own a small percentage of firm equity, monitoring by outside directors may lead to greater derivatives' use, Marsden and Prevost (2005) do not

support the hypothesis that board composition plays a significant role in the use of derivatives.

To date, in terms of the relationship between corporate governance and hedging activities, only the relationship between several specific governance mechanisms and hedging activities has been examined. Instead, Lel (2012) addresses the impact of corporate governance on the determinants of a firm's use of derivatives through the use of one firm-specific variable that provides an aggregate measure of the quality of governance. He follows the methodology of Gompers *et al.* (2003) and constructs a firm-specific governance index that proxies for firm-level quality of governance. The index comprises seven alternative governance rules related to ownership and board structures that are hand-collected from the firms' annual reports (see Table 2.10, Panel A). From the view of the corporate governance literature, the degree of monitoring of managerial activities is expected to increase (which means that the agency costs of equity are expected to decrease) with higher values of this governance index. As a result, the likelihood of derivatives' use for hedging purposes is expected to increase. In addition, Lel (2012) uses a proxy for the country-level quality of governance obtained from La Porta *et al.* (1998) – the English legal origin. His evidence suggests that strongly governed firms use derivatives in a way that is consistent with shareholder value-maximization. By contrast, weakly governed firms use derivatives for reasons related to managerial utility-maximization.

2.5.3 The value of corporate risk management and the quality of governance structures

To the best of our knowledge, Allayannis *et al.* (2012) are the only ones to have investigated the impact of quality of governance on the value of risk management

activities. As before in Lel (2012), they follow the methodology of Gompers *et al.* (2003) and construct a firm-specific governance index which proxies for internal corporate governance structures. The index comprises seven alternative governance rules and ranges from 0 (weak governance) to 7 (strong governance) (see Table 2.10, Panel A). In fact, this index is very similar to those of Lel (2012).

In addition, Allayannis *et al.* (2012) use several proxies for external country-level governance mechanisms: i) an aggregate index representing the strength of shareholders' rights that is obtained from La Porta *et al.* (1998) and that provides a measure of the level of shareholders' protection under law; ii) the strength of creditors' rights that is represented by an aggregate index, also obtained from La Porta *et al.* (1998) and that measures the level of creditors' rights under bankruptcy and reorganization laws; iii) English legal origin; iv) the efficiency of the judicial system as it affects business, which is scaled from 0 to 10 and is produced by Business International Corporation; v) the extent to which private or public enforcement exists; vi) the merger activity within the country, and vii) the legality measure constructed by Berkowitz *et al.* (2003). Both the public enforcement index and private enforcement index are obtained from La Porta *et al.* (2006). With regard to merger activity within the country, it is expected that the threat of a takeover disciplines managers and leads them to focus on value maximization. Finally, it is expected that firms that reside in countries with strong legality pursue more valuable risk management activities in comparison to firms residing in countries with weak legality.

The authors document that hedging is a value-increasing strategy for firms around the world. They also suggest that stronger internal and external corporate governance structures lead to increases in the value of firms that hedge. Moreover, they find that firms

characterized by weak internal governance, but residing in countries with strong external governance structures, also engage in valuable risk management activities.

2.6 Summary and further directions

The research reviewed above provides great insights into the link between risk management, corporate governance, and firm value. Firstly, we documented that hedging activities tend to be systematically associated with the use of derivatives, disregarding the fact that hedging can be pursued by other means. This has been recognized by several works that present evidence concerning the use of non-derivative hedging instruments and that point to this approach as a potential bias on empirical tests. So, providing an adequate measure for corporate hedging is a necessary element to the success of empirical tests. However, the choice of one or other measure for corporate hedging is to a great extent limited by the data availability. Indeed, this matter of data availability is quite obvious when we look at the limited number of studies using data on non-US firms.

Secondly, we provide a review about the theoretical foundation for corporate risk management. In essence, we identify four principal arguments, classified under two main groups of theories. The first one predicts that hedging can increase firm value by reducing the expected tax costs, the probability of financial distress and the agency costs of debt. The second group is based on managerial utility maximization. In the third part of section 2.3, we present an overview of relevant empirical work related with identified arguments. In general, the empirical evidence concerning theoretical predictions is fairly mixed. Overall, individual firms do not seem to hedge in order to reduce expected tax payments or the costs of financial distress. There is also mixed empirical evidence concerning managers' use of derivative instruments to maximize their personal utility of wealth. The

empirical studies, however, do seem to support the hypothesis that firms hedge more if they face agency costs of debt.

Thirdly, we review empirical studies that examine the relationship between firm value and corporate hedging. This matter builds on the recent body of literature that recognizes that corporate risk management might be ineffective by failing to add firm value or even counterproductive by destroying value. Hence, the central question is whether hedging does, in fact, add value to the firm. Again, the empirical results are misleading.

Finally, in the face of the inconclusive evidence on the value premium associated with hedging, Allayannis *et al.* (2012) suggest that if there is no proper control over managers' actions, they may be tempted to pursue risk management activities looking to maximize their own objectives, thereby hurting risk management value. This idea highlights that value through risk management could be conditional to corporate governance structures. Despite the straightforwardness of this prediction, the issue is rarely addressed in the literature. So, it is clear that further research on the corporate governance effect on hedging premium is needed.

In summary, the review showed that according to the risk management literature an impressive amount of work has been done. Nevertheless, it seems obvious that certain issues remain controversial and without a clear bottom line. Several studies identified endogeneity issues and the problem of hedgers' misclassification as potential sources for the accounted mixed results. So, it could be challenging to address properly simultaneous equation bias in empirical analyses. Furthermore, it is essential to identify appropriate proxies for corporate hedging beyond the use of financial derivatives. Finally, it is important to expand empirical evidence to non-US firms.

CHAPTER 3

Sample selection and data issues

3.1 Introduction

The sample to be selected will serve as the basis for the testing of the hypotheses to be drawn in the three empirical studies. Therefore, to prevent duplication we start our empirical analysis with the description of the sample selection procedure, data collection, and the definition of the input variables of the models, specifically for the hedging variable and the corporate governance indexes. Moreover, we present and interpret the descriptive statistics for all the variables.

The remainder of the chapter is organized into six more sections. The next section presents sample selection details. The data collection and variables' definition will be done in section 3.3. Section 3.4 presents a comprehensive description of the hedging variable and section 3.5 shows an exhaustive description with regard to the corporate governance indexes. Then, in section 3.6 we present the descriptive statistics. Finally, section 3.7 concludes the chapter.

3.2 Sample selection

For estimating the models proposed in chapter 4, 5 and 6, we use a sample restricted

to non-financial sector firms.[18] These firms typically concentrate their efforts on hedging transactions, whereas firms belonging to the financial sector include both hedging and speculative transactions in their risk management activities. Accordingly, the initial sample includes all non-financial sector firms listed on Euronext, specifically those belonging to the following indexes on December 31, 2007: Brussels all Shares (BAS) Price,[19] CAC all shares,[20] Amsterdam Exchanges (A-DAM) all shares,[21] and PSI General.[22] We did not take into account multiple listings by the same firms. When alternatives arise, we selected the Exchange's main market where the firm is listed.

Our final sample is constructed by matching firms that have an annual report for 2007 in English, French or Portuguese published on their website, with firms that have sufficient accounting data, for the same year, and at least 15 non-missing monthly stock returns reported during the 2006-2008 period on the *Infinancials* database.[23] In addition, we only considered firms that have foreign sales and the necessary hedging and governance data disclosed in their annual report. This approach left us with 567 firms in our final sample. Table 3.1 summarizes how the sample size is reduced by succeeding data requirements.

[18] We excluded all the firms classified into the financial industry (code 8000), according the Industry Classification Benchmark (ICB): bank institutions, insurance companies, real estate companies, financial services, and equity/non-equity investment companies.

[19] The BAS price index is a market capitalization weighted index that includes the Belgian stocks that are listed on the Euronext Brussels market.

[20] The CAC all shares is a market capitalization weighted price index that comprises all stocks listed on Euronext Paris with an annual velocity of more than 5%, irrespective of market capitalization.

[21] The A-DAM all shares index is a market capitalization weighted price index and comprises all shares listed on the Euronext Amsterdam market.

[22] The PSI General index is a market capitalization weighted index that only includes shares issued by companies that are listed on the Euronext Lisbon market.

[23] This last selection requirement follows Bartram, Brown and Minton (2010) approach. For the period 1998-2002, that is 60 monthly stock returns, these authors required that the sample firms have at least 25 non-missing monthly stock returns.

Table 3.1: **Sample selection**

Selection criteria	Sample size
Non-financial firms listed on Euronext belonging to the BAS Price, CAC All Shares, A-DAM All Shares, and PSI General indexes, excluding cross listings	684
Firms with annual reports in English, French, and Portuguese on their websites	626
Firms with the required stock returns and accounting data on the *Infinancials* database[a]	598
Firms with inside ownership data on the *Bloomberg* database	585
Firms with foreign sales, hedging, and governance data disclosed in their annual reports	567

Note. [a] At least 15 stock returns during the 2006-2008 period and accounting data for 2007 are required to calculate several inputs from the regression model.

Firms are classified into industries according to the ICB classification codes in the *Infinancials* database. This procedure results in firms' distribution across nine industries. Table 3.2, Panel A and Panel B, show the country and industry composition, respectively.

Table 3.2: **Country and industry composition**

Panel A. Country composition			
Country		**Obs.**	**% of sample**
Belgium		75	13.3%
France		367	64.7%
The Netherlands		84	14.8%
Portugal		41	7.2%
Panel B. Industry composition			
Industry	**ICB industry codes**	**Obs.**	**% of sample**
Oil and gas	0001	12	2.1%
Basic materials	1000	36	6.3%
Industrials	2000	145	25.6%
Consumer goods	3000	89	15.7%
Health care	4000	42	7.4%
Consumer services	5000	101	17.8%
Telecommunications	6000	10	1.8%
Utilities	7000	14	2.5%
Technology	9000	118	20.8%

We observe that French firms represent around 65% of the sample and the largest industry (Industrials) represents around 26% of the sample. Despite the highlighted distribution by countries, our sample shall be considered as a whole - our intention is not to make comparative analysis between countries, but instead to analyse the group of Euronext non-financial firms.

3.3 Data collection

Infinancials is the main source for the accounting and financial information used in the construction of the variables that proxy for firms' characteristics. An exception is made for the information on foreign involvement. We use firms' annual reports to collect information about foreign involvement, industry diversification, and hedging and governance practices.[24] Further, we collect data from different sources besides *Infinancials* database and firms' annual reports.

In the first empirical study and following Allayannis and Ofek (2001), the data sets use a firm's monthly returns for the three years surrounding 2007 (2006-2008). We use a trade-weighted exchange risk index – the Euro effective index[25] – to proxy for the foreign exchange risk factor. The proxy used to represent the interest rate risk factor is the three-month Euro Interbank Offered Rate (Euribor). Both the nominal effective exchange rate and the three-month EURIBOR data were obtained from the European Central Bank. To represent the commodity price risk factor, we consider the Euronext Rogers International

[24] Typically, foreign involvement, hedging, and governance data are disclosed, respectively, in the segment information, financial risks and risk management, and corporate governance sections of firms' annual reports. For those firms that do not disclose the required information on those sections, the entire financial report is read to make sure that the information is not disclosed anywhere else.

[25] The trade-weighted Euro effective exchange rate index (EER) covers 22 currencies. In order of weighting they are Great Britain, USA, Japan, Switzerland, Sweden, China, Hong Kong, Taiwan, Denmark, South Korea, Poland, Singapore, Czech Republic, Russia, Turkey, Hungary, Malaysia, India, Norway, Canada, Thailand, and Brazil.

Commodity Index (RICI) provided by Uhlmann Price Securities.[26] Finally, we collected the MSCI Euro index provided by Morgan Stanley Capital International Barra which is used as a proxy for the equal-weighted returns market index.[27]

As for the second and third empirical studies, we also obtained data on inside ownership from the *Bloomberg* database which provides the proportion of a firm's shares owned by directors and officers for each sample firm. Furthermore, we collected ADR's information from the Bank of New York's ADR database. Relating to the country-specific governance variables that are required to assess a country-level governance index, we used elements from the datasets described in Djankov *et al.* (2007), Djankov *et al.* (2008), Dahlquist, Pinkowitz, Stulz and Williamson (2003), Kaufmann *et al.* (2008), Berkowitz *et al.* (2003) and, finally, La Porta *et al.* (1998). A summary of data definition and sources is provided in Table 3.3. In addition, we list the study where each variable will be used.

[26] The RICI represents the value of a basket of commodities employed in the global economy, ranging from agricultural and energy products to metals and minerals. The value of this commodity basket is tracked via future contracts on 35 different exchange-traded physical commodities, quoted in four different currencies and listed on 11 exchanges in five countries.

[27] The MSCI Euro index is a subset of the MSCI Pan-Euro index and includes the largest and most liquid stocks from the ten European Union countries. The countries included in the index are: Austria, Belgium, Finland, France, Germany, Ireland, Italy, The Netherlands, Portugal, and Spain.

Table 3.3: **Definitions and sources of variables**

Panel A. Firm-specific variables					
Dependent variables	**Definition**	**Empirical study**[a]	**Study 1**	**Study 2**	**Study 3**
CP exposure (*EXP_CP*)	Absolute value of CP exposure obtained from the estimated augmented market model (see section 4.4) that includes returns on the exchange rate index, changes on the interest rate factor, and returns on the commodity index.	Allayannis and Weston (2001) (adapted to the type of risk)	×	×	×
FX exposure (*EXP_FX*)	Absolute value of FX exposure obtained from the estimated augmented market model (see section 4.4) that includes returns on the exchange rate index, changes on the interest rate factor, and returns on the commodity index.	Allayannis and Weston (2001)	×	×	×
Interest rate exposure (*EXP_IR*)	Absolute value of interest rate exposure obtained from the estimated augmented market model (see section 4.4) that includes returns on the exchange rate index, changes on the interest rate factor, and returns on the commodity index.	Bartram (2002)	×	×	×
Hedging (*HEDGE*)	Dummy=1 if a firm reports the use of either external and/or internal hedging instruments for hedging purposes in its annual report; 0 otherwise. See section 3.4 for the construction of the variable.	Judge (2006)	×	×	×
Tobin's Q (*L_Q*)	Natural logarithm of Tobin's Q. Tobin's Q is computed as the ratio of market value to book value of assets. Market value of assets is computed as market value of equity plus book value of assets minus book value of equity. Obtained from *Infinancials*.	Belghitar *et al.* (2008); Hagelin *et al.* (2007); Lookman (2004)			×
Independent variables	**Definition**	**Empirical study**[a]	**Study 1**	**Study 2**	**Study 3**
American Depositary Receipts (*ADR*)	Dummy=1 if the firm is issuing American Depository Receipts; 0 otherwise. Obtained from the Bank of New York's ADR database.	Beiner *et al.* (2006): Klapper and Love (2004)		×	×
Capital expenditures (*CAPEX*)	Purchases of fixed assets divided by total assets. Obtained from *Infinancials*.	Lin and Smith (2008); Jin and Jorion (2006)	×	×	×
Cash flow (*CASH*)	Operating income before interest, taxes and depreciations (EBITDA) minus the sum of tax, interest expenses, common dividends, and preferred dividends scaled by total assets. Obtained from *Infinancials.*	Lin and Smith (2008)		×	

Table 3.3: **Definitions and sources of variables** (*cont.*)

Panel A. Firm-specific variables					
Independent variables	**Definition**	**Empirical study**[a]	**Study 1**	**Study 2**	**Study 3**
Firm-level corporate governance index (*CG_INT*)	An index that proxies for the firm-level quality of governance. The index ranges from 0 to 7, being 7 identified with a high quality of governance. See section 3.5.1 for the composition and construction of the index. Collected from firms' annual reports.	Lel (2012)	×	×	×
Dividend yield (*DIV*)	Dummy=1 if the firm dividend yield is greater than the median yield for the sample; 0 otherwise. Obtained from *Infinancials*.	Allayannis *et al.* (2012)	×	×	×
High CP exposure (*EXP_CP_DUM*)	Dummy=1 if the firm has an absolute CP exposure (*EXP_CP*) greater than the median CP exposure for the sample; 0 otherwise. See section 3.6 for the construction of the variable.	Similar to Bartram *et al.* (2009)		×	×
High FX exposure (*EXP_FX_DUM*)	Dummy=1 if the firm has an absolute FX exposure (EXP_FX) greater than the median FX exposure for the sample; 0 otherwise. See section 3.6 for the construction of the variable.	Similar to Bartram *et al.* (2009)		×	×
High IR exposure (*EXP_IR_DUM*)	Dummy=1 if the firm has an absolute IR exposure (*EXP_IR*) greater than the median IR exposure for the sample; 0 otherwise. See section 3.6 for the construction of the variable.	Similar to Bartram *et al.* (2009)		×	×
General high Exposure (*EXP*)	Dummy=1 if the firm has any of the FX, IR or CP exposure variables equal to 1; 0 otherwise. See section 3.6 for the construction of the variable.	Similar to Bartram *et al.* (2009)		×	×
Geographic diversification (*FS*)	Ratio of foreign sales to net sales. Obtained and collected from *Infinancials* and firms' annual reports.	Allayannis and Weston (2001)			×
Firms' use of commodity hedging instruments (*HEDGE_CP*)	Dummy=1 if a firm reports the use of either external and/or internal commodity instruments for hedging purposes in its annual report; 0 otherwise.	Similar to Davies *et al.* (2006) and Judge (2006)	×		
Firms' use of foreign exchange hedging instruments (*HEDGE_FX*)	Dummy=1 if a firm reports the use of either external and/or internal foreign exchange instruments for hedging purposes in its annual report; 0 otherwise.	Davies *et al.* (2006)	×		

Table 3.3: **Definitions and sources of variables** (*cont.*)

Panel A. Firm-specific variables					
Independent variables	**Definition**	**Empirical study**[a]	**Study 1**	**Study 2**	**Study 3**
Firms' use of foreign exchange hedging instruments (*HEDGE_IR*)	Dummy=1 if a firm reports the use of either external and/or internal interest rate instruments for hedging purposes in its annual report; 0 otherwise.	Similar to Davies *et al.* (2006) and Judge (2006)	×		
Four-digit ICB code dummies (*IND*)	Dummy=1 if a firm's main industry is classified into one of the following eight industries: 0001, 1000, 2000, 3000, 4000, 5000, 6000, and 7000, according to the 4-digit ICB classification; 0 otherwise. 4-digit ICB classification comprises nine non-financial industries. Obtained from *Infinancials*.	Similar to Allayannis *et al.* (2012)	×	×	×
Industry diversification (*INDDIV*)	Dummy=1 if a firm has at least two business segments with a different ICB 4-digit subsector classification code; 0 otherwise. Obtained from firms' annual reports.	Allayannis *et al.* (2012)			×
Insider ownership (*INS*)	Number of shares held by officers and directors divided by common shares outstanding. Obtained from *Bloomberg*.	Beiner *et al.* (2006)			×
Financial leverage (*LEV*)	Ratio of long-term debt plus short-term debt to total assets. Obtained from *Infinancials*.	Berkman and Bradbury (1996); Graham and Rogers (2002)	×	×	×
Net foreign exchange exposure (*NET_FX*)	Absolute value of the difference between the fraction of revenues and the costs denominated in foreign currency. Assuming that local firms use foreign assets for foreign production, we use assets denominated in foreign currency as a proxy for costs denominated in foreign currency. Obtained and collected from *Infinancials* and firms' annual reports.	Bartram *et al.* (2009); Hagelin *et al.* (2007)	×		
Return on assets (*ROA*)	Operating income before interest and taxes (EBIT) scaled by total assets. Obtained from *Infinancials*.	Allayannis *et al*. (2012)			×
Rate of return on the commodity price risk factor (R_CP_t)	The rate of return on the Euronext Rogers International Commodity Index (RICI) in month *t*. Obtained from Uhlmann Price Securities.	Similar to Bartram (2005)	×		

Table 3.3: **Definitions and sources of variables** (*cont.*)

Panel A. Firm-specific variables					
Independent variables	**Definition**	**Empirical study**[a]	**Study 1**	**Study 2**	**Study 3**
Rate of return on the foreign exchange risk factor (R_FX_t)	The rate of return on the Euro Effective Index in month *t*. Obtained from European Central Bank.	Clark and Mefteh (2010)	×		
Rate of return on the interest rate risk factor (R_IR_t)	The rate of change on the three-month Euro Interbank Offered rate (EURIBOR) in month *t*. Obtained from European Central Bank.	Bali *et al*. (2007)	×		
Rate of return on the market index (R_MSCI_t)	The rate of return on the Euronext MSCI Euro Index in month *t*. Obtained from Morgan Stanley Capital International Barra.	Clark and Mefteh (2010)	×		
Firm total assets (*SIZE*)	Natural logarithm of total assets. Obtained from *Infinancials*.	Allayannis *et al*. (2012)	×	×	×
Tax losses carry forward (*TAX*)	Net operating losses carry forward divided by total assets. Obtained from *Infinancials*.	Davies *et al.* (2006); Gay and Nam (1998); Géczy *et al*. (1997)	×	×	×
Revenues from commodity operations (*TI_TS*)	Ratio of total inventory to total sales. Obtained from *Infinancials*.	Bali *et al.* (2007)	×		
Panel B. Country-specific variables					
Independent variables	**Definition**	**Empirical study**[a]	**Study 1**	**Study 2**	**Study 3**
Country-level governance index (CG_EXT)	Country-level governance index derived from a principal component analysis (PCA) where the first component accounts for 80.3% of the total variance. It is calculated as the equally weighted averages of the country-governance attributes with factor loadings in excess of 0.40 in absolute terms and is given by (see section 3.5.2): CG_EXT=0.722 × CR_R + 0.653 × LEG.			×	×

Table 3.3: **Definitions and sources of variables** (*cont.*)

Panel B. Country-specific variables					
Independent variables	**Definition**	**Empirical study**[a]	**Study 1**	**Study 2**	**Study 3**
Creditor rights (*CR_R*)	Aggregate index of creditor rights protection with values from 0 (low) to 4 (high). Obtained from Djankov *et al.* (2007).	Allayannis *et al.* (2012); Bartram *et al.* (2009); La Porta *et al.* (2002)		×	×
Rule of law (*LAW*)	Index of rule of law. Obtained from Kaufmann *et al.* (2008).	Bartram *et al.* (2009); Durnev and kim (2005)		×	×
Legality (*LEG*)	Index of effective legal institutions derived from a PCA where the first component accounts for 84.6% of the total variance and is given by: Legality = 0.381× Efficiency of judiciary + 0.578 × rule of law + 0.503 × absence of corruption + 0.347 × risk of expropriation + 0.384 × risk of contract repudiation. Obtained from Berkowitz *et al.* (2003) and La Porta *et al.* (1998).	Allayannis *et al.* (2012); Bartram *et al.* (2009)		×	×
Country ownership concentration (*OWN*)	Measure of ownership concentration calculated as the fraction of the country shares that are closely held; closely-held shares are defined as those held by controlling shareholders (shareholders that hold more than 5% of firms' shares). Obtained from Dahlquist *et al.* (2003).	Bartram *et al.* (2009)		×	×
Shareholder rights (*SH_R*)	Aggregate index of shareholder rights protection with values from 0 (low) to 6 (high). Obtained from Djankov *et al.* (2008).	Allayannis *et al.* (2012); Bartram *et al.* (2009); La Porta *et al.* (2002)		×	×

Note. The table provides the definitions and sources for the firm-specific (Panel A) and country-specific (Panel B) dependent and independent variables analysed. Study 1, study 2, and study 3 provide the information of the empirical study where each variable will be used.

[a] The third column contains a few examples of empirical studies that have used the same specification for each one of the described variables.

The next sections of this chapter will provide a detailed overview of the main variables carried out in testing our hypotheses: (1) the hedging variable, (2) the firm-level corporate governance index, and (3) a country-level governance index to be used as a potential instrument to estimate the stage of governance quality in firms.

3.4 Measure of corporate risk management

Recent empirical studies have employed qualitative and quantitative proxies of hedging practices based on firms' disclosures on annual reports. However, data collected from this source is often incomplete and differs greatly from firm to firm, even though the quality of disclosure has improved with the adoption of International Accounting Standards (IAS), namely IAS 32 and IAS 39 in January, 2005. Although we would prefer to use a continuous measure of hedging instruments' usage, only a small fraction of our sample firms disclose information concerning their positions and their level, namely notional amounts. We therefore fall back on the categorical variables commonly used in prior studies to proxy for the non-use/use of hedging instruments (*HEDGE*).

Following Judge (2006), we search annual reports for qualitative disclosures about hedging practices and classify firms as hedgers, if their annual report specifically mentions the use of internal and/or external hedging instruments. Firms that reveal the existence of natural hedge,[28] foreign currency borrowing, domestic currency invoicing, netting agreements and asset/liability management, which is termed as matching/netting, contract interest limitation clauses, pricing agreements, and contract pass-through clauses, are all considered within the scope of internal instrument users. On the other hand, a firm is classified as an external hedger if it discloses the use of any of the following derivative

[28] When firms do not explicitly reveal the existence of a natural hedge, but describe the existence of foreign sales and simultaneously the existence of foreign assets, we still categorize them as "natural hedge users".

instruments for hedging purposes: forwards, futures, forwards or options.[29] In fact, all the firms in our sample reveal the use of derivatives for hedging purposes.

Table 3.4 provides summary statistics for Euronext firms' hedging practices. Panel A shows that across the entire sample of 567 firms, 80% of firms disclose the use of some type of hedging instruments. Similarly, Judge (2006) reports a usage ratio of 77.9%. Furthermore, it shows that the general usage of internal hedging instruments and derivatives are comparable, 62% and 65%, respectively. The internal and external hedging practices most frequently used are matching/netting and swaps, 53% and 49%, respectively.

Table 3.4: **Summary statistics of hedging by category of risk instrument**

Panel A. All hedging instruments									
		Internal			**Derivatives**				
Country	**Hedgers**	**All**	**Matching /netting[a]**	**Others**	**All**	**Forwards**	**Futures**	**Swaps**	**Options**
Belgium	81%	49%	36%	20%	73%	56%	9%	51%	37%
France	80%	64%	56%	23%	64%	41%	4%	47%	36%
The Netherlands	92%	82%	69%	45%	69%	61%	12%	54%	18%
Portugal	63%	34%	22%	17%	54%	22%	10%	46%	32%
All firms	80%	62%	53%	25%	65%	45%	7%	49%	33%
Panel B. Exchange rate instruments									
		Internal			**Derivatives**				
Country	**Hedgers**	**All**	**Matching /netting[a]**	**Others[b]**	**All**	**Forwards**	**Futures**	**Swaps**	**Options**
Belgium	73%	45%	36%	13%	63%	56%	3%	15%	20%
France	71%	62%	56%	19%	46%	41%	1%	13%	19%
The Netherlands	88%	81%	69%	42%	63%	58%	2%	18%	11%
Portugal	46%	32%	22%	12%	24%	20%	0%	10%	10%
All firms	72%	60%	53%	21%	49%	44%	1%	14%	17%

[29] Options include caps, floors, collars and swaptions.

Table 3.4: **Summary statistics of hedging by category of risk instrument** *(cont.)*

Panel C. Interest rate instruments									
		Internal			Derivatives				
Country	**Hedgers**	**All**	**Matching /netting[a]**	**Others[c]**	**All**	**Forwards**	**Futures**	**Swaps**	**Options**
Belgium	53%	1%	0%	0%	53%	0%	3%	49%	25%
France	51%	3%	1%	1%	50%	1%	1%	45%	24%
The Netherlands	56%	6%	0%	0%	52%	5%	0%	49%	5%
Portugal	54%	0%	0%	0%	54%	0%	0%	46%	27%
All firms	52%	3%	1%	1%	51%	1%	1%	46%	22%
Panel D. Commodity price instruments									
		Internal			Derivatives				
Country	**Hedgers**	**All**	**Matching /netting[a]**	**Others[d]**	**All**	**Forwards**	**Futures**	**Swaps**	**Options**
Belgium	15%	7%	0%	7%	9%	0%	8%	3%	3%
France	12%	5%	0%	5%	8%	4%	2%	3%	5%
The Netherlands	20%	11%	0%	10%	14%	6%	10%	5%	6%
Portugal	17%	5%	0%	5%	15%	5%	10%	5%	5%
All firms	14%	6%	0%	6%	10%	4%	5%	4%	5%

Note. This table shows summary statistics of hedging instruments' usage by country and by category of risk instrument. The second column provides the percentage of total firms that use hedging instruments. Further, it is presented the percentage of firms using internal and external hedging instruments in general and by particular instrument (Panel A). The usage of hedging instruments is also provided by type of risk. Panel B presents statistics about exchange rate instruments; Panel C presents interest rate instrument statistics; and Panel D commodity price instrument statistics. The information about hedging practices is hand-collected from the firms' annual reports.

[a] Statistics for matching/netting includes natural hedge, asset/liability management, and netting agreements, depending the category of risk. [b] In Panel B, statistics for others include foreign currency debt, domestic currency invoicing, and contract exchange rate pass-through clauses. [c] In Panel C, statistics for others is limited to contract interest limitation clauses. [d] In Panel D, statistics for others includes both pricing agreements and pass-through clauses in sales contracts.

Despite these remarkable general usage rates, the examination of hedging practices according to the category of risk hedged reveals pronounced differences between them. The most common is the use of exchange rate hedging instruments (72%), followed by interest rate instruments (52%). Yet, only 14% of the firms in the sample use commodity hedging instruments, which may be consistent with Bartram's (2005) view that only a few corporate cash flows are affected by commodity price changes.

Although the general usage rates for internal and external instruments do not vary considerably, several differences are identified when we break down the usage by type of

underlying risk and particular types of instruments. Clearly, some patterns emerge. Internal instruments (used by 60% of firms) are the most used for managing exchange rate risk, whereas external instruments (used by 51% of firms) are the instruments of choice for interest rate risk. In managing commodity price risk, the distribution across internal and external instruments is more even.

Examining derivatives' usage by type of particular instruments also reveals distinct patterns. As one would expect, for exchange rate risk derivatives, forwards (used by 44% of firms) are the most commonly used instrument, while for managing interest rate risk, swaps (used by 46% of firms) are the most frequent instrument. Instead, firms' usage of different types of commodity price derivatives is low and round about the same rate for each type of instrument: 4% of firms use forwards, 5% use futures, 4% use swaps and 5% use options. These results are in line with the ones of Bartram *et al.* (2009) and Bartram *et al*. (2011).

The use of hedging instruments does not vary significantly across countries. In general, The Netherlands has the highest usage rate (92%) and Portugal the lowest (63%).

3.5 Corporate governance indexes

3.5.1 Firm-level corporate governance index

The four countries of our sample, likewise other European Union countries, have initiated self-regulation efforts to improve corporate governance practices. These self-regulation initiatives are mainly characterized by voluntary compliance, and monitoring without enforcement (Jong, DeJong, Mertens, & Wasley, 2005). Nonetheless, these initiatives are in line with the standard of the European Commission. Clearly, this adherence to a single standard facilitates the collection from firms' annual reports of detailed firm-level internal governance information.

Thus, in line with Lel (2012), we make use of a firm-level index (*CG_INT*) comprising seven widely used governance control mechanisms hand-collected from the firms' annual reports and ranging from 0 (weak governance) to 7 (strong governance). The index was built taking into account two dimensions considered important by the literature in accessing corporate governance quality: (1) ownership structure, namely ownership concentration and the identity of the major shareholders, and (2) board matters. Each feature must refer to a governance element that is not legally required. Lel's firm-level governance index follows Gompers *et al.'s* (2003) index-based methodology,[30] but whereas a higher G-index is associated with a weaker governance structure, a higher score of Lel's index is expected to represent a higher level of monitoring of managerial activities, which is associated with a higher governance structure.

The construction of Lel's firm-level governance index (*CG_INT*) is straightforward: first, each of the seven governance attributes in analysis is assigned the value of 1 if it is applied, and zero otherwise. So, one point is added for each attribute that is assigned the value of 1, which is interpreted as an active move by management to improve a firm's corporate governance structures. Second, a simple sum over the seven attributes is computed. With regards to board matters, a firm earns one additional point if the roles of the chief executive officer (CEO) and the chairman are separated. This is in line with Yermack (1996), who finds that firms are more highly valued when the CEO and the chairman positions are separated. Related to the ownership concentration dimension, the firm gets one point if there is no divergence between the cash flow and voting rights of the largest managerial shareholder (La Porta *et al.*, 2002), and, according to Doidge (2004), if

[30] A firm's score is based on the number of shareholder rights' decreasing provisions a firm has. The index ranges from a feasible low of 0 to a high of 24 and a high G-Score is associated with weak shareholder rights (see Table 2.10, section 2.5.1.4).

there are no stocks with differential voting rights.[31, 32] The confirmation of these last requirements can be interpreted as the nonexistence of limitations to shareholder rights. The next stage establishes the type of entity that is in control of each of our sample firms, for the reason that ownership concentration may not suffice as an indicator of the degree of governance, while the identity of owners may play a more crucial role. A firm earns one additional point if at least one non-managerial (Mitton, 2002) and non-institutional large shareholder[33] exists (Shleifer & Vishny, 1997), if an institutional large shareholder (e.g., Cremers & Nair, 2005; Han & Suk, 1998) exists, if there is no family large shareholder (Faccio *et al*., 2001; Thomsen & Pedersen, 2000; Yermack, 1996),[34] and, finally, if there is any ownership by the state (e.g., Boardman and Vining, 1989; Thomsen & Pedersen, 2000).

[31] We identify all shareholders (blockholders) who hold more than 10% of the firm's outstanding shares (Lins, 2003). Frequently the major shareholders are corporate entities, so we try to identify the major shareholders to those entities. Further, to determine which blockholders are held by individuals involved with management, we compare the list of officers and directors of each firm with the list of the identified blockholders. If the name of an officer or director matches the name of an owner, this shareholder is classified as the largest managerial shareholder (Mitton, 2002). This name matching procedure is not free from bias, because in some cases the true owner of a particular block could be difficult to identify.
Officially reported shareholdings often leave out the extent of voting rights, so we capture the existence of cash flow/voting rights' divergence through the analysis of the deviations from the one-share-one-vote principle. Namely, we check the existence of dual-class share structures, voting and ownership ceilings, priority shares, preferred shares, depositary certificates, and double voting shares (which is limited to the French case). In fact, the deviations from the one-share-one-vote principle create a wedge between financial interest and voting power, which induces a shareholder to pursue self-serving actions at the expense of firm value. As outlined before in section 2.5.1.1 the idea underlying cash flow/voting rights divergence' is that it increases the incentive for expropriation (Shleifer & Vishny, 1997).

[32] Doidge (2004) suggests that the measurement of private benefits of control is only possible when firms have dual-class share structures. Moreover, he suggests that when voting power is more concentrated, the private benefits of controls are more preeminent.

[33] In line with Murphy and Van Nuys (1994), we define an institutional shareholder as a portfolio manager who is managing capital on behalf of others. We consider banks or bank-owned investment companies, insurance companies, pension funds, and mutual funds. From the perspective of Shleifer and Vishny (1997), the presence of an active blockholder may or may not be beneficial. On the one hand, the outside blockholder can use his/her influence to increase security benefits. On the other hand, he/she may choose to collude with management to share corporate private benefits, thereby becoming *de facto* an inside blockholder.

[34] Similarly to Smith and Amoako-Adu (1999), we classify a firm as a "family firm" if a person or a group related by family ties holds the largest block of shares and at least 10% of the outstanding shares.

As stated before our index ranges from 0 to 7. We classified firms with firm-level governance in the first quartile, which ranges from 0 to 2, as weak governed and firms in the top quartile, which ranges from 5 to 7, as strong governed. The distribution of our sample firms across firm-level governance categories are as follows: the majority of the firms of our sample (24.5%) have a score of 4, 187 firms (33%) of our sample firms are classified as weak governed, and 154 firms (27.2%) are classified as strong governed.

In general, it is implicit that strongly governed firms are more likely to pursue value-maximizing decisions. Consequently, better governed firms are more likely to use hedging instruments in a way consistent with the value-maximizing theories of hedging.

3.5.2 Country-level corporate governance index

La Porta *et al.* (1998) refer to the degree of a country's laws protecting investor rights and the degree to which those laws are enforced as fundamental determinants of the ways in which corporate governance progresses in that country. Within this context, and in the spirit of Allayannis *et al.* (2012) and Bartram *et al.* (2009), we use five variables to capture the influence from country-level governance on firms' governance quality: (1) the index of effective legal institutions, and (2) the index of rule of law, that measures both the legal environment and the law enforcement; (3) the aggregate index of creditor rights' protection as a measure for creditor rights; (4) the aggregate index of shareholder rights' protection as a measure for shareholder rights, and (5) country ownership concentration. In Table 3.3 we reported the definitions and sources for the data.

Given that the average correlation between some pair of the country-level governance proxies is generally high,[35] multicollinearity problems could arise. Therefore,

[35] Analysing some of the larger correlations, we observe that countries where the legal system is more efficient also have efficiency on contract enforcement (r = 0.984), countries that afford creditors significant rights also have more efficiency on contract enforcement (r = 0.739), countries that afford creditors

following Ammann, Oesch and Schmid (2010), we use exploratory principal component analysis (PCA) in order to capture the commonalities in the five country-governance measures and aggregate them into one representative variable – a country-level governance index (*CG_EXT*). We retain the factors that have an eigenvalue greater than unity. We define our country-level governance index (*CG_EXT*) as the first principal component of the PCA, which retains 80.3% of the total variance within the original data. In order to interpret the factor, we analyse which variables have a substantive association with the factor. To be exact, we associate the factor with those variables that have a loading that exceeds 0.4 in absolute value (see Table 3.5). Using this approach the variables index of rule of law (*LAW*), the aggregate index of shareholder rights' protection (*SH_R*), and country ownership concentration (*OWN*) do not load in the retained governance factor. This suggests that these three variables are not relevant to the structure of country-level governance. Moreover, we analyse the reliability of the index using Cronbach's alpha. The coefficient of reliability is about 0.80, which indicates that our country-level governance index has internal consistency reliability. According to Sekaran (2003: 307) as long as the Cronbach's alpha measure is above 0.70, it can be said that the instrument has internal consistency reliability.

Table 3.5: **Country-level governance index based on exploratory principal component analysis**

Panel A. Factor loadings for the principal components					
Variables	**PC1**	**PC2**	**PC3**	**PC4**	**PC5**
CR_R	**0.722**	-0.556	0.350	-0.047	0.210
LAW	0.125	0.098	-0.229	-0.960	0.000
LEG	**0.653**	0.715	-0.129	0.189	-0.094
OWN	0.002	0.009	0.508	-0120	-0.853
SH_R	-0.190	0.411	0.742	-0.160	0.468

significant rights have a higher legal quality (r = 0.655), and countries with strong creditors protection laws, inversely have weak shareholders protection laws (r = -0.888).

Table 3.5: **Country-level governance index based on exploratory principal component analysis** *(cont.)*

Panel B. Eigenvalues and variance explained					
	PC1	**PC2**	**PC3**	**PC4**	**PC5**
Eigenvalue	2.194	0.534	0.005	0.000	0.000
Variance explained	0.803	0.195	0.002	0.000	0.000
Variance explained (cumulative)	0.803	0.998	1.000	1.000	1.000

Note. Panel A reports the factor loadings of the five country-level governance proxies included in PCA. Firstly we retain the factors with an eigenvalue greater than unity. Then, we follow Ammann *et al.* (2010) and calculate the equally weighted averages of the country-governance attributes with factor loadings in excess of 0.4 in absolute value. Figures in bold exhibit factor loadings in excess of 0.40 in absolute terms. CR_R = Aggregate index of creditor rights' protection collected from Djankov *et al.* (2007); LAW = index of rule of law from Kaufmann *et al.* (2008); LEG = index of effective legal institutions from Berkowitz *et al.* (2003) and La Porta *et al.* (1998); OWN = country ownership concentration collected from Dahlquist *et al.* (2003); SH_R = Aggregate index of shareholder rights' protection from Djankov *et al.* (2008).

Our country-level governance index (*CG_EXT*) could be interpreted on the basis of the level of creditor rights' protection and on the basis of legal quality. It seems reasonably to suppose that a country with weak creditor protection laws and weak legal quality possibly will have implicit a poor governance environment at the firm level. This is in line with La Porta *et al.*'s (2002) findings, which recognize that in countries with weak laws the degree of flexibility a firm has to affect their own governance is likely to be small. As they stated, in these countries controlling shareholders have the power to expropriate minority shareholders, as well as creditors, within the constraints imposed by the law.

On the other hand, Klapper and Love (2004) suggest that firms in countries with weak laws would be prone to adopt better firm-level governance to compensate for the limitations in their country's laws and their enforcement, thereby signalling their intentions to offer great investor rights.

3.6 Descriptive statistics

Table 3.6 reports the descriptive statistics of the variables that proxy for firms' characteristics and firms' hedging and governance structures. In Panel A we present the

descriptive statistics concerning the continuous variables and in Panel B the descriptive statistics inherent to the dichotomous variables. Several aspects of the descriptive statistics are worth noting. In Panel A we report information on the empirical distribution of *CG_INT* and *CG_EXT*. The means (medians) of *CG_INT* and *CG_EXT* are 3.415 (4.0) and 13.601 (12.852), respectively. A comparison of the statistics obtained for our *CG_INT* with the ones obtained by Lel (2012), who uses a sample of firms from 34 countries cross-listed in the US, confirms that average values are similar. In addition, we conclude that there are substantial differences in our firm-level corporate governance index (std.dev. = 1.602), which suggest that our governance proxies are chosen and constructed in a way that leads to sufficient variance in the cross-section. Inversely, the empirical distribution of our country-level governance index reveals low variation between countries. This result is expected and can be explained by the fact that all the four countries on our sample are included in the Continental European Governance Model.

Table 3.6: **Sample summary statistics**

Panel A. Summary statistics of continuous variables					
Variables	**Mean**	**Median**	**Std. dev.**	**Minimum**	**Maximum**
CAPEX	0.056	0.040	0.063	-0.063	0.741
CASH	0.078	0.075	0.113	-1.002	0.646
CG_EXT	13.601	12.852	1.410	11.954	16.386
CG_INT	3.415	4.000	1.602	0.000	7.000
FS	0.259	0.200	0.255	0.000	1.000
INS	0.088	0.001	0.173	0.000	0.844
LEV	0.243	0.214	0.281	0.000	5.213
NET_FX	0.166	0.042	0.223	0.000	1.000
Q	1.653	1.356	1.102	0.702	14.577
L_Q	0.395	0.304	0.412	-0.354	2.679
ROA	0.063	0.068	0.109	-0.534	0.787

Table 3.6: **Sample summary statistics** *(cont.)*

Panel A. Summary statistics of continuous variables					
Variables	**Mean**	**Median**	**Std. dev.**	**Minimum**	**Maximum**
SIZE_V (in millions)	3 329	64.612	13 707	0.007	186 150
SIZE	17.460	17.984	3.778	8.790	25.950
TAX	0.016	0.000	0.062	0.000	0.534
TI_TS	0.135	0.085	0.232	0.000	2.694
Panel B. Summary statistics of dichotomous variables					
Variables	**Mean**[a]	**Median**	**Std. dev.**[b]	**Minimum**	**Maximum**
ADR	0.213	0.000	----	0.000	1.000
DIV	0.499	0.000	----	0.000	1.000
EXP	0.760	1.000	----	0.000	1.000
HEDGE	0.804	1.000	----	0.000	1.000
HEDGE_CP	0.138	0.000	----	0.000	1.000
HEDGE_FX	0.719	1.000	----	0.000	1.000
HEDGE_IR	0.520	1.000	----	0.000	1.000
INDDIV	0.444	0.000	----	0.000	1.000

Note. The statistics reported are obtained by using summary statistics procedure in Gretl (version 1.9.1). Variables are as follows: ADR is a dummy which is assigned a value of 1 if a firm is issuing American Depository Receipts; CAPEX is the ratio of capital expenditures to total assets; CASH is the ratio of EBITDA minus the sum of tax, interest expenses, and common dividend to total assets; CG_EXT is a country-level governance index which is computed as the common factor derived from a PCA of five measures of country-level governance mechanisms; CG_INT is a firm-level internal governance index comprising seven governance mechanisms that take into account two governance dimensions: (1) board matters and (2) ownership structure; DIV is a dummy which is assigned a value of 1 if the firm dividend yield is greater than the median yield for the sample; EXP is a dummy which is assigned a value of 1 if the firm has either FX, IR or CP exposure above the median exposure for the sample; FS is the ratio of foreign sales to net sales; HEDGE is a dummy which is assigned a value of 1 if a firm reports the use of either external and/or internal hedging instruments; HEDGE_CP is a dummy which is assigned a value of 1 if a firm reports the use of either external and/or internal CP hedging instruments; HEDGE_FX is a dummy which is assigned a value of 1 if a firm reports the use of either external and/or internal FX hedging instruments; HEDGE_IR is a dummy which is assigned a value of 1 if a firm reports the use of either external and/or internal IR hedging instruments; INDDIV is a dummy which is assigned a value of 1 if a firm has at least two business segments with a different ICB 4-digit subsector classification code; INS is the number of shares held by officers and directors divided by common shares outstanding; LEV is the ratio of total debt to total assets; NET_FX is absolute value of the difference between the percentage of sales that are foreign and the percentage of assets that are foreign; Q is the ratio Tobin's Q computed as the ratio of market value to book value of assets, and market value of assets is computed as market value of equity plus book value of assets minus book value of equity; L_Q is the natural logarithm of Tobin's Q; ROA is the ratio of EBIT by total assets; SIZE_V is the value of total of assets; SIZE is the natural logarithm of total assets; TAX is the net operating losses to total assets, and TI_TS is the ratio of total inventory to total sales.

[a] The computing of dummy variables means give us the information about the percentage of firms that are assigned the value of 1. [b] The computing of dummy variables standard deviation is considered inappropriate.

To capture the firms' investment spending set, we use the ratio of capital expenditures to total assets (*CAPEX*) to measure the level of investment. The mean

(median) of *CAPEX* is 5.6% (4.0%), respectively. In this measure the median is somewhat smaller than the mean, indicating that there are some firms in our sample with a high value of *CAPEX*, thus significantly influencing the mean. The average insider fraction of outstanding shares (*INS*) is 8.8%. Likewise the median is much smaller (0.1%) than the mean, which denotes the presence of at least one blockholder that is over 84%.

On average, about 24.3% of firms' total assets are financed by debt. This leverage ratio (*LEV*) is very similar to the ones of Lel (2012) and Géczy *et al.* (1997) – 27.4% and 28%, respectively. Not far from Beiner *et al.*'s (2006) results that analysed 109 non-financial Swiss firms, around 21.3% of our sample firms issued American Depository Receipts (*ADR*).

On average, 76% of the sample firms are exposed to some kind of financial risk (*EXP*), which is, *a priori*, consistent with the higher general level of hedging instruments' usage reported earlier (80% of the firms disclose the use of some type of hedging instruments. See Table 3.4, section 3.4). With the purpose of separating out firms with high exposure from those with low exposure, we define the variable general high exposure as a dummy which is assigned a value of 1 if a firm experiences any of the following exposures: foreign exchange, interest rate and commodity price exposure, and zero the otherwise situation. This is in line with Bartram *et al.* (2009). In advance we have classified the firms as being exposed to foreign exchange, interest rate, and commodity price exposure. This is accomplished throughout an augmented market model that includes returns on the exchange rate index, changes on the interest rate factor, and returns on the commodity index, estimated in chapter 4, section 4.4.1. Then we take into account the absolute value of each exposure and define dummy variables that identify high exchange rate exposure for firms with absolute exposure above the inherent sample median exposure, and the same for high interest rate and high commodity price exposure.

Finally, we create a "general high exposure" dummy variable that is equal to 1 if any of the FX, IR or CP exposure dummy variables is equal to 1.

In the third empirical study we use Tobin's Q (*Q*) as a proxy for firm value (e.g., Allayannis & Weston, 2001; Allayannis *et al.*, 2012; Beiner *et al*., 2006; Belghitar *et al*., 2008; Carter *et al*., 2006; Jin & Jorion, 2006; Klapper & Love, 2004; Lookman 2004). We define Tobin's Q as the ratio of market value to book value of assets, and market value of assets is computed as the market value of equity plus book value of assets minus book value of equity (e.g., Belghitar *et al*., 2008; Klapper & Love, 2004; Lookman 2004). In this specification of Tobin's Q the numerator approximates the market value of assets and the denominator the replacement costs of assets. The minimum value of Tobin's Q (0.702) reveals that, on average, some firms have lower market value than book values of assets. The distribution of Tobin's Q is skewed, since the mean value (1.653) is higher than median value (1.356). Following Hagelin *et al.* (2007) and others, we use the natural logarithm of Tobin's Q (*L_Q*) to correct for the skewness. Moreover, using the natural logarithm has the benefit that variations in the value of the variable can be interpreted as percentage changes in firm value.

We observe that the average value of the size variable (*SIZE_V*) is 3 329 millions with a standard deviation of 13 707 millions. Thus the firms are mostly large-sized. Again, we use the natural logarithm of total assets (*SIZE*) to reduce the skewness of the distribution (e.g., Allayannis & Weston, 2001; Carter *et al*., 2006).

In addition, Table 3.6 exhibits several other interesting statistics, which we briefly summarize: i) on average, 49.9% of the firms have dividend yield above the median yield for the sample (*DIV*); ii) the standard value of tax losses carry forward (*TAX*) is about 1.6%; iii) the mean value of return on assets (*ROA*) is 6.3%; iv) on average, the net foreign exchange exposure (*NET_FX*) is 16.6%; v) on average, the foreign sales (*FS*) are

25.9%, which proxies for geographic diversification, and, finally, vi) firms' inventory (*TI_TS*) represents 13.5% of total sales. In unreported results we observed that 325 firms (57.3% of the full sample) have reported net foreign exchange exposure, which is somewhat close to the percentage of firms that use currency hedging instruments (72% of the full sample). This difference could be explained by the fact that firms with no foreign currency exposure through foreign sales might face currency risk through other channels such as import competition. Unfortunately, we cannot access this type of information. Finally, 418 firms (73.7% of the full sample) have foreign sales reported, which quite similar to the percentage of firms that use currency hedging instruments.

3.7 Conclusion

In this chapter we began by examining the sample selection procedure. Then we follow with the description of data collection and the definition of all the variables that will be useful in the three empirical studies. We approached exhaustively some of the main features of our hedging measure and describe the hedging behaviour of the firms in our sample.

To provide insights into the inter-firm variations of governance performance within our sample, this chapter also discusses the construction of the firm-level corporate governance. Our index put together in only one measure seven internal corporate governance attributes. These attributes are seeking to describe two main categories that are considered key drivers of governance performance: (1) board characteristics and (2) ownership structure. Moreover, based on five country characteristics that are intending to represent the extent of legal protection of investors, we construct a country-level governance index which is derived from a principal component analysis. This country

governance index will be useful to analyse if inter-country governance differences have an effect on the performance of firm-level governance.

Lastly, we present and interpret the descriptive statistics of all the variables under consideration. In the subsequent chapters we will proceed with the three empirical studies.

CHAPTER 4

Firm financial price exposures and the use of risk management instruments

4.1 Introduction

As outlined in chapter 2, section 2.3.1 and 2.3.2, hypothetically, the use of risk management would provide a number of benefits and it has been suggested that users will improve their performance and lower risk relative to non-users. However, with the widely publicized corporate failures (Procter & Gamble, Metallgesellschaft, Parmalat, Société Générale, among others[36]) a perception does exist that the use of risk management instruments, namely derivatives, is highly risky and they are sometimes regarded as a speculative tool.

Indeed, hedging, by definition, will seek to reduce the level of risk to which a firm is exposed. On the other hand, when derivatives are used to take advantage of perceived market imperfections, they will increase risk. Preceding risk management-based studies start their empirical tests with the implicit assumption that firms use derivatives solely for the purpose of hedging. However, if firms are not using derivatives to hedge the existing exposures, hedging cannot be taken as a value-enhancing strategy, which implies also the misinterpretation of the empirical tests. So, before undertaking any risk management empirical testing the researcher must guarantee the proper use of risk management tools.

[36] See, McCarthy (2000) for a summary of some of these corporate failures.

There is substantial literature concerning non-financial firms that suggest that changes in financial prices (foreign exchange rate, interest rate, and commodity price risk) affect firm value (e.g., Bartram, 2002; Hagelin & Pramborg, 2004; He & Ng, 1998; Jorion, 1990; Tufano, 1998). Furthermore, it is a common belief that financial price exposures are created via firms' operating profiles and are reduced through the implementation of financial hedging strategies (Bali *et al*., 2007).

The purpose of this study is to analyse whether risk management practices are associated with lower levels of risk. To this end, we use monthly returns of 567 European firms traded on Euronext during the period 2006-2008. We start with the standard approach used since Jorion (1990). Therefore, we consider a two stage procedure to investigate, firstly, the relationship between firm value and exchange rate, interest rate, and commodity price risks, all together; and afterwards, the effect of hedging activities and firms' operating profiles on financial price exposures estimated in the first stage. Nevertheless, we do not discard the fact that the hedging decision may be correlated with some unknown factors that are also correlated with the magnitude of a firm's exposure to risks. Thus, in order to establish causality from hedging decisions to financial risk exposure, we need to deal with a potential endogeneity problem. To clearly investigate this point, we proceed with a two-step treatment effect model.

Our study differs in several ways from previous studies on financial price exposures and hedging matters. Firstly, we use a full hedging variable by category of risk, that is to say, while previous studies frequently employ derivatives' use as a proxy of hedging activities, we use a dummy variable that accounts simultaneously for the use/non-use of internal and external hedging instruments. Secondly, we simultaneously test the relationship between firms' equity returns and each of the financial price risks (exchange rate, interest rate, and commodity price). To our knowledge, our study is one of the few

studies that explicitly incorporates the wide range of financial risks used in Jorion's augmented market model. Thirdly, our contribution is also methodological in nature. Specifically, we contribute to the existing exposure-based literature by explicitly addressing the endogeneity of a firm's hedging decision, which is accomplished by means of a treatment effect methodology. Finally, in our tests we make use of a broader sample of European non-financial firms across all industries. This is motivated by the fact that there are few studies published using data from Continental Europe concerning hedging matters, namely with data based on the International Accounting Standards 32 and 39 that require detailed reporting on derivatives.

The remainder of the chapter is organized into four further sections. The next section presents empirical evidence related to the financial price exposures, namely foreign exchange rate, interest rate and commodity price exposures, and explores the determinants of these exposures. The research framework, which includes the development of the hypotheses and the definition of the statistical modelling, take place in section 4.3. Section 4.4 includes the empirical results and provides its discussion. Finally, section 4.5 summarizes and concludes the chapter.

4.2 Empirical evidence on financial price exposures of non-financial firms

Since firm value is represented by the present value of future cash flows, a firm's financial price exposure can be estimated focusing on the effects that the financial risk factor movements have on these cash flows (Muller & Verschoor, 2006). Initial research in this area focussed on stock returns to provide empirical measures of corporate exposure to financial risks. Most of this research has been devoted to exchange rate exposure (e.g., Jorion, 1990; Williamson, 2001) and while some has tested for interest rate exposure (e.g., Bartram, 2002), this has largely been for financial firms (e.g., Oertmann, Rendu, &

Zimmermann, 2000). In contrast, the impact of commodity price changes on corporations is only analysed in a few studies (e.g., Bartram, 2005; Tufano, 1998). Subsequent research investigates the effect of financial hedging in financial risk exposures, predominantly in foreign exchange exposure (e.g., He & Ng, 1998; Nguyen & Faff, 2003), and a few studies have also examined the ability of operational hedging to reduce risk exposures (e.g., Carter *et al*., 2003). It is worth noting that the studies outlined above focus solely on one type of financial price exposure. In contrast Prasad and Rajan (1995) analysed exchange and interest rate risk, and Bali *et al.* (2007) consider the simultaneously three categories of risk.

The focus of existing empirical studies on foreign exchange rate risk has been justified with the argument that exchange rate risk represents a major source of risk, due to its higher volatility, when compared to other financial prices (Jorion, 1990). Nevertheless, a comparison of the standard deviations of various financial prices (exchange rate, interest rate, and commodity price) reveals that in recent years, interest rate and commodity price display even higher volatility than foreign exchange rate (Bartram, 2005).[37] Therefore, the impact of interest rate and commodity price changes on firm value can be classified as an important issue for corporate risk management. Table 4.1 presents a comprehensive description of the studies that considers the all assortment of financial price risk exposures.

[37] After calculating the standard deviations of the monthly returns of various financial prices risk factors during the period 2006-2008 we corroborated Bartram's (2005) assertions. To represent the exchange risk factor we use a trade-weighted exchange rate index – the Euro effective index; to represent the interest rate risk factor we make use of the three-month Euribor; and to represent the commodity price risk factor we consider the Euronext Rogers International Commodity Index. The calculated monthly volatilities are 1.35%, 5.82% and 7.3%, respectively.

Table 4.1: **Empirical evidence on financial price risk exposure and hedging**

Author(s) of study	Area of study	Country	Findings
Prasad and Rajan (1995)	Measurement of exchange rate and interest rate exposures.	Germany, Japan, UK and US	This study group's individual stock returns data into industry-based portfolios for each country. The authors found evidence of exchange rate risk and interest rate risk sensitivity in each of the four markets to varying degrees, with the German and the US markets yielding a maximum number of industries with significant exchange rate exposure and Japan yielding the greatest number of industries with significant interest rate risk exposure.
Bali *et al.* (2007)	Interaction between firms' risk exposures, derivatives use and real operations.	US and Canada	There is little evidence that derivatives use reduces risk exposures. There is some evidence that user firms are increasing risk exposure in the use of commodity derivatives. Furthermore, the empirical results do not suggest a positive association between any of the variables for real operations and related exposures.

4.2.1 Foreign exchange rate exposure

Adler and Dumas (1984) suggest that exchange rate can be estimated by the slope coefficient of a linear regression of the dollar value of the firm on the exchange rate. Moreover, Adler, Dumas and Simon (1986) suggest the use of stock returns and exchange rate changes in order to avoid statistical difficulties concerning the stationarity in the time series. Thus, foreign exchange rate exposure can be measured through a simple time-series regression that considers the change in firm value (represented by stock returns) as the dependent variable and the exchange rate changes as the independent variable.

Later, to prevent misspecification of the model, Jorion (1990) added the return on the market index to control for market movements. Examining the monthly stock returns of 287 US multinationals during the period 1971-1987, the author found that only about 5.5% of the firms are significantly exposed to exchange rate risk. He discovered, however, that nine out of 14 foreign firms listed on the NYSE have significant exposures.

In line with Jorion (1990), several other studies were carried out. For firms on the stock market in the US, researchers have applied various specifications of Jorion's framework to investigate the significance of exposure for particular samples of industries or firms, including multinational firms (e.g., Amihud, 1994; Choi & Prasad, 1995; Jorion, 1991), non-financial firms (e.g., Allayannis & Ofek, 2001; Crabb, 2002), firms in the automotive industry (Williamson, 2001), and a broader sample of industries (e.g., Bodnar & Gentry, 1993). In Table 4.2 we present a detailed description of the reviewed studies surrounding this matter.

Table 4.2: **Empirical evidence on exchange rate exposure and hedging**

Author(s) of study	Area of study	Country	Findings
Jorion (1990)	Measurement of exchange rate exposure and its determinants.	US	Only 5% of firms exhibited significant exchange rate exposure. Estimated exchange rate exposure increased as the firm's foreign involvement (measured by foreign sales) increased.
Jorion (1991)	Measurement of exchange rate exposure.	US	The returns of 20 value-weighted industry portfolios are shown to be insensitive to exchange rate changes.
Bodnar and Gentry (1993)	Measurement of exchange rate exposure and its determinants.	US, Japan and Canada	Eleven out of 39 two-digit industry portfolios exhibit significant exchange rate exposure. They notice, however, that export and import levels, reliance on internationally-priced outputs, product-type (traded or non-traded) and the degree of foreign assets help to determine exchange risk exposure at the industry level.
Amihud (1994)	Measurement of exchange rate exposure.	US	The author find that there is no significant contemporaneous exposure, even for the portfolio composed of the eight largest exporting companies where, on average, exports account for almost a quarter of their total sales.
Khoo (1994)	Measurement of exchange rate exposure	Australia	The sensitivity of stock returns to exchange rate movements, and the proportion of stock returns explained by exchange rate movements are found to be small.
Bartov and Bodnar (1994)	Measurement of exchange rate exposure.	US	The results fail to find a significant correlation between the abnormal returns of the sample firms and contemporaneous change in the dollar.

Table 4.2: **Empirical evidence on exchange rate exposure and hedging** *(cont.)*

Author(s) of study	Area of study	Country	Findings
Choi and Prasad (1995)	Measurement of exchange rate exposure and its determinants.	US	About 15% of the 409 firms in the sample have significant exchange rate sensitivities. Estimations revealed a positive relationship between the scope of the foreign operations of a firm – measured by foreign sales, assets and operating profits – and its exchange rate risk sensitivity.
Nydahl (1999)	Measurement of exchange rate exposure and its determinants, namely the impact of hedging.	Sweden	About 26% of the 47 firms in the sample are significantly exposed to exchange rate risk. It is shown that the level of foreign involvement significantly increases exposure, and that the use of derivatives decreases exposure.
He and Ng (1998)	Measurement of exchange rate exposure and its determinants.	Japan	About 25% of the 171 firms in the sample yield significant positive exposure coefficients and about 2% yield negative coefficients. Smaller firms and firms with weak short-term liquidity positions, or firms with high financial leverage, have more incentive to hedge and hence have smaller exchange-rate exposure.
Williamson (2001)	Measurement of exchange rate exposure and its determinants.	US and Japan	There is empirical evidence that automotive firms face exposure to exchange rate shocks. Evidence is presented that is consistent with foreign sales being a major determinant of exposure and the effectiveness of operational hedging in the form of foreign production.
Crabb (2002)	Measurement of exchange rate exposure, while controlling for the use of derivatives.	US	The results presented in this study show that the exchange rate exposure for large US multinationals is significant, but hedging activities by firms reduce such risk.

Table 4.2: **Empirical evidence on exchange rate exposure and hedging** *(cont.)*

Author(s) of study	Area of study	Country	Findings
Nguyen and Faff (2003)	Analysis of both short-term and long-term exposure and impact of the use of derivatives on exchange rate exposure.	Australia	The results show that out of the full sample of 144 firms, only 10.34% have a significant monthly short-term exposure and 58.33% are significantly exposed in the long run. While both firm size and the use of financial hedging are associated with a reduction of short-term exchange rate exposure, the exposure of longer horizons is positively related to a firm's liquidity.
Hagelin and Pramborg (2004)	Foreign exchange risk reduction effect of hedging.	Sweden	About 24% of firms exhibited significant exchange rate exposure. Estimated exchange rate exposure increased with the level of inherent exposure and with a firm's size. The evidence also suggests that the usage of foreign denominated debt as well as currency derivative reduces firms' foreign exchange exposure.
Bartram *et al*. (2010)	Influence of both financial and operational hedges on foreign exchange exposure.	16 countries	This study shows that for a typical sample firm, pass-through and operational hedging each reduces exposure by 10% to 15%. Moreover, financial hedging with foreign debt, and to a lesser extent currency derivatives, decreases exposure by about 40%.

Amihud (1994) did not find any significant exchange rate exposure for a sample of 32 US exporters from 1982 to 1988. To some extent, Choi and Prasad (1995) provided strong evidence of significant exposure. They examined a sample of 409 multinational firms that have foreign sales, profits and assets of at least 25% of their respective totals.[38] About 15% of the firms are significantly exposed. Furthermore, Bodnar and Gentry (1993) show that roughly 30% of industries in the US, Japan and Canada have significant exposure to exchange rate movements. However, they found that the percentage of industries significantly exposed is smaller for the US than for Canada and Japan, which suggests that industries in smaller and more open economies are likely to be more exposed to exchange rate risk. In the case of Williamson (2001), which analyses the automotive industry in the US, significant exposure only occurs for certain firms.

Whereas most papers focus on US financial markets, several studies have also been surveying other markets, such as Japan (Bodnar & Gentry, 1993; He & Ng, 1998; Williamson, 2001), Canada (Bali *et al*., 2007; Bodnar & Gentry, 1993), Australia (Khoo, 1994; Nguyen & Faff, 2003), Sweden (Hagelin & Pramborg, 2004; Nydahl, 1999), and a broad sample of countries (Bartram *et al*., 2010), among others. In general, these studies have had somewhat more success in documenting a significant contemporaneous relation between a firm's stock returns and changes in foreign exchange rates. For example, He and Ng (1998), who studied the exchange rate exposure of Japanese multinational firms between the period 1978-1993, found that roughly 25% of the 171 firms in the sample yield significant positive exposure coefficients. Also, Nydahl (1999) analysing the exchange rate exposure of Swedish firms with a foreign sales ratio of at least 10%, finds that approximately 26% of the 47 firms in the sample are significantly exposed to exchange rate changes. On the other hand, Khoo (1994), examining the foreign exchange

[38] The authors classified a firm as a multinational if the firm foreign sales, net operating profits, and identifiable physical assets are all 25% or more of their respective corporate totals and exceed 1 million US dollars in 1989. This is a method similar to the one commonly used in the international business literature.

rate exposure of mining companies in Australia, finds very weak evidence of such exposure. He links this lack of exposure to the extensive use of hedging by mining firms. Summing up, the empirical evidence on the impact of exchange rates on firm value in non-US markets is not conclusive either.

A controversial point in Jorion's augmented market model concerns the definition of the exchange risk factor. The empirical literature often employs one of the following proxies: a trade weighted exchange rate or a bilateral currency exchange rate, this latter being under the assumption of a dominant trading currency that affects almost all the firms in the sample. The aforementioned studies typically use a trade-weighted exchange rate index (e.g., Bali *et al*., 2007; Bodnar & Gentry, 1993; He & Ng, 1998; Jorion, 1990, 1991). Despite the view of Williamson (2001), among others, that points out that the use of a trade-weighted exchange rate index can mute the effect of exchange rate fluctuations on firm value, when a firm is mostly exposed to only a few currencies, Nydahl (1999), alternatively employing a trade weighted exchange rate index and a bilateral currency exchange rate, concludes that there are no significant differences.

Financial exposure related studies frequently use data with monthly sampling frequency (e.g., Allayannis & Ofek, 2001; Bali *et al*., 2007; Bodnar & Gentry, 1993; Choi & Prasad, 1995; Jorion, 1990). Allayannis and Ofek (2001) justify this option by the fact that daily and weekly exchange rate indices frequently exhibited problems of misalignment between the stock return and exchange rate series.

4.2.2 Interest rate exposure

The majority of interest rate exposure studies are restricted to financial firms, which mainly have financial assets and, thus, are expected to exhibit varying sensitivity with regards to changes in interest rates, when compared to non-financial firms. At the same

time, financial firms have the ability to manage their interest rate risk more accurately because they use sophisticated techniques for the identification and quantification of interest rate exposures. However, changes in interest rates are also important for non-financial firms. First, interest rate risk impacts on the value of non-financial firms through changes in cash flows generated by operations, which arise due to the direct effect of the interest rate on the cost of capital that is inherent to investment decisions. In addition, there may be indirect effects of interest rate risk on the competitive position of firms, which also impact on their expected cash flows. Finally, interest rate risk may influence firms' value due to changes in the value of their financial assets and liabilities.

Within the scope of non-financial firms, very little empirical evidence is found concerning the impact of interest rate risk on firm value. Sweeney and Warga (1986) conducted an extensive study of interest rate sensitivity and pricing in the US stock market. They concluded that changes in the yield on the government bonds clearly affect ex-post returns to electric utilities, and that this phenomenon is concentred to a much larger extent in this particular industry. Similarly, research on the interest rate sensitivity of non-financial firms outside the US is relatively sparse. Prasad and Rajan (1995), using a sample of four industrialized countries between the period 1981-1989, grouped individual stock returns data into industry-based portfolios. Their results indicate that interest rate risk varies among countries and that there are industries with significant exposure to interest rate risk, specifically in Japan and Germany. Confirming these results, Bartram (2002) also reports a significant rate of exposure in German non-financial firms, which is confirmed when several interest risk factors are used. In Table 4.3 we present a detailed description of the few studies that investigate interest rate risk exposure.

Table 4.3: **Empirical evidence on interest rate exposure and hedging**

Author(s) of study	Area of study	Country	Findings
Sweeney and Warga (1986)	The pricing of interest rate risk.	US	The paper shows that, empirically, most of the interest rate sensitivity stocks are in the utility industries, and that there is evidence that the interest factor is priced in the same way as APT.
Bartram (2002)	Interest rate exposure and its determinants.	Germany	A significant interest rate exposure of non-financial corporations with regard to changes in the short-term and long-term riskless interest rate as well as the interest rate spread is reported. While many stocks show a significant linear interest rate exposure (e.g., for the short-term interest rate, 6.4% to 18.8% of firms), a large number of firms have an important non-linear exposure component (e.g., for the short-term interest rate, 11.5% to 25.4% firms for the cubic function). In addition, there is evidence of a negative relationship between the interest rate exposure and measures of liquidity.

According to the existing evidence, most of the empirical studies on interest rate risk are based on a two-index model developed by Stone (1974), which includes an interest rate change factor in addition to the traditional market index.

4.2.3 Commodity price exposure

The economic commodity price exposure describes the effect of unexpected price movements of commodities on firm value. This effect is primarily determined by firms' economic business activity.[39] On the other hand, indirect effects result from the economic interdependence of companies in the economic value chain.[40] In general, the relevance of a commodity as an input (output) factor should lead to a negative (positive) exposure.

Despite the fact that the changes of all production factors on the range of products have, potentially, a direct economic effect on the firms' cost and/or revenue, only some inputs and outputs, namely commodities, are traded on the spot and futures international commodity exchanges. Apart from the use of exchange traded derivatives, OTC contracts such as swaps, forwards or more complex financial products can also be used to hedge commodity price risk. Also, the price of various commodities that are not exchange traded can be hedged via cross hedging. This is achievable when their price is highly correlated with some other commodities for which derivatives are available. So, it seems unquestionably the effectiveness of commodity risk management on commodity price exposure reduction; yet, very little attention to this matter has been attracted to date at the empirical literature level.

[39] For example, energy products are primarily relevant for the power, oil/refining, rubber/plastics, and transportation industries.

[40] For example, impact on competitiveness and pass-through of commodity price changes to customers.

Exceptions are made for several empirical studies based on the American gold mining industry (Petersen & Thiagarajan, 2000; Tufano, 1998), gas and oil industry (Jin & Jorion, 2006) and airline industry (Carter *et al*., 2006). This is justified by the fact that companies in those industries turn out fairly homogeneous products, which imply relatively simple exposure structures. On the other hand, being industries with strictly disclosing rules brings about the conception of high level databases on risk management practices. These studies make use of the common approach assessed in the literature – a two factor augmented market model, which includes a commodity price change factor.

The few studies that focus on commodity price exposure over a broad sample of non-financial firms across multiple industries are the ones by Bartram (2005) and Bali *et al*. (2007). Bartram (2005) makes use of a sample of 490 German non-financial firms, but limits his analysis to the sensitivity of firm value towards commodity price risk. Using time series regression, he tests whether commodity price risk that has not been hedged may negatively (positively) affect stock prices in industries for which a certain commodity represents an important input (output) factor in the production process. The author reports that the percentage of firms with significant exposure to commodity price risk is in the range of 4.5% - 15.9%. Thus, commodity price risk is not found to be of greater importance than other financial risks. This result is consistent with the few corporate cash flows affected by commodity price changes. Table 4.4 exhibits a detailed description on studies regarding commodity price exposure.

Table 4.4: **Empirical evidence on commodity price exposure and hedging**

Author(s) of study	Area of study	Country	Findings
Tufano (1998)	Commodity price exposure and its determinants.	US	The estimation of the gold price exposure for the sample firms results in more than half of the firm-quarter exposures being statistically significant. These exposures are significantly negatively related to the firm's hedging and diversification activities and to gold prices and gold return volatility, and are positively related to a firm's leverage.
Petersen and Thiagarajan (2000)	The impact of risk management strategies in a firm's commodity price exposures.	US	The analysis of the gold price exposure of the companies American Barrick and Homestake Mining shows that financial and operative hedging, as well as financial and operative leverage, have an impact on the exposure of firm value with regard to the analysed factors.
Bartram (2005)	Commodity price exposure.	Germany	Even though commodity prices are more volatile, the fraction of sample firms with statistically significant commodity price exposure is, however, comparable to studies on foreign exchange exposure – roughly 4.5% to 15.9%. The results are consistent with few cash flows being affected by commodity price movements.
Carter *et al*. (2006)	The effect of hedging on firm value.	US	The authors examine a monthly market model using an equally-weighted airline industry return that includes a jet fuel return factor to measure airline exposure to jet fuel prices. They find that airline industry stock prices are negatively related to jet fuel prices, namely one standard deviation movement in jet fuel price results in a 2.75% change (monthly) in airline industry stock prices.
Jin and Jorion (2006)	Firm value and hedging.	US	The study confirms that exposures to oil and gas prices are mostly positive and generally significant, so for the median firm, a 1% increase in oil (gas) prices leads to a 0.28% (0.41%) increase in the stock price. About 28.95% of the oil betas and 86.84% of the gas betas are significantly positive. Additionally, the authors find that hedging reduces the firm's stock price sensitivity to oil and gas prices and that greater oil and gas reserves increase it.

Finally, in the case of the study carried out by Bali *et al.* (2007), the focal point is the interaction between a firm's risk exposures, derivatives use and a firm's real operations. Their data set includes US and Canadian non-financial firms belonging to four-industry SIC code classifications: gold and silver mining, food processing, pharmaceuticals and large biotechnologies, and primary metals processing. Evidence is found that commodity derivatives users have increasingly inherent risk exposure, which may suggest that hedging with derivatives is not always important to a firm's return rate and may be linked to other non-financial and economic factors.

4.2.4 Determinants of financial price exposures

With respect to factors that influence exchange rate exposure, several authors, such as Jorion (1990), Bodnar and Gentry (1993), Amihud (1994), Williamson (2001), Allayannis and Ofek (2001), and Bali *et al.* (2007) have found in their studies that a higher foreign involvement, *proxied* by the ratio of foreign sales to total sales, implies a stronger correlation between a depreciation (appreciation) of the dollar and an increase (decrease) in stock market values.

When the focus is the interest rate exposure, Bartram (2002) investigated two partial exposure determinants: financial leverage and firm liquidity and only found a significant relation between interest rate exposure and firm liquidity. Instead, Bali *et al.* (2007) considered only financial leverage as a proxy for a firm's real operations.

Williamson (2001), among others, argues that the low significance of exposure coefficients being reported empirically may arise from the fact that what is really being measured is the net exposure to exchange rates, or the exposure that remains after the firm has engaged in some hedging activity. Bartram (2002) emphasized that non-financial firms should be able to immunize firm value against changes in interest rates to some

extent by matching the interest rate sensitivity of their assets and liabilities through active risk management, but not in the same way as financial intermediaries. Additionally, Bartram (2005) suggested that firms for which commodity price volatility is an important source of risk are likely to efficiently implement their risk management strategies, rendering net commodity price exposure to be seen as much smaller than gross exposure. It seems likely that, to the extent that hedging activities are efficiently implemented, they have a direct impact on the nature and characteristics of a firm's exposure. In spite of the recognition of the influence of hedging activities on firms' exposures, only a few authors try to incorporate the impact of hedging on exposures analysis.

In the field of commodity price exposure, Tufano (1998) considers the hedging activities to be a potential determinant of financial price risk exposure. Additionally, he tests several other potential determinants that are strictly related to the gold mining industry: gold production quantity, gold total reserves, average gold price, cost structure, financial leverage, gold return volatility, and percentage of assets in mining. Similarly, Jin and Jorion (2006) investigated the effect of hedging with derivatives and of gas and oil reserves on the commodity price exposure of a sample of US oil and gas firms. More recently, Bali *et al.* (2007) investigated the effect of the use of derivatives and of real firm's operations, represented by the ratio of total inventory to total sales, on commodity price exposure.

Focusing on internal hedging strategies, Williamson (2001) shows that foreign production decreases exchange rate exposure, which is consistent with the idea that an exporter can counteract the sensitivity of the cash flow to exchange rate movements by having costs denominated in the local currency, that is to say, the success of operational hedging through production. Corroborating conclusions are drawn by Carter *et al.* (2003). Other authors try to empirically link estimated exposure coefficients with data on foreign

hedging activities. Nydahl (1999), Allayannis and Ofek (2001), and Nguyen and Faff (2003) assess data on foreign exchange derivatives usage; Carter *et al.* (2003), Hagelin and Pramborg (2004), and Bartram *et al.* (2010) consider both, data on internal and external hedging activities. Additionally, Carter *et al*. (2003) account for the fact that the magnitude of a firm's exposure to foreign exchange risk affects its hedging decisions. In other words, they recognise that foreign exchange rate exposure and hedging are endogenously determined.

Another set of studies are based on optimal hedging theories, which postulate that non-hedging firms should be more exposed to currency movements than hedging companies (He & Ng, 1998; Nguyen & Faff, 2003). In particular, He and Ng (1998) use variables that proxy for a firm's incentives to hedge to examine the influence of presumed hedging activities.

4.3 Research framework: Development of the hypotheses and proposed model

We use a two-step approach procedure to investigate the effect of a firm's hedging activities and operating profiles on its exposure to financial risks. Following Bali *et al*. (2007), this study provides more complete estimates of firms' financial risk by extending the exposure models of Jorion (1990) and Allayannis and Ofek (2001) for currency exchange risk, to also include interest rate and commodity price risk. So, in the first stage, we quantify a firm's exposure to exchange rate, interest rate, and commodity price risk by means of a time-series analysis applied over the 36 months in the sample, which corresponds to our 2006-2008 data. In the second stage, we examine the relationship between the financial price exposures already estimated, a firm's hedging activities and operating profiles.

4.3.1 Time series analysis: Measuring stock price exposure

As mentioned in the previous section, the current approach adopted in the literature to estimate a firm's stock exposure to financial price risk is a two factor augmented market model. In line with Bali *et al.* (2007), in the first stage regression we provide estimates of individual firm's exposure by category of risk using a four-factor augmented market model:

$$R_{i,t} = \beta_{0,i} + \beta_{1,i} \cdot R\_FX_t + \beta_{2,i} \cdot R\_IR_t + \beta_{3,i} \cdot R\_CP_t + \beta_{4,i} \cdot R\_MSCI_t + \varepsilon_{i,t} \quad (4.1)$$

where:

$R_{i,t}$ = the stock rate of return for the i^{th} firm's common stock in month t is computed using the following expression:

$$R_{i,t} = \frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}}$$

where, P represents the closing price for the time series January 31, 2006 to December 31, 2008. The returns are adjusted for the payment of dividends and stock splits;

R_FX_t = the rate of return on the Euro effective index in month t;

R_IR_t = the rate of change on the three-month Euro Interbank Offered Rate (Euribor) in month t;

R_CP_t = the rate of return on the Euronext Rogers International Commodity Index in month t;

R_MSCI_t = the rate of return on the MSCI Euro index in month t;

$\varepsilon_{i,t}$ = error term.

In equation (4.1) each non-intercept term β represents a firm's exposure by category of risk. The coefficient $\beta_{1,i}$ represents the exchange rate exposure, $\beta_{2,i}$ represents the

interest rate exposure, $\beta_{3,i}$ represents the commodity price exposure, and $\beta_{4,i}$ firm *i*'s return sensitivity to market risk.

As discussed in the work of Bartov and Bodnar (1994) and in several other papers, an appreciation in the domestic currency makes exporting goods more expensive in foreign currency territories and this may lead to a fall in foreign demand. Consequently, the value of an exporting firm would then decrease, following its domestic currency appreciation. On the other hand, importing firms would benefit from the appreciation of the domestic currency because their imports would become cheaper. As a result, the $\beta_{1,i}$ coefficient should be negative for importing and positive for exporting firms. In this context, an association between the exchange rate factor and firm value, when *proxied* by firms' stock returns, is expected. Therefore, the hypothesis to be tested for each firm of our sample is theoretically undetermined:

HYPOTHESIS 1: The company is significantly exposed with regard to exchange rate risk.

According to Bartram (2002), it is expected that increases in interest rates are likely to have a negative effect on firm value due to the expected consequences on the investment activity. This implies a negative interest rate exposure ($\beta_{2,i}$). In this sense, we tested if:

HYPOTHESIS 2: The company exhibit a negative exposure with regard to interest rate risk.

Finally, following a similar approach to the ones of Bartov and Bodnar (1995) in the scope of exchange rate risk, Bartram (2005) suggests that the use of a commodity as an important input factor in the production process in a particular industry should induce a negative commodity price exposure. Yet, its use as an output factor should lead to a positive exposure. Therefore, it is expected that commodity price risk may negatively (positively) affect the share prices of companies in industries for which a certain

commodity represents a relevant input (output) factor. In this way, $\beta_{3,i}$ coefficient should be negative (positive). The hypothesis to be tested is theoretically undetermined:

HYPOTHESIS 3: The company is significantly exposed with regard to commodity price risk.

4.3.2 Cross-sectional analysis: Determinants of financial price exposure

Previously, we have measured the financial price exposure of our sample. Now, we turn the focus of our analysis to the explanation of firms' exposures estimated in the first stage regression. Previous empirical studies (e.g., Allayannis & Ofek, 2001; Carter *et al*., 2003; Hagelin & Pramborg, 2004; He & Ng, 1998; Nydahl, 1999) analysed the efficiency of hedging activities by examining the determinants of the financial price exposure in a cross-sectional regression with the exposure coefficients estimated for each category of risk as the dependent variable. In line with this we use our cross-sectional 2007 data and the exposure estimates for each category of risk obtained using the four-factor model outlined in the preceding section (equation 4.1). Our baseline regression models, each one related to a category of risk, are as follows:

(i) For exchange rate exposure:

$$EXP\_FX_i = \alpha_0 + \alpha_1 \cdot HEDGE\_FX_i + \alpha_2 \cdot NET\_FX_i + \sum_{j=1}^{8} \alpha_{2+j} \cdot IND_i + \eta_i \qquad (4.2)$$

(ii) For interest rate exposure:

$$EXP\_IR_i = \alpha_0 + \alpha_1 \cdot HEDGE\_IR_i + \alpha_2 \cdot LEV_i + \sum_{j=1}^{8} \alpha_{2+j} \cdot IND_i + \eta_i \qquad (4.3)$$

(iii) For commodity price exposure:

$$EXP\_CP_i = \alpha_0 + \alpha_1 \cdot HEDGE\_CP_i + \alpha_2 \cdot TI\_TS_i + \sum_{j=1}^{8} \alpha_{2+j} \cdot IND_i + \eta_i \qquad (4.4)$$

where:

EXP_FX = absolute value of FX exposure obtained from the estimated augmented market model (see equation 4.1, section 4.3.1);

EXP_IR = absolute value of IR exposure obtained from the estimated augmented market model (see equation 4.1, section 4.3.1);

EXP_CP = absolute value of CP exposure obtained from the estimated augmented market model (see equation 4.1, section 4.3.1);

HEDGE_FX = dummy which is assigned a value of 1 if a firm uses external and/or internal foreign exchange hedging instruments, 0 otherwise;

HEDGE_IR = dummy which is assigned a value of 1 if a firm uses external and/or internal interest rate hedging instruments, 0 otherwise;

HEDGE_CP = dummy which is assigned a value of 1 if a firm uses external and/or internal commodity hedging instruments, 0 otherwise;

IND = Dummy which is assigned the value of 1 if the firm's main industry is classified into one of the eight industries according to the 4-digit ICB classification, 0 otherwise;

NET_FX = Absolute value of the difference between the proportion of revenues and costs denominated in foreign currency;[41]

LEV = financial leverage, measured by the ratio of long-term debt plus short-term debt to total assets;

TI_TS = revenues from commodity operations, measured by ratio of total inventory to total sales;

[41] Following Bartram *et al.* (2009), we assume that local firms use foreign assets for foreign production, so we use assets denominated in foreign currency to represent for the costs denominated in foreign currency, since the reporting for these costs are not always available in firms' annual reports.

In our estimation of equations (4.2), (4.3) and (4.4) we test if a firm's use of hedging instruments affects its exposure to the underlying risk factor. For instance, when we analyse the case of exchange rate exposure, we observe that the use of risk management instruments should decrease exchange rate exposure for firms with positive exposures and increase it (decrease in absolute value) for firms with negative exposures (Allayannis & Weston, 2001). By this means, we choose the use of absolute value of exposure as a proxy for exchange rate exposure, neglecting the sign of exposure in our empirical tests. The same approach is considered with regard to interest rate exposure (Bartram, 2002). Regardless of the fact that interest rate exposure can be originated from the liability side and/or from the assets side, it is straightforward that the large part of this type of exposure originates from the liability side. As for the exchange rate exposure, we can expect that interest rate instruments used to offset existing exposures should decrease interest rate exposure.

As already explained, within commodity price exposure scope, positive and negative exposures can be originated, depending on the use of commodity as an input factor or as an output factor in the production process (Bartram, 2005). In light of this, we also use the absolute value to proxy for this commodity price exposure. As with exchange rate and interest rate, commodity hedging instruments' use is expected to decrease commodity price exposure (Tufano, 1998).

Hence, in each category of risk, if firms use risk management instruments as a hedge against financial risk exposures, the absolute value of exposure should be negatively related to the use of risk management instruments. In contrast, if firms use risk management instruments, namely derivatives, to speculate, we should expect a positive relation between the use of risk management instruments and the absolute value of inherent financial price risks. Consequently, the main hypotheses to be tested are:

HYPOTHESIS 4a: If firms use risk management instruments with hedging purposes, there is a negative relationship between the use of exchange rate hedging instruments and the inherent exposure to risk.

HYPOTHESIS 4b: If firms use risk management instruments with hedging purposes, there is a negative relationship between the use of interest rate hedging instruments and the inherent exposure to risk.

HYPOTHESIS 4c: If firms use risk management instruments with hedging purposes, there is a negative relationship between the use of commodity price hedging instruments and the inherent exposure to risk.

Additionally, in equations (4.2), (4.3), and (4.4) we test if a firm's operating profiles, which we proxy through net foreign exchange exposure, leverage and revenues from commodity operations, respectively, are important determinants of specific risk exposure. Regarding exchange rate exposure, it is expected that net exporter firms will exhibit a positive exchange rate exposure when the Euro appreciates. In contrast, if a firm is a net importer the appreciation of the Euro should produce a negative exposure. On the other hand, for a given exposure, an increase in the firm foreign involvement should always increase exposure. However, when we take the absolute value of exchange rate exposure, we cannot hypothesize any relation between the absolute value of exposure and the firm foreign involvement (e.g., Allayannis & Ofek, 2001), which we found appropriate to be *proxied* through net foreign exchange exposure.[42] We take the same approach for commodity price exposure, supported by the fact that commodities can be identified empirically in a particular industry, either as an input factor or as an output factor in the production process (Bartram, 2005). In what concerns interest rate exposure, we hypothesize, similarly to Bartram (2002), that firms with a high level of leverage (*LEV*) have the expectation of higher costs of financial distress. As a result, one can expect the interest rate exposure to be positively related to firms' leverage. We test the following hypotheses concerning exchange rate, interest rate, and commodity price exposure:

[42] If the firm has foreign assets denominated in the same currency as its foreign sales, the firm will show only residual foreign exchange exposure.

HYPOTHESIS 5a: The extent of firms' foreign involvement has an impact on the magnitude of the exchange rate exposure.

HYPOTHESIS 5b: The extent of firms' leverage has a positive impact on the magnitude of the interest rate exposure.

HYPOTHESIS 5c: The extent of firms' revenues from commodity operations has an impact on the magnitude of the commodity price exposure.

Moreover, to control for differences in hedging behaviour between industries, we include eight industry dummy variables (*IND*), in equations (4.2), (4.3), and (4.4).

So far, we suggested that an increase in the level of hedging activities in one class of risk should be associated to a reduction in the inherent risk exposure. In a subsequent test, we consider that an increase in hedging activities associated to one category of risk may also impact upon the exposure to risk in another category. That is to say, we suggest the interaction of hedging activities. For this test we substitute *HEDGE_FX*, *HEDGE_IR*, and *HEDGE_CP* with *HEDGE*. The variable *HEDGE* is a *full hedging* variable that takes instruments relating to all kinds of financial risks into consideration. The hypotheses to be tested are:

HYPOTHESIS 6a: If firms use risk management instruments with hedging purposes, there is a negative relationship between the use of hedging instruments and the exchange rate exposure.

HYPOTHESIS 6b: If firms use risk management instruments with hedging purposes, there is a negative relationship between the use of hedging instruments and the interest rate exposure.

HYPOTHESIS 6c: If firms use risk management instruments with hedging purposes, there is a negative relationship between the use of hedging instruments and the commodity price exposure.

4.3.3 Cross-sectional analysis: Determinants of financial price exposure controlling for endogeneity

Carter *et al.* (2003) suggest that it is not possible to draw inferences about the effect of hedging on firm risk exposure, because there are economic reasons to believe that firms

do not randomly select their hedging policies. Indeed, several other authors argue that firms with more exposure have higher probabilities of becoming hedgers (e.g., Bartram *et al*., 2009; Géczy *et al*., 1997; Hagelin *et al*., 2007; Lel, 2012; Purnanandam, 2008). On the one hand, financial exposures should be a function of hedging activities and of a firm's operating profiles (Bali *et al*., 2007; Bartram, 2002). On the other hand, hedging instruments' usage should be a function of the financial price exposures' magnitude and other factors also related to firms' hedging decisions. Clearly, the relation between financial exposures and hedging activities may be subject to reverse causality interpretations. The consequence of a contemporaneous correlation of the independent variable, namely the hedging dummy, and the error term in equations (4.2), (4.3), and (4.4) is a biased and inconsistent estimation of α.

To explicitly address the endogeneity problem described above, we use a treatment effect model (e.g., Heckman, 1979) estimated in a two-step procedure. The model we estimate differs from the standard instrumental variable approach because of the binary nature of the endogenous variable of interest. Cameron and Trivedi (2010) also suggest the potential use of the IV approach. However, the IV approach is often confused by a fundamental problem: in practice, it is difficult to find an instrument that is both highly correlated with the treatment condition and independent of the error term of the outcome regression. With regards to the treatment effect models, the identification is achieved through exclusion restriction, a much less demanding way of identification than the instrumental variables approach. Summing up, it is suggested that whenever users find a problem for which the IV approach appears tempting, they can use the treatment effect model (Guo & Fraser, 2010).

As before, we compare the exposure outcome of two groups of firms: those who decide to hedge (treatment variable *HEDGE_FX* or *HEDGE_IR* or *HEDGE_CP*=1) and

those who decide not to hedge (treatment variable *HEDGE_FX* or *HEDGE_IR* or *HEDGE_CP*=0). The exposure outcome was assessed using the exposure estimates for each category of risk outlined by the four-factor model given in equation (4.1).

Explicitly, our estimation with the treatment effect model is expressed through two equations, for each category of risk and defined in two steps. The first-step model is the probit regression of the hedging decision:

(i) For exchange rate exposure:

$$HEDGE\_FX_i = \delta_0 + \delta_1 \cdot CAPEX_i + \delta_2 \cdot CG\_INT_i + \delta_3 \cdot DIV_i + \delta_4 \cdot LEV_i + \delta_5 \cdot SIZE_i + \delta_6 \cdot TAX_i + \sum_{j=1}^{8} \delta_{6+j} \cdot IND_i + \xi_i \quad (4.5)$$

(ii) For interest rate exposure:

$$HEDGE\_IR_i = \delta_0 + \delta_1 \cdot CAPEX_i + \delta_2 \cdot CG\_INT_i + \delta_3 \cdot DIV_i + \delta_4 \cdot LEV_i + \delta_5 \cdot SIZE_i + \delta_6 \cdot TAX_i + \sum_{j=1}^{8} \delta_{6+j} \cdot IND_i + \xi_i \quad (4.6)$$

(iii) For commodity price exposure:

$$HEDGE\_CP_i = \delta_0 + \delta_1 \cdot CAPEX_i + \delta_2 \cdot CG\_INT_i + \delta_3 \cdot DIV_i + \delta_4 \cdot LEV_i + \delta_5 \cdot SIZE_i + \delta_6 \cdot TAX_i + \sum_{j=1}^{8} \delta_{6+j} \cdot IND_i + \xi_i \quad (4.7)$$

where the variables not defined earlier on are:

CAPEX = purchases of fixed assets to total assets;

CG_INT = index that proxies for the firm-level quality of governance.

DIV = dummy which is assigned a value of 1 if a firm dividend yield is greater than the median yield for the sample, 0 otherwise;

SIZE = natural logarithm of total assets;

TAX = net operating losses carry forward to total assets;

The independent variables are the key firm-level characteristics that, in line with the optimal hedging theory, influence hedging decisions. In this sense, the theory predicts that hedging can enhance firm value if it can decrease the agency costs of debt. It was

suggested that these agency costs of debt are more evident in firms with more growth options, as these firms could have a high probability of underinvestment or asset substitution. In general, to control for this last argument, studies include variables representing firms' available growth opportunities. In line with Jin and Jorion (2006), to proxy for investment we use the ratio of capital expenditures to total assets (*CAPEX*). In line with Lin and Smith (2008) the hypothesis to be tested is:

HYPOTHESIS 7: If risk management is used to protect the continued funding of future investment programmes, we expect a positive relationship between hedging activities and capital expenditures.

Next, drawing on Lel (2012), we use a firm-level governance index (*CG_INT*), comprising seven widely used governance control mechanisms hand-collected from the firms' annual reports, to proxy for the level of managerial agency costs. In general, it is implicit that strongly governed firms are more likely to pursue value-maximizing decisions. Consequently, the hypothesis to be tested is:

HYPOTHESIS 8: Better-governed firms are more likely to use hedging instruments in a way that is consistent with the value-maximizing theories of hedging.

The presence of liquid assets could reduce the need for hedging with derivatives (e.g., Davies *et al*., 2006; Géczy *et al*., 1997; Marsden & Prevost, 2005; Nance *et al*., 1993; Tufano, 1996). The common approach consists of using measures of liquidity or the dividend yield. In fact, holding cash or other liquid assets allows firms to cover temporary shortfalls in revenues and to fulfil short-term liabilities. As a result, the probability of encountering financial distress is reduced. Indeed, low dividend payouts could provide more liquidity. The empirical implication of this argument is that firms with higher cash holdings or lower dividend payouts are less likely to hedge (e.g., Berkman & Bradbury, 1996; Nance *et al.*, 1993). We control for liquidity through the dividend yield dummy (*DIV*) and predict:

HYPOTHESIS 9: Firms with a lower dividend level are less likely to hedge.

The fourth variable – leverage (*LEV*) – proxies for the probability of financial distress (Lel, 2012; among others). We expect firms with a greater degree of financial distress to engage more often in hedging activities. Measuring financial distress costs by leverage levels relies on the implicit assumption that firms with important gearing in their capital structure have a greater probability of facing financial distress. Leverage is measured by debt ratio (e.g., Berkman & Bradbury, 1996; Gay & Nam, 1998; Graham & Rogers, 2002). Thereby, the hypothesis to be tested is:

HYPOTHESIS 10: Firms with a greater degree of financial distress, thereby with higher level of debt, are more likely to engage more often in hedging activities.

Moreover, we use the natural logarithm of the total assets (*SIZE*) to control for firm size. We need to control for firm size because the establishment and implementation of a hedging programme involves some fixed costs (Nance *et al*., 1993). Larger firms that have access to risk management expertise, or that have economies of scale in hedging costs, are more likely to hedge than smaller firms. However, there are circumstances where smaller firms have more incentive to hedge than larger firms; for instance, smaller firms will hedge more because they face greater bankruptcy costs. Thus, the effect of firm size on hedging activities is ambiguous and shall be empirically determined.

HYPOTHESIS 11: Firm size is expected to be associated with the likelihood of hedging.

Finally, we use the ratio of net operating losses to total assets (*TAX*) as a proxy for the convexity of a firm's tax schedules. The vast majority of the variables that are used to test the relation between taxes and derivatives' usage are based on the existence of net operating losses (e.g., Géczy *et al*., 1997; Howton & Perfect, 1998; Marsden & Prevost, 2005; Nance *et al.*, 1993; Tufano, 1996). Usually, the hypothesis tested is as follows:

HYPOTHESIS 12: If the firm incurs tax losses which will be carried forward, the probability of the firm's engagement in hedging will be higher.

Finally, as before, to control for differences in hedging behaviour between industries, we include eight industry dummy variables (*IND*), in equations (4.5), (4.6), and (4.7).

On balance, consistent with previous studies on optimal hedging theories δ_1, δ_2, δ_3, δ_4 and δ_6 in equations (4.5), (4.6), and (4.7) are expected to be positive, and δ_5 could be either positive or negative.

Next, a firm's financial exposures are modelled and how they are affected by the predicted probability of using hedging instruments is assessed. So, in the second-stage model, after calculating the statistic labelled "lambda" (λ_i) which is the inverse Mill's ratio (using the estimated results from the first-stage), or non-selection hazard, the estimation of the exposure model (outcome model) uses λ_i as a control variable and applies OLS:

(i) For exchange rate exposure:

$$EXP\_FX_i = \alpha_0 + \alpha_1 \cdot HEDGE\_FX_i + \alpha_2 \cdot NET\_FX_i + \alpha_3 \cdot \lambda_i + \sum_{j=1}^{8} \alpha_{3+j} \cdot IND_i + \eta_i \quad (4.8)$$

(ii) For interest rate exposure:

$$EXP\_IR_i = \alpha_0 + \alpha_1 \cdot HEDGE\_IR_i + \alpha_2 \cdot LEV_i + \alpha_3 \cdot \lambda_i + \sum_{j=1}^{8} \alpha_{3+j} \cdot IND_i + \eta_i \quad (4.9)$$

(iii) For commodity price exposure:

$$EXP\_CP_i = \alpha_0 + \alpha_1 \cdot HEDGE\_CP_i + \alpha_2 \cdot TI\_TS_i + \alpha_3 \cdot \lambda_i + \sum_{j=1}^{8} \alpha_{3+j} \cdot IND_i + \eta_i \quad (4.10)$$

All the parameters have the same predicted signs as those in the baseline OLS models (equations 4.2, 4.3, and 4.4). In light of this, the hypotheses 4a, 4b, 4c, 5a, 5b, and 5c are retested allowing for the self-selection issue implicit in the relation between hedging and the underlying exposure.

The coefficient on lambda (inverse Mill's ratio) - α_3 - measures the extent to which unobserved factors that make hedging more likely to occur are associated with financial exposures. If it is positive (negative), hedging is more likely to occur with a higher (lower) level of exposure. Thus, the additional hypotheses to be tested are:

HYPOTHESIS 13a: Hedging with exchange rate instruments is more likely to take place with higher levels of exchange rate exposure.

HYPOTHESIS 13b: Hedging with interest rate instruments is more likely to take place with higher levels of interest rate exposure.

HYPOTHESIS 13c: Hedging with commodity price instruments is more likely to take place with higher levels of commodity price exposure.

4.4 Results and discussion

4.4.1 Time series analysis: Measuring stock price exposure

The relation between changes in stock prices and changes in financial price exposure factors is analysed by estimating equation (4.1). The standard errors of the coefficients are estimated by using the Newey-West method to correct for autocorrelation and heteroscedasticity. Table 4.5 reports the results of the regression. The table reports the average, minimum, maximum, standard deviation, and the percentage of exposure coefficients by each category of risk and by country that are significant at the 10% significance level.

From the analysis of Table 4.5, we verify that several firms in our sample are significantly exposed to the three types of risks in analysis. The interest rate and commodity price exposure factors show the highest significance, each one with 29.1% of significant cases, followed by an exchange rate exposure factor with 27.5% of significant cases. Therefore, the hypothesis 1 is corroborated for 156 of the cases (27.5% from the total of the firms) and hypothesis 2 and hypothesis 3 are corroborated each one for 165 of the cases (29.1% from the total of the firms).

Table 4.5: **Summary statistics on financial price exposures**

Panel A. Descriptive statistics of exchange rate exposure coefficients					
	All Cases	**Belgium**	**France**	**The Netherlands**	**Portugal**
Mean	-0.552	-0.446	-0.559	-0.379	-1.031
Minimum	-42.358	-4.223	-10,781	-9.913	-42.358
Maximum	12.075	5.148	12.075	4.568	8.229
Std. Deviation	2.804	1.938	2.217	2.244	6.971
Nº positive/negative cases	212/355	31/44	130/237	36/48	15/26
Nº positive/negative significant cases	40/116	7/13	22/79	7/19	4/5
% significant cases	27.5%	26.7%	27.5%	31.0%	22.0%
Panel B. Descriptive statistics of interest rate exposure coefficients					
	All Cases	**Belgium**	**France**	**The Netherlands**	**Portugal**
Mean	-0.089	-0.022	-0.083	-0.124	-0.202
Minimum	-5.370	-1.606	-3.470	-2.471	-5.370
Maximum	3.436	0.924	3.436	1.172	0.874
Std. Deviation	0.579	0.444	0.564	0.544	0.910
Nº positive/negative cases	240/327	39/36	155/212	33/51	13/28
Nº positive/negative significant cases	58/107	10/11	37/71	9/20	2/5
% significant cases	29.1%	28.0%	29.4%	34.5%	17.1%
Panel C. Descriptive statistics of commodity price exposure coefficients					
	All Cases	**Belgium**	**France**	**The Netherlands**	**Portugal**
Mean	0.075	0.135	0.058	0.180	-0.102
Minimum	-3.470	-0.454	-3.470	-0.603	-0.855
Maximum	1.708	1.282	1.708	1.564	0.758
Std. Deviation	0.408	0.316	0.433	0.356	0.353
Nº positive/negative cases	338/229	46/29	218/149	59/25	15/26
Nº positive/negative significant cases	111/54	19/7	68/32	21/7	3/8
% significant cases	29.1%	34.7%	27.3%	33.3%	26.8%

Note. This table reports the descriptive statistics of β_{ix} - the exchange rate exposure (Panel A), the interest rate exposure (Panel B), and the commodity price exposure (Panel C) – estimated from the following equation (equation 4.1) for the period January 31st, 2006 to December 31st, 2008:

$$R_{i,t} = \beta_{0,i} + \beta_{1,i} \cdot R\_FX_t + \beta_{2,i} \cdot R\_IR_t + \beta_{3,i} \cdot R\_CP_t + \beta_{4,i} \cdot R\_MSCI_t + \varepsilon_{i,t} ,$$

where $R_{i,t}$ is the rate of return on the i^{th} firm's common stock in period t, R_FX_t is the rate of return on the Euro Effective Index in period t, R_IR_t is the rate of change in the three-month EURIBOR in period t, R_CP_t is the rate of return on the Euronext Rogers International Commodity Index in period t, and R_MSCI_t is the rate of return on the MSCI Euro Index in period t. The percentage of significant cases is achieved at 10% or lower levels of significance. The data represent observations from 567 firms during the 2006-2008 period. The standard errors are corrected for heteroscedasticity and autocorrelation according to Newey and West (1987).

If we compare our results with the previous empirical studies presented in Table 4.1 and 4.2, we can conclude that our sample firms are more frequently exposed in terms of exchange rate exposure factor. For instance, for the US market, Jorion (1990) shows that only 5% of his sample exhibits significant exchange rate exposure, while Choi and Prasad (1995) document that 15% of their sample experiences significant exchange risk sensitivity. Focusing on the Japanese market, He and Ng (1998) report that about 25% of their sample has significant exchange rate exposure, and for Swedish firms, Nydahl (1999) finds 26% of the firms to be significantly exposed. In fact, our results corroborate Bodnar and Gentry's (1993) assertion that firms in smaller and more open economies are likely to be more exposed to exchange rate risk.[43]

It is worth noting that 40 (116) firms with significant currency exposure have positive (negative) exposure coefficients, which seems to indicate that on average these firms are exporting (importing) firms. The mean exchange rate exposure coefficient in Table 4.5, Panel A is -0.552, which indicates that the median firm in our sample, which is mainly an importing firm, loses 0.552% in value (*proxied* by stock price returns) when the Euro depreciates by 1%.

Likewise, our study also documents higher levels of exposure when compared with the findings of earlier studies on the extent of interest rate and commodity price exposures. For German firms, Bartram (2002) finds a linear interest rate exposure to be in the range of 6.4% to 18.8%, and Bartram (2005) finds that the fraction of sample firms with statistically significant commodity price exposure is roughly 4.5% to 15.9%.

The mean interest rate exposure coefficient in Table 4.5, Panel B is -0.089, which corroborates Bartram's (2002) assertion that increases in interest rates are likely to have a

[43] In the year 2007, Belgian exports and imports were 70.5% and 70% of GDP, respectively; French exports and imports were 21% and 23.2% of GDP, respectively; Dutch exports and imports were 59.4% and 52.3% of GDP, respectively, and Portuguese exports and imports were 23.3% and 34.1% of GDP, respectively. In comparison, in the US, exports and imports were only 8.3% and 14.3% of GDP, respectively (CIA, 2007).

negative effect on firm value due to the consequences at the investment level. This value indicates that the median firm in sample loses -0.089% with regards to an interest rate increase of 1%.

Within the scope of commodity price exposure, Table 4.5, Panel C documents that 111 (54) firms with significant exposure have positive (negative) exposure coefficients, which indicates that significant coefficients occur primarily in industries where the relevant commodities represent significant output (input) factors of production. In this case, the mean commodity price exposure coefficient in Table 4.5, Panel C is 0.075, which indicates that the median firm in our sample has mainly output factors affected by commodity price changes and increases 0.075% in stock price when commodity prices increase by 1%.

Moreover, from the analysis of Table 4.5, we observe that in all categories of risk Portuguese firms presented fewer cases with significant exposure. In contrast, in the scope of exchange rate and interest rate exposure, Dutch firms revealed a higher number of cases with significant financial exposure. Even though the use of hedging instruments does not vary significantly across countries (see section 3.4, Table 3.4), it is worth noting that The Netherlands has the highest usage rate of hedging instruments (92%) and Portugal the lowest (63%).

4.4.2 Cross-sectional analysis: Determinants of financial price exposure

In a first approach, we estimate our baseline model with the continuous variable (financial price exposure) estimated in the preceding section as the dependent variable, using OLS (equations 4.2, 4.3, and 4.4). Columns 2 to 4, in Table 4.6, report the regression results of exchange rate, interest rate and commodity price exposure on hedging instruments' use by category of risk and firms' operating profiles.

Table 4.6: **Firm financial price exposures and hedging**

Independent variables	Hedging variable is assigned by category of risk			Predicted influence	Hedging variable representing all hedging instruments			Predicted influence
	Dependent variable				Dependent variable			
	EXP_FX	EXP_IR	EXP_CP		EXP_FX	EXP_IR	EXP_CP	
HEDGE_FX	-0.377			-				
	(-1.44)							
HEDGE_IR		-0.051		-				
		(-1.28)						
HEDGE_CP			0.026	-				
			(0.69)					
HEDGE					-0.466	-0.074	-0.089	-
					(-1.42)	(-0.97)	(-1.95)*	
NET_FX	-0.078			na	-0.124			na
	(-0.23)				(-0.36)			
LEV		0.234		+		0.219		+
		(5.29)***				(4.77)***		
TI_TS			0.067	na			0.073	na
			(0.91)				(0.97)	
Constant	2.295	0.345	0.282		2.389	0.385	0.347	
	(5.23)***	(5.16)***	(11.28)***		(4.73)***	(3.61)***	(7.73)***	
Four-digit ICB code dummies	Yes	Yes	Yes		Yes	Yes	Yes	
Observations	567	567	567		567	567	567	
R^2	0.0176	0.0419	0.0231		0.0191	0.0411	0.0268	

Note. The table shows the estimates of OLS regressions for 567 non-financial Euronext firms. The statistics reported are obtained through Stata (version 10.1). In the predicted influence column – na – means that there is no prediction. The variables are: EXP_FX, EXP_IR, and EXP_CP represent respectively the absolute value of exchange rate exposure, interest rate exposure, and commodity price exposure estimated earlier; HEDGE_FX, HEDGE_IR, and HEDGE_CP are dummies which are assigned a value of 1 if a firm uses either external or internal foreign exchange hedging instruments, interest rate hedging instruments and commodity hedging instruments, respectively; HEDGE is a dummy which is assigned a value of 1 if a firm uses external and/or internal hedging instruments; NET_FX proxies for the firm operating profile, measured by the absolute value of the difference between the percentage of sales that are foreign and the percentage of assets that are foreign; LEV is financial leverage that proxies for the probability of financial distress, measured by the ratio of long-term debt plus short-term debt to total assets, and TI_TS is the proxy for the need to hedge commodity price, measured by the ratio of total inventory to total sales. *t*-values of the regressions coefficients are in parentheses and are computed using robust standard errors. Statistical significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

The results of the OLS regression indicate that currency hedging activities (*HEDGE_FX*) and the degree of firms' foreign involvement (*NET_FX*) do not have a statistically significant influence on the magnitude of exchange rate exposure (column 2 in Table 4.6). These results do not confirm our hypotheses that foreign involvement relates to the level of exposure (hypothesis 5a) and hedging reduces it (hypothesis 4a), which is in contrast with the results of Allayannis and Ofek (2001) and Jorion (1990). Moreover, we follow Bali *et al*. (2007) and investigate the fact that an increase in hedging in one category of risk may reduce the exposure to risk in another category. Specifically, we substitute the variable that represents currency hedging by a variable that proxies for the hedging instruments inherent to all categories of risk (*HEDGE*). Column 6 in Table 4.6 reports the results for this new specification. Once again, the results suggest that hedging instruments' use (hypothesis 6a) and firms' operating profile (hypothesis 5a) are not important to the individual exchange rate exposure of the firms analysed. Bali *et al*. (2007) also achieved divergent-hypothesis findings.

In the same way, the OLS analysis does not establish any significant link between exposure and hedging (*HEDGE_CP*) within the scope of commodity hedging-related activities (column 4 in Table 4.6). As for the question of whether the revenues from commodity operations (*TI_TS*) have an impact on the absolute value of commodity exposure, the results also converge to an insignificant impact. So, hypothesis 4c and hypothesis 5c are not corroborated either for this model specification. Nonetheless, when we consider the use of the *HEDGE* specification (column 8 in Table 4.6), OLS results indicate that the coefficients on hedging activities is significantly negative at the 10% significant level (-0.089, with a *t*-statistic of -1.95), suggesting that hedging activities on the whole reduce the level of exposure to commodity price risk (hypothesis 6c). Again,

there is no significant relationship between the level of commodity price exposure and revenues from commodity operations (hypothesis 5c).

Lastly, regarding the interest rate exposure, the results show that the use of interest rate hedging instruments is not a significant factor in the reduction of the inherent exposure (column 3 in Table 4.6). Also, when we introduce the *HEDGE* specification (column 7 in Table 4.6) the sensitivity for hedging instruments' usage remains negative, but still insignificant. These results do not confirm hypothesis 4b and hypothesis 6b. As for the question of whether leverage (*LEV*) impacts upon the absolute value of interest rate exposure, the results always converge, as expected, to a positive and significant impact (for *HEDGE_IR* specification the coefficient is 0.234 with a *t*-statistic of 5.29 and for *HEDGE* specification the coefficient is 0.219 with a *t*-statistic of 4.77). This last result corroborates our hypothesis 5b and is in line with Bartram's (2002) view that firms with a high level of leverage have the expectation of higher costs of financial distress, therefore, interest rate exposure is positively related to firms' leverage.

In light of the fact that most of the OLS regression coefficients are insignificant, except for commodity price exposure with regards to the *HEDGE* specification, this could suggest that the use of hedging instruments is not important to the lessening of individual market risk exposures of the firms studied. It is worth noting that a generally low coefficient of determination was obtained (between 1.76% and 4.19% in all the regressions). Yet, these results are consistent with the ones of Allayannis and Ofek (2001) that obtained 1.6% for the model specification where the absolute value of exchange rate exposure is used.

4.4.3 Cross-sectional analysis: Determinants of financial price exposure controlling for endogeneity

In the equations (4.2), (4.3) and (4.4), the firms' exposure to risk is explained by whether or not the firm decides to hedge. However, it is likely that firms that are highly exposed to risk self-select themselves into the hedger-firm group. As a result, it is likely that the error in the regression will be correlated with the hedging dummy and will cause bias. Therefore, in a second approach, we control for endogeneity in the form of selection bias by using the treatment effect model described earlier through the equations (4.5) to (4.10). Each pair of equations (4.5) and (4.8), (4.6) and (4.9), and (4.7) and (4.10) correspond to a category of risk.

To put into practice the treatment effect model approach we have to define a set of instrumental variables which are highly correlated with the treatment condition, but that affect the outcome variable only through its effect on the hedging decision. In practice, however, it is difficult to identify such instrumental variables. In fact, early hedging-studies (e.g., Carter *et al.*, 2003; Lel, 2012; Lin & Smith, 2008) have chosen the instruments based only on economic reasons which imply that they have frequently relied on weak instruments. Also, for economic reasons, we chose to use 14 potential variables to the instrumenting of the decision equations (4.5), (4.6), and (4.7): (1) the ratio of purchases of fixed assets to total assets (*CAPEX*); (2) the firm-level governance index (*CG_INT*); (3) the dividend yield dummy (*DIV*); (4) the ratio of long-term debt plus short-term debt to total assets (*LEV*); (5) the natural logarithm of total assets (*SIZE*); (6) the net operating losses carry forward to total assets (*TAX*), and (7-14) eight industry dummy variables (*IND*). We present the summary of the treatment effect model in Table 4.7 and Table 4.8.

Table 4.7: **Firm financial price exposures and hedging assigned by category of risk when controlling for endogeneity**

Independent variables	First stage probit Dependent variable			Predicted influence	Second stage treatment regression Dependent variable			Predicted influence
	HEDGE_FX	HEDGE_IR	HEDGE_CP		EXP_FX	EXP_IR	EXP_CP	
HEDGE_FX					-1.820 (-2.39)**			-
HEDGE_IR						-0.345 (-2.68)***		-
HEDGE_CP							-0.337 (-2.08)**	-
NET_FX					-0.015 (-0.03)			na
LEV	-0.526 (-2.01)**	0.592 (3.26)***	-0.195 (-0.56)	+		0.301 (3.60)***		+
TI_TS							0.060 (1.00)	na
Lambda (λ)					0.910 (1.99)**	0.201 (2.45)**	0.216 (2.35)**	+
CAPEX	-0.127 (-0.14)	1.338 (1.47)	-0.634 (-0.38)	+				
CG_INT	0.144 (3.60)***	0.138 (3.56)***	0.140 (2.57)***	+				

Table 4.7: **Firm financial price exposures and hedging assigned by category of risk when controlling for endogeneity** *(cont.)*

Independent variables	**First stage probit** **Dependent variable**			**Predicted influence**	**Second stage treatment regression** **Dependent variable**			**Predicted influence**
	HEDGE_FX	HEDGE_IR	HEDGE_CP		EXP_FX	EXP_IR	EXP_CP	
DIV	0.301 (2.36)**	0.356 (2.90)***	0.203 (1.18)	+				
SIZE	0.078 (4.28)***	0.106 (6.03)***	0.043 (1.96)*	+/-				
TAX	0.255 (0.27)	-3.128 (-2.49)**	-5.807 (-1.37)	+				
Constant	-1.337 (-3.39)***	-2.998 (-7.50)***	-3.318 (-5.79)***		3.251 (6.03)***	0.425 (7.12)***	0.288 (9.38)***	
Four-digit ICB code dummies	Yes	Yes	Yes		Yes	Yes	Yes	
Observations	567	567	567		567	567	567	
Wald χ^2					28.72*	52.87***	71.50***	

Note. The table shows the results from the treatment effect regression estimated in a two-step procedure for 567 non-financial European firms when hedging variable is assigned by category of risk. The statistics reported are obtained through Stata (version 10.1). In the predicted influence column – na – means that there is no prediction. The variables are: EXP_FX, EXP_IR, and EXP_CP represent respectively the absolute value of exchange rate exposure, interest rate exposure, and commodity price exposure estimated earlier; HEDGE_FX, HEDGE_IR, and HEDGE_CP are dummies which are assigned a value of 1 if a firm uses either external or internal foreign exchange hedging instruments, interest rate hedging instruments, and commodity hedging instruments, respectively; CAPEX proxies for the firm investment level, measured by the ratio of capital expenditures to total assets; CG_INT is a firm-level internal governance index comprising seven governance mechanisms that take into account two governance dimensions (board matters and ownership structure), and proxies for the firm managerial agency costs; DIV proxies for the firm liquidity and is measured by a dummy which is assigned a value of 1 if the firm dividend yield is greater than the median yield for the sample; LEV is financial leverage that proxies for the probability of financial distress, measured by the ratio of measured by the ratio of long-term debt plus short-term debt to total assets; NET_FX is the proxy for the firm foreign operating profile, measured by the absolute value of the difference between the percentage of sales that are foreign and the percentage of assets that are foreign; SIZE proxies for the firm size, measured by the natural logarithm of total assets; TAX proxies for the convexity of firm tax schedule, measured by the net operating losses to total assets, and TI_TS is the proxy for the need to hedge commodity price, measured by the ratio of total inventory to total sales. *t*-values of the regressions coefficients are in parentheses. Statistical significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

Table 4.8: **Firm financial price exposures and hedging when controlling for endogeneity**

Independent variables	First stage probit Dependent variable			Predicted influence	Second stage treatment regression Dependent variable			Predicted influence
	HEDGE	HEDGE	HEDGE		EXP_FX	EXP_IR	EXP_CP	
HEDGE					-1.804 (-2.29)**	-0.396 (-2.10)**	-0.403 (-3.28)***	-
NET_FX					-0.068 (-0.16)			na
LEV	-0.114 (-0.58)	-0.114 (-0.58)	-0.114 (-0.58)	+		0.207 (2.65)***		+
TI_TS							0.054 (0.92)	na
Lambda (λ)					0.823 (1.79)*	0.199 (1.79)*	0.195 (2.70)***	+
CAPEX	1.274 (1.30)	1.274 (1.30)	1.274 (1.30)	+				
CG_INT	0.176 (3.95)***	0.176 (3.95)***	0.176 (3.95)***	+				
DIV	0.326 (2.30)**	0.326 (2.30)**	0.326 (2.30)**	+				
SIZE	0.098 (4.77)***	0.098 (4.77)***	0.098 (4.77)***	+/-				

Table 4.8: **Firm financial price exposures and hedging when controlling for endogeneity** *(cont.)*

Independent variables	**First stage probit** **Dependent variable**			**Predicted influence**	**Second stage treatment regression** **Dependent variable**			**Predicted influence**
	HEDGE	HEDGE	HEDGE		EXP_FX	EXP_IR	EXP_CP	
TAX	-0.106 (-0,11)	-0.106 (-0,11)	-0.106 (-0,11)	+				
Constant	-1.704 (-3.87)***	-1.704 (-3.87)***	-1.704 (-3.87)***		3.356 (5.59)***	0.622 (4.24)***	0.577 (6.08)***	
Four-digit ICB code dummies	Yes	Yes	Yes		Yes	Yes	Yes	
Observations	567	567	567		567	567	567	
Wald χ^2					28.80*	37.10***	38.47***	

Note. The table shows the results from the treatment effect regression estimated in a two-step procedure for 567 non-financial Euronext firms when hedging variable seek to represent all type of instruments independent from the kind of risk they serve as a hedge, for the reason that in this specification we consider that an increase in hedging activities associated to one category of risk may also impact upon the exposure to risk in another category. The statistics reported are obtained through Stata (version 10.1). In the predicted influence column – na – means that there is no prediction. The variables are: EXP_FX, EXP_IR, and EXP_CP represent respectively the absolute value of exchange rate exposure, interest rate exposure, and commodity price exposure estimated earlier; HEDGE is a dummy which is assigned a value of 1 if a firm uses either external or internal hedging instruments; CAPEX proxies for the firm investment level, measured by the ratio of capital expenditures to total assets; CG_INT is a firm-level internal governance index comprising seven governance mechanisms that take into account two governance dimensions (board matters and ownership structure), and proxies for the firm managerial agency costs; DIV proxies for the firm liquidity and is measured by a dummy which is assigned a value of 1 if the firm dividend yield is greater than the median yield for the sample; LEV is financial leverage that proxies for the probability of financial distress, measured by the ratio of long-term debt plus short-term debt to total assets; NET_FX is the proxy for the firm foreign operating profile, measured by the absolute value of the difference between the percentage of sales that are foreign and the percentage of assets that are foreign; SIZE proxies for the firm size, measured by the natural logarithm of total assets; TAX proxies for the convexity of firm tax schedule, measured by the net operating losses to total assets, and TI_TS is the proxy for the need to hedge commodity price, measured by the ratio of total inventory to total sales. *t*-values of the regressions coefficients are in parentheses. Statistical significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

In each treatment effect regression (equations 4.5, 4.6, and 4.7), in columns 2-4 we provide the results of the first stage probit regression and in columns 6-8 we display the results from the exposure regressions after applying the treatment effect technique (the second stage treatment regression). Table 4.7 presents the results for the estimations of the equations (4.8), (4.9), and (4.10) when we consider the hedging dummy by category of risk.

The empirical findings from the treatment effect exchange exposure regression (column 6 in Table 4.7) confirm, as expected, that the use of currency hedging instruments has a negative and significant influence on the inherent exposure, which we proxy through the absolute value of currency exposure estimated earlier (see section 4.4.1). The coefficient (*t*-statistic) estimate is -1.820 (-2.39). Indeed, the use of exchange rate instruments for hedge seems to be associated to a lesser level of exchange rate exposure. This result is in line with our hypothesis 4a and with the results from Allayannis and Ofek (2001). Moreover, the sensitivity for foreign firms' operations is negative, yet shows insignificant statistical effects. This might be due to the fact that our foreign operations variable only relates to the part of the exposure that originates from foreign sales and foreign assets, while neglecting the impact on the exchange sensitivity of firm value from foreign income and from the indirect exchange exposure when firms' primary competitors are foreign firms. Our results are contrary to Jorion's (1990) findings that the relationship between stock returns and exchange rates is positively related to firms' foreign operations, although this is not significant either. Therefore, the results do not corroborate hypothesis 5a.

As in the baseline model, the treatment effect regression indicates a negative relationship between hedging with interest rate instruments and the absolute value of the interest rate exposure (column 7 in Table 4.7), but this time this relationship is highly

significant. In addition, there is also a positive significant effect of leverage on interest rate exposure, which is consistent with the findings from Bartram (2002). The coefficients (*t*-statistics) estimates are -0.345 (-2.68) and 0.301 (3.60), respectively. As expected, the use of interest rate instruments for hedge reduces the level of the underlying exposure (hypothesis 4b) and highly levered firms have higher expected costs of financial distress, which make them more vulnerable to interest risk fluctuations (hypothesis 5b).

Also, consistent with our hypothesis (hypothesis 4c) that firms use risk management instruments as a hedge, in the treatment effect regression we find a negative and significant relationship between the use of commodity hedging instruments and the absolute value of commodity-related exposure. The coefficient (*t*-statistic) is -0.337 (-2.08). Other studies report similar results, e.g., Tufano (1998) and Jin and Jorion (2006). In addition, the sensitivity for revenues from commodity operations is positive, as expected, however insignificant (hypothesis 5c).

The sign of all the coefficients on lambda (inverse Mill's ratio) are positive and statistically significant, indicating that the error term in the decision equation and the exposure equation are positively correlated. As a result, unobserved factors that make hedging with currency, interest rate, and commodity price instruments more likely to occur are associated with higher levels of exchange rate, interest rate, and commodity price exposure, respectively. These results are in line with the hypothesis 13a, hypothesis 13b, and hypothesis 13c.

When we hypothesize that an increase in hedging in one category of risk may reduce the exposure to risk in another category, we again take into account the *HEDGE* specification. Table 4.8 presents the results for the estimations of the equations (4.8), (4.9), and (4.10) with the *HEDGE* specification. It is clear from Table 4.8 (columns 6-8) that the results of the treatment effect regressions corroborate the existence of a significant

negative effect between the use of hedging instruments and the absolute value of exchange rate (hypothesis 6a), interest rate (hypothesis 6b), and commodity price exposure (hypothesis 6c). We also verify that all the estimated coefficients of the inverse Mill's ratios are positive and significant. Thus, these results confirm that self-selection is also important here. To be exact, the characteristics that induce a firm to be a hedger are positively related to the firms' financial exposures. Again, these results corroborate the hypothesis 13a, hypothesis 13b, and hypothesis 13c.

By examining the control variables on equations (4.5), (4.6), and (4.7), we verify that there exists variation for the determinants of each type of hedging instrument. The probit results indicate that size (*SIZE*) has a positive influence on hedging instruments' usage (columns 2-4 in Table 4.7), which seems to corroborate our hypothesis 11. This result is largely consistent with expectations: larger firms that have access to risk management expertise, or that have economies of scale in hedging costs, are more likely to hedge.

Also, as expected, the probit results indicate that financial leverage (*LEV*) has a significant positive effect on the use of interest rate hedging instruments (column 3 in Table 4.7). This result suggests that firms with a greater degree of financial distress engage more often in hedging activities. Several authors corroborate this prediction, e.g., Graham and Rogers (2002), Bartram *et al*. (2009), and Lel (2012).

Contrary to expectations, financial leverage (*LEV*) impacts negatively on the use of currency (column 2 in Table 4.7) and commodity (column 4 in Table 4.7) hedging instruments. However, the statistical significance is only achieved in the scope of currency hedging instruments. These results are in line with the ones of Allayannis and Ofek (2001), Carter *et al*. (2006), and Hagelin *et al.* (2007). Carter *et al.* (2006) argue that the financial distress argument is suitable if all the firms face identical costs of distress (if

distress occurs). Yet, if firms with greater distress costs optimally choose lower target debt ratios, then the observed results appear more reliable. Given the results, hypothesis 10 is only corroborated with regard to interest rate hedging instruments.

Also contrary to the expectations, the variable net operating losses (*TAX*) has a negative effect on the use of interest rate (column 3 in Table 4.7) and commodity (column 4 in Table 4.7) hedging instruments, but the negative effect is only statistically significant with regard to interest rate hedging instruments. This is in line with Graham and Smith (1999) that documented a tax disincentive to hedge when net operating losses exist, but limited to companies with expected losses. They documented that existing net operating losses provide a tax disincentive to hedge for companies with expected losses, but provide an incentive to hedge for companies that are expected to be profitable. In fact, variables based on existing net operating losses can work backwards for expected loss firms. Graham and Smith (1999) also show that the firms that are most likely to have convex tax functions are small, have expected income near to zero and alternate between profit and loss. In our sample, we can observe that firms that recently accumulate losses tend to be small, which suggests that these firms might find the fixed costs associated with hedging programmes implementation unaffordable, and as a result, not hedge at all. Summarizing, only the relationship between interest rate hedging instruments' usage and the tax variable was significant, but the sign was opposite to that predicted, which means that hypothesis 12 is not corroborated.

As for the firm-level governance index and the dividend dummy variable, they are generally in keeping with the expectations and previous empirical studies (column 2-4 in Table 4.7). Indeed, the degree of monitoring of managerial activities has an important effect on a firm's decision to use hedging instruments. Therefore, better governed firms are more likely to use hedging instruments in a way reliable with shareholder-value

maximization, which corroborates hypothesis 8, and is in line with the findings of Lel (2012). Also, firms with a lower dividend level, which could be associated with higher cash holdings, are less likely to implement exchange rate and interest rate hedging strategies, which corroborates hypothesis 9.

We find no significant relationship between hedging and the level of investment spending (hypothesis 7), and the sign of the relation is opposite to that predicted. This opposite sign is consistent with the findings of Clark and Judge (2008). Also Carter *et al.* (2006) and Haushalter (2000) do not achieve statistically significance regarding this variable.

Lastly, when we test if the increase in hedging in one category of risk reduces the exposure to risk in another category (*HEDGE* specification), we achieve more consistent results. Once more, we verify that: (1) larger firms are more prone to hedge (hypothesis 11); (2) better governed firms are more likely to hedge in a way consistent with shareholder-value maximization (hypothesis 8), and (3) firms with lower dividend payouts are less likely to hedge (hypothesis 9). The other firm level factors, such as firms' financing (hypothesis 10), investment level (hypothesis 7), and the shape of firms' tax schedules (hypothesis 12), do not appear to be important in the decision to use hedging instruments, despite the fact that in this specification the variable that represents the level of investment spending achieved, as expected, a positive relationship with hedging.

4.5 Conclusions and further directions

This study presents a comprehensive investigation of the financial risk exposures of European non-financial firms, based on the analysis of 567 firms during the period 2006-2008. We built on previous studies that have used multifactor market models to access the level of financial risk exposures (exchange rate, interest rate, and commodity price

exposure), all together. In addition, taking into consideration the influence of both internal and external hedging instruments, we extend the recent investigation on the determinants of such exposures, recognizing that financial risk exposure and hedging are endogenous.

We document that our sample firms exhibit higher percentages of exposure to the three categories of risk when compared to preceding empirical studies. In addition, we found evidence that the use of hedging-related instruments is a significant determinant of firm exposure to risk, but only when we consider the endogeneity of hedging activities. We also find reliable results when we consider that the increase in hedging in one category of risk reduces the exposure to risk in another category. By means of this specification, we can confirm, as expected, that hedging impacts negatively upon a firm's inherent exposures.

As for the association between a firm's operating profiles and inherent exposures, we only find evidence on the matter in the scope of interest rate risk. Moreover, the results confirm that self-selection is an important issue. In fact, the characteristics that induce a firm to be a hedger are positively related to the firm's financial exposures. Finally, in terms of the remaining determinants of hedging activities, we consistently verify that: (1) larger firms have a stronger tendency to hedge, which supports the economies-of-scale-in-hedging argument; (2) better governed firms tend to use hedging instruments in line with the firm value-maximization objectives, and (3) firms with a lower dividend level are less likely to hedge.

A possible limitation appointed to this kind of study is the fact that the measure of exposure used seeks to represent a net exposure, that is to say, the exposure that remains after the firm has engaged in some hedging activity. Nonetheless, the evidence up to now indicates that risk management instruments' usage by Euronext non-financial firms has a statistical and significantly negative effect on exposure levels. Without doubt this is direct

evidence that risk management instruments are actually used to hedge. But to clearly draw a picture of a firm's hedging behaviour regarding our data, we must also analyse the determinants of hedging decision. In light of this in the next section we proceed with the analysis of hedging determinants, emphasizing the need to control for firm-level governance structures.

CHAPTER 5

The use of risk management instruments and corporate governance

5.1 Introduction

Theories suggesting that corporate risk management is value-enhancing found support in the existence of capital market imperfections. They stated that: (1) by reducing the probability of bankruptcy and costly financial distress; (2) by fitting the need and availability of funds through coordinating investment and financing policies; (3) by fixing the level of taxable income, and (4) by reducing the costs associated with agency conflicts, risk management strategies can increase firm value (see section 2.3).

The role of hedging in attenuating or intensifying the agency problem, associated with separation of ownership and control, has originated a lot of controversy in the literature. While, some researchers argue that hedging reduces agency costs by reducing the underinvestment and asset substitution problems (e.g., Myers, 1977), others argue that divergent risk preferences exist between managers and shareholders. Consequently, managers may use the investing and financing policy of the firm, and also risk management to pursue their own risk preferences (e.g., Smith & Stulz, 1985; Tufano, 1996 and 1998).

Indeed, the empirical literature frequently recognizes the relationship between corporate hedging and managerial agency conflicts that arise from managerial risk preferences (see section 2.3.2). However, other important determinants of managerial agency conflicts exist, such as the level of monitoring of managerial activities (Lel,

2012), and have been rarely addressed in the literature. This different perspective concerning managerial agency conflicts brings to light the importance of governance structures on corporate hedging decisions. Therefore, corporate governance can be viewed as an important determinant of risk management activities (Lel, 2012).

Our work intends to more closely analyse the issue of what motivates the use of hedging instruments. In particular, we contribute to the bulk of empirical literature by deeply analysing the link between firm-level governance mechanisms and firms' use of hedging instruments. Our primary assertion relies on the fact that corporate governance and several other firm characteristics affect a firm's decision to hedge. Nonetheless, we have economic reasons to believe that some of the regressors of our model could be endogenously determined. Along this line, we have adjusted our estimation methodology to account for the fact that our endogenous variable of interest is binary and proceed with instrumental variables probit estimation.

Our study contributes to the existing literature in several ways. Firstly, in contrast to the bulk of empirical literature that commonly focuses on no more than one type of risk and on small industry-specific samples, we focus on financial risk as a whole and make use of a broader sample of non-financial firms across all industries. Secondly, we use as a proxy for hedging activities a variable that accounts simultaneously for the use/non-use of on-balance sheet and off-balance sheet hedging instruments, contrary to the majority of prior studies that tend to associate hedging activities solely with the use of derivatives. Thirdly, we draw on a firm-level governance index to deeply analyse the link between firm's governance structures and firm's use of hedging instruments. Finally, we rely on the assertion that hedging, corporate governance and other firm characteristics can be simultaneously undertaken. Hence, we expand the existing literature by applying the

AGLS and the 2SCML estimators to simultaneously assess effects across several variables.

The chapter is organized as follows: section 5.2 describes the research framework, which includes the development of the hypotheses and the definition of the statistical modelling. Sample and data description takes place on section 5.3. Section 5.4 presents and discusses the empirical results. Finally, section 5.5 summarizes and concludes the study.

5.2 Research framework: Development of the hypotheses and proposed model

The focus of our investigation is the analysis of the characteristics of corporations that engage in hedging activity, emphasizing the importance of firm governance structures. Our primary assertion relies on the fact that firm-level corporate governance and several other financial policies affect the firm's decision to hedge. However, based on results of preceding works and on economic reasons, we believe that hedging decisions must be considered simultaneously with governance decision and also with other financial decisions made by firms.

In the one hand, a higher score of the firm-level governance index (*CG_INT*) is expected to represent a higher level monitoring of managerial activities, which turns out in better-governed firms that are more likely to pursue value-maximizing hedging decisions (Lel, 2012). On the other hand, hedging can induce managers to invest larger stakes in the firm because it promotes the lowering of firm risk (Stulz, 1996) and in that way a firm's governance structure can be changed (Lel, 2012).

It was also suggested that agency costs of debt related to underinvestment or asset substitution problems are more evident in firms with more growth opportunities (e.g., Campello, Lin, Ma, & Zou, 2011; Haushalter, 2000; Myers, 1977), as these firms would

suffer most from failing to invest into the available profitable projects, and also have greater latitude in shifting their investments towards riskier assets. In addition, the coordinating financing and investment rationale is frequently tested along the same lines as the underinvestment or the asset substitution hypotheses at it also significantly depends on available growth opportunities (Froot *et al*., 2003). Hence, if risk management is used to protect the availability of funds to futures investment programmes, theory predicts a positive relationship between investment spending (*CAPEX*) and hedging (e.g., Haushalter, 2000). Alternatively, hedging can influence the investment level through their effect on the firm's ability to finance its investments (Lin & Smith, 2008).

Further, in our first empirical study (see chapter 4, section 4.4.3) it is observed that some unobserved factors that induce firms to hedge are positively associated with the firm's financial exposure (*EXP*). In this sense, it is expected that firms with a higher level of exposure to financial risk engage more often in hedging activities. Several other researchers support this point of view (e.g., Hagelin *et al*., 2007). However, as outlined in the results from our first empirical study (see chapter 4, section 4.4.3) and also in line with several other studies (Allayannis & Ofek, 2001; Bartram *et al*., 2010; Hagelin & Pramborg, 2004), the use of hedging instruments can reduce the firm's exposure to financial risk.

Lastly, it is expected that firms with a greater degree of financial distress engage more often in hedging activities (e.g., Lel, 2012; Smith & Stulz, 1985). To proxy for the probability of financial distress, we use leverage (*LEV*). However, as highlighted before (see section 2.3.1.2), several pieces of research have advanced the possibility that hedging allows firms to increase their debt capacity by reducing the probability of default associated with higher debt (Stulz, 1996; Graham & Rogers, 2002).

In the four preceding set of arguments the possibility of endogeneity, specifically reverse causation, between the firm hedging behaviour and firm-level governance structures, firm investment policy, firm financing policy, and firm exposure to financial risk are revealed to exist. However, despite the straightness of these arguments we cannot proceed to the definition of our empirical framework without making a pre-assessment in our empirical setting about the endogeneity between these firm decisions. So, in advance, we performed a simple test of endogeneity by regressing each of the variables suspected to be endogenous on the set of the other endogenous regressors.[44] This procedure gives us a clearly indication of the causal relationships between the possible endogenous variables. We only validate our suspicious of endogeneity on the scope of the firm's corporate governance and investment decisions.

If interest is in firms' hedging behaviour alone, we could simply estimate this model directly. However, as discussed above, this is very likely to be problematic given the endogeneity between hedging, governance and investment decisions. In this sense a correlation between the error term, and governance and investment variables would be expected. In this context the coefficient estimates of the hedging model would be biased and a simultaneous equations model should be employed. We argue that is important to model jointly the firm hedging and governance behaviour, and the firm investment spending set. Hence, analytically our structural system of equations is defined as follows:

$$\begin{aligned} HEDGE_i = {} & \alpha_{10} + \alpha_{11} \cdot CG\_INT_i + \alpha_{12} \cdot CAPEX_i \\ & + \beta_{11} \cdot DIV_i + \beta_{12} \cdot EXP_i + \beta_{13} \cdot LEV_i + \beta_{14} \cdot SIZE_i + \beta_{15} \cdot TAX_i \\ & + \sum_{j=1}^{8} \beta_{15+j} \cdot IND_i + \varepsilon_i \end{aligned} \tag{5.1}$$

[44] The regressions estimated are as follows:

$$HEDGE_i = \alpha_0 + \alpha_1 \cdot CG\_INT_i + \alpha_2 \cdot CAPEX_i + \alpha_3 \cdot EXP_i + \alpha_4 \cdot LEV_i + \varepsilon_i$$
$$CG\_INT_i = \alpha_0 + \alpha_1 \cdot HEDGE_i + \alpha_2 \cdot CAPEX_i + \alpha_3 \cdot EXP_i + \alpha_4 \cdot LEV_i + \varepsilon_i$$
$$CAPEX_i = \alpha_0 + \alpha_1 \cdot CG\_INT_i + \alpha_2 \cdot HEDGE_i + \alpha_3 \cdot EXP_i + \alpha_4 \cdot LEV_i + \varepsilon_i$$
$$EXP_i = \alpha_0 + \alpha_1 \cdot CG\_INT_i + \alpha_2 \cdot CAPEX_i + \alpha_3 \cdot HEDGE_i + \alpha_4 \cdot LEV_i + \varepsilon_i$$
$$LEV_i = \alpha_0 + \alpha_1 \cdot CG\_INT_i + \alpha_2 \cdot CAPEX_i + \alpha_3 \cdot EXP_i + \alpha_4 \cdot HEDGE_i + \varepsilon_i$$

$$CG\_INT_i = \alpha_{20} + \alpha_{21} \cdot HEDGE_i + \alpha_{22} \cdot CAPEX_i + \beta_{21} \cdot ADR_i + \beta_{22} \cdot CG\_EXT_i + \beta_{23} \cdot LEV_i + \beta_{24} \cdot SIZE_i + \sum_{j=1}^{8} \beta_{24+j} \cdot IND_i + \varepsilon_i \quad (5.2)$$

$$CAPEX_i = \alpha_{30} + \alpha_{31} \cdot HEDGE_i + \alpha_{32} \cdot CG\_INT_i + \beta_{31} \cdot CASH_i + \beta_{32} \cdot LEV_i + \beta_{33} \cdot SIZE_i + \sum_{j=1}^{8} \beta_{33+j} \cdot IND_i + \varepsilon_i \quad (5.3)$$

To examine the cross-sectional relation between a firm's hedging decision and their governance and financial characteristics, the dependent variable in our main equation (equation 5.1) is *HEDGE*, a dummy variable which is assigned a value of 1 if a firm uses either external or internal hedging instruments and 0 otherwise. As already discussed, it is expected that hedging behaviour depends on the firm choices on governance and on investment matters, as well as an additional set of the exogenous control variables made known in the optimal hedging theory presented in section 2.3.

Stulz (1984) and Smith and Stulz (1985) focus on managerial risk aversion as a justification for risk management. They argue that risk adverse managers tend to use hedging if they have relatively undiversified financial and human capital, and if it is costly to hedge on their own account. As a result, managers may be particularly interested in maximizing their personal utility instead of creating shareholder value. In light of this, theory states that a firm with a high governance level assures effective monitoring of management activities, which in turn increases the likelihood of derivatives' use for hedging purposes. This builds on the recent body of literature that acknowledges the role of governance structures on hedging policies (e.g., Allayannis *et al.*, 2012; Lel, 2012). Regarding the variables used to measure the level of managerial agency costs, several authors have proposed measures of specific governance mechanisms. For example, Hagelin *et al.* (2007) analyse the impact of CEO shareholdings on hedging decision, namely when the CEO is the largest shareholder or when he/she comes from the family

which is the largest shareholder in the firm. Instead, Lel (2012) addresses the impact of firm-level corporate governance on the determinants of firms' use of derivatives through the use of a variable that seeks to measure in aggregate the quality of governance. Following Lel (2012), we proxy for the level of monitoring of managerial activities with a firm-level governance index comprising seven governance mechanisms that take into account two governance dimensions: (1) board matters and (2) ownership structure (see section 3.5.1). The main hypothesis to be tested is:

HYPOTHESIS 1a: Better governed firms are more likely to use hedging instruments in a way that is consistent with value-maximizing theories of hedging.

When a firm has high financial leverage and its cash flows are volatile, suboptimal investment behaviour can arise – the so-called problem of underinvestment. That is managers acting in the interest of shareholders may have an incentive to reject projects with positive NPV, since shareholders have to pay for the whole investment, whereas the returns from the investment accrue first to bondholders. This situation leads to overall firm value decline. So, corporate hedging by shifting cash flows from states in which cash flows are sufficient to states where cash flows are insufficient to meet the firm obligations can create value to shareholders. This can be achieved because the future states in which shareholders are the residual claimants increase, which means that shareholders will be less inclined to underinvest (Bessembinder, 1991). Froot *et al.* (1993) provide an alternative explanation for the underinvestment problem, in which hedging can increase shareholder value through harmonization of financing and investment policies. They suggest that, due to cash flow volatility imposed by financial risks, a shortfall in internal funds induces firms to reject positive NPV projects in order to avoid a very costly visit to the capital market. Since hedging can reduce cash flow volatility, it enables the firm to control the need for and the availability of internal funds to pursue optimal investment projects, thus avoiding underinvestment. Moreover, hedging also allows negotiating better

contract terms and as a consequence lowering borrowing costs (Smith & Stulz, 1985). This is the case when firms can experience agency costs of debt arising from the so-called asset substitution problem or risk shifting problem (Jensen & Meckling, 1976). Thereby, if firms are able to credibly pre-commit on a hedging strategy, the situation described above can be reduced or even avoided. Consequently, if hedging reduces the bondholders' expected loss conditions, it will reduce the required rate of return of debt financing and the existence of restrictive bond covenants.

The theoretical analysis provided above has revealed that hedging can enhance firm value if it can decrease the agency costs of debt. It was predicted that these agency costs of debt are more evident in firms with more growth options, as these firms could have a high probability of underinvestment or asset substitution (e.g., Campello *et al*., 2011; Haushalter, 2000; Myers, 1977). Among the proxies which measure the existence and magnitude of available growth opportunities is the firms' capital expenditures (e.g., Bartram *et al*., 2009; Clark and Judge, 2008; Hagelin *et al*., 2007; Haushalter, 2000; Lin & Smith, 2008). Hagelin *et al.* (2007), justify that firms with more valuable growth opportunities are likely to invest more. So, we use the ratio of capital expenditures to total assets (*CAPEX*) to proxy for investment spending and hypothesize that:

HYPOTHESIS 1b: Firms with a higher level of investment spending are more prone to hedge.

In addition, the presence of liquid assets could reduce the need for hedging with derivatives (e.g., Davies *et al*., 2006; Géczy *et al*., 1997; Marsden & Prevost, 2005; Nance *et al*., 1993; Tufano, 1996). The common approach consists of using measures of liquidity or the dividend yield. In fact, holding cash or other liquid assets allows firms to cover temporary shortfalls in revenues and to fulfil short-term liabilities. As a result, the probability of encountering financial distress is reduced. Indeed, low dividend payouts could provide more liquidity. The empirical implication of this argument is that firms with

higher cash holdings or lower dividend payouts are less likely to hedge (e.g., Berkman & Bradbury, 1996; Nance *et al.*, 1993). We control for liquidity through dividend yield dummy (*DIV*) and predict:

HYPOTHESIS 1c: Firms with a lower dividend level are less likely to hedge.

A firm with greater variation in cash flows or a greater fraction of their revenues exposed to the risk considered, has greater potential benefits from hedging. We use an exposure variable that seeks to control for financial risk as a whole (exchange rate, interest rate, and commodity price risk). In advance, and in line with Bartram *et al.* (2009), we have classified the firms as being exposed to foreign exchange, interest rate, and commodity price exposure. This is accomplished throughout an augmented market model that includes returns on the exchange rate index, changes on the interest rate factor, and returns on the commodity index, estimated in chapter 4, section 4.4.1. Then we take into account the absolute value of each exposure and define dummy variables that identify high exchange rate exposure for firms with absolute exposure above the inherent sample median exposure, and the same for high interest rate and high commodity price exposure. Finally, we create a "general high exposure" dummy variable (*EXP*) that is equal to 1 if any of the FX, IR, or CP exposure dummy variables is equal to 1. The exposure argument usually provides strong empirical evidence (e.g., Géczy *et al.*, 1997; Hagelin *et al.*, 2007; Purnanandam, 2008). Therefore, the hypothesis to be tested is as follows:

HYPOTHESIS 1d: Firms indicating a higher level of exposure to financial risk have the chance of greater potential benefits from hedging.

The larger the debt relative to firm value and the variability of cash flows, the higher the probability of financial distress, as both factors increase the probability of winding up in bankruptcy in the future. Indeed, since the future cash flows of the firm are subject to uncertainty, situations can arise where a firm cannot, or is expected not to, fully and timely meet its fixed payment obligations. This illiquidity condition originates transaction

costs of financial distress (Warner, 1977). Under this assumption, hedging by reducing the volatility of cash flows, and thus lowering the likelihood of financial distress and the related deadweight costs that arise between bondholders and shareholders, can contribute to maximizing a firm's value (Smith & Stulz, 1985). To proxy for the probability of financial distress, we use leverage (*LEV*), which is measured by debt ratio (e.g., Berkman & Bradbury, 1996; Gay & Nam, 1998; Graham & Rogers, 2002). Most studies stated that higher leverage leads to higher probabilities of encountering financial distress and thus interpret a positive leverage coefficient as evidence that greater leverage increases the likelihood of hedging (e.g., Bartram *et al.*, 2009; Berkman & Bradbury, 1996; Graham & Rogers, 2002; Haushalter, 2000; Judge, 2006; Lel, 2012; Smith & Stulz, 1985). The hypothesis to be tested is:

HYPOTHESIS 1e: Firms with a greater degree of financial distress, thereby with a higher level of debt, are more likely to engage more often in hedging activities.

Moreover, we use the natural logarithm of the total assets (*SIZE*) to control for firm size. Nance *et al.* (1993) argue that corporate risk management may be positively related to firm size because economies of scale may apply to the operative and transaction costs of hedging. However, taking financial distress hypothesis into account, the authors predict that smaller firms deal with relatively high costs of financial distress, so it is also possible that they are more likely to hedge. This is in line with the view of Warner (1977), where direct costs of bankruptcy are less than proportional to firm size. Also, the tax motivation hypothesis predicts a negative relation between size and hedging, on the assumption that smaller firms are more likely to have taxable income in the progressive region of the tax schedule (Graham & Smith, 1999). Thus, the effect of firm size on hedging activities is uncertain and shall be empirically determined:

HYPOTHESIS 1f: Firm size is expected to be associated with the likelihood of hedging.

Smith and Stulz (1985) suggest that if pre-tax income is subject to a convex tax function, then the volatility of pre-tax income is costly to the firm. In this case, hedging taxable income by reducing the variability of pre-tax income reduces a firm's expected tax liability and consequently increases the expected post-tax value of the firm, as long as the hedging costs do not exceed its benefits. In this context Smith (1995) considered three general sources of effective tax function convexity for firms: tax rate progressivity, the existence of a minimum tax, and limitations on the use of tax credits, the so-called tax preference items. From the preceding analysis, it follows that the benefits of hedging should be greater i) the higher the probability the firm's pre-tax income is in the progressive region of the tax schedule; ii) the greater the firm's tax loss carry forwards is, and iii) the greater the firm's other tax credits are. The vast majority of the variables that are used to test the relation between taxes and derivatives' usage are based on the existence of net operating losses (e.g., Géczy *et al*., 1997; Howton & Perfect, 1998; Marsden & Prevost, 2005; Nance *et al.*, 1993; Tufano, 1996). In light of this, we use the ratio of net operating losses to total assets (*TAX*) as a proxy for the convexity of a firm's tax schedules. The hypothesis to be tested is as follows:

HYPOTHESIS 1g: If the firm incurs tax losses which will be carried forward, the probability of the firm's engagement in hedging will be higher.

In line with the hypothesis predicted above, the coefficients of endogenous variables (α_{11} and α_{12}) in equation (5.1) are all expected to be positive. Regarding the exogenous control variables, β_{11}, β_{12}, β_{13}, and β_{15} are expected to be positive and β_{14} could be either positive or negative.

The governance model (equation 5.2) uses the firm-level governance index (*CG_INT*) as the dependent variable. As already discussed, we expect that *CG_INT* depends on the firm's hedging behaviour, because hedging by decreasing the firm's financial risk can induce a higher level of insider shareholding and in that way a firm's

governance structure can be changed (Lel, 2012). Indeed, in accordance with the management entrenchment hypothesis, when managers accumulate stock, the capability of outside investors to monitor managerial non-value activities decreases; so, they are in a better position to become entrenched.[45] In that way a firm may be forced to improve their governance structure. Therefore, we expect that hedging instruments' use (*HEDGE*) has a positive effect on *CG_INT*.

We also expect that *CG_INT* depends on the firm's investment and financing choices, as well as on additional exogenous control variables. Therefore, firms with good growth opportunities are expected to need to raise external financing, but to obtain any external financing they are forced to improve their governance structure. This is because better governed firms increases investors' willingness to provide financing and this should be reflected in lower costs and greater availability of external financing (Klapper & Love, 2004). As for *HEDGE*, we expect again a positive relationship between *CG_INT* and investment (*CAPEX*), and financing (*LEV*) proxies.

Firms issuing American Depository Receipts in the US are subject to stricter governance listing requirements, so these firms are expected to have better corporate governance rankings. To test this prediction, we include a dummy variable that is assigned a value of 1 if a firm is issuing American Depositary Receipts in the US (*ADR*), and 0 otherwise (Beiner *et al.*, 2006). We also include as a control variable a country-level corporate governance index (*CG_EXT*). This index is computed as the common factor derived from a principal component analysis of five measures of country-level governance mechanisms (see section 3.5.2). La Porta *et al.* (2002) point out the view that firms located in countries with a weak legal environment may not have much flexibility to improve their own investor protection and consequently have weak firm-level governance

[45] On this matter, Morck *et al.* (1988), among others, documented an inverted U-shaped relationship between insider ownership and firm performance. Namely, they find a negative ownership-performance relationship when managerial ownership is in the range of 5% to 25%.

structures. In reverse, according to Klapper and Love (2004), it is possibly to observe better firm-level governance in countries with poorly legal systems as these firms would be more in "need" of good governance mechanisms to compensate for their poorly legal systems.

Finally, we analyse the effect of *SIZE* in *CG_INT*. On the one hand, it is recognized that larger firms may have greater agency costs and therefore need to enforce their governance structures; in contrast, small firms may have better growth opportunities, and in line with the investment argument, may therefore find it optimal to improve their governance (Beiner *et al.*, 2006). In accordance with the arguments offered above, the coefficient of endogenous variables α_{21} and α_{22} in equation (5.2) are expected to be positive. With regard to the exogenous control variables, β_{21} and β_{23} are expected to be positive. Moreover, β_{22} and β_{24} might be either positive or negative. In summary the hypotheses to be tested are:

HYPOTHESIS 2a: Firms that hedge are associated with a higher quality of firm-level governance structures.

HYPOTHESIS 2b: Firms with more growth options are expected to improve their governance structures.

HYPOTHESIS 2c: Firms issuing American Depository Receipts are expected to have better governance ratings.

HYPOTHESIS 2d: Country-level governance provisions influence firm-level governance performance.

HYPOTHESIS 2e: Firms with more external financing are expected to improve their governance structures.

HYPOTHESIS 2f: The size of the firm is expected to influence firm-level governance performance.

Finally, the investment model (equation 5.3) uses capital expenditures (*CAPEX*) as the dependent variable. Ross (1996) argues that hedging to increase leverage may not mitigate the underinvestment problem, since if firms increase debt capacity after hedging

then this higher leverage increases the agency cost of debt that, in turn, leads to the incentive for underinvestment. So, we expect that *LEV* impacts *CAPEX* negatively (Lin & Smith, 2008), however, as for the expected relation between *HEDGE* and *CAPEX*, another hypothesis has to be considered: hedging reduces the incidence of investment restrictions on loan agreements, and, at the same time, reduces the costs of external financing, which should give the firm greater flexibility in its investment decisions. Testing this hypothesis Campello *et al.* (2011) find that hedgers are able to invest more than non-hedgers. Therefore, from a theoretical point of view, the effect of *HEDGE* on a firm's capital expenditures is ambiguous.

Following Bauer, Braun and Clark (2008), we predict that firms with higher overall scores on corporate governance should be more prudent on investment spending, which leads to a negative relation between *CG_INT* and *CAPEX*.

Again, we predict that small firms should have greater future investment opportunity sets (Lin & Smith, 2008). Finally, we include the cash flow (*CASH*) variable to proxy for the availability of funds and predict that a higher level of *CASH* implies a higher level of investment (Lin & Smith, 2008).

In accordance with the arguments just presented, the coefficient of the endogenous variable α_{32} in equation (5.3) is expected to be negative, and the coefficient α_{31} could be either positive or negative. With regard to the exogenous control variables, β_{31} is expected to be positive, and β_{32} and β_{33} are expected to be negative. Therefore, we test the following hypotheses:

HYPOTHESIS 3a: The implementation of a hedging programme at the firm level should have an impact in its investment spending.

HYPOTHESIS 3b: Firms with higher governance ratings should be more prudent on investment spending.

HYPOTHESIS 3c: Firms with a higher level of cash should have a higher level of investment.

HYPOTHESIS 3d: Firms with higher leverage should have an incentive for underinvestment.

HYPOTHESIS 3e: Small firms have probably more future investment opportunities.

Lastly, to control for differences in hedging behaviour between industries, we include eight industry dummy variables (*IND*) in all three equations of our system.

Our system of equations includes 8 exogenous, not accounting for the eight industry dummy variables, and three endogenous variables. The order condition for identification states that if an equation is to be identified, the number of predetermined variables excluded from the equation must be greater than, or equal to, the number of the included endogenous variables minus 1. Therefore, at least two of the exogenous variables must be excluded from any single equation to identify the system. Regarding the order condition for identification, all the equations of our system are over-identified.

To verify the rank condition we use Table 5.1, Panel A, in which "×" indicates a variable appears in the given equation and "0" indicates a variable does not appear in the given equation. As a result, Panel A exhibits the 3×11 matrix of 0's and ×'s. For each equation *i* we first select the columns corresponding to the variables that do not appear in the equation *i*. From this submatrix we delete row *i*. If the remaining submatrix has rank greater than the number of the included endogenous variables minus 1, then the rank condition is satisfied for the equation and the parameters of the equation are identified.

Panel B shows the submatrix inherent to hedging equation. Panel C shows the submatrix inherent to governance equation. Panel D shows the submatrix inherent to investment equation. From the analysis, we conclude that in each of the submatrix the two rows are linearly distinct. So, in each of the submatrix the rank is 2 and all the equations are identified.

Table 5.1: **Rank condition for identification**

Panel A. Main matrix of 0's and ×'s											
	Variables										
Equations	1	2	3	4	5	6	7	8	9	10	11
Hedging	×	×	×	×	×	×	×	×	0	0	0
Governance	×	×	×	0	0	×	×	0	×	×	0
Investment	×	×	×	0	0	×	×	0	0	0	×
Panel B. Relevant submatrix of hedging equation											
				×	×	0					
				0	0	×					
Panel C. Relevant submatrix of governance equation											
				×	×	×	0				
				0	0	0	×				
Panel D. Relevant submatrix of investment equation											
			×	×	×	0	0				
			0	0	0	×	×				

Note. Panel A Variables are as follows: (1) HEDGE is a dummy which is assigned a value of 1 if a firm reports the use of either external and/or internal hedging instruments; (2) CG_INT is a firm-level internal governance index comprising seven governance mechanisms that take into account two governance dimensions: board matters and ownership structure; (3) CAPEX is the ratio of capital expenditures to total assets; (4) DIV is a dummy which is assigned a value of 1 if the firm dividend yield is greater than the median yield for the sample; (5) EXP is a dummy which is assigned a value of 1 if the firm has either FX, IR or CP exposure above the median exposure for the sample; (6) LEV is the ratio of total debt to total assets; (7) SIZE is the natural logarithm of total assets; (8) TAX is the net operating losses to total assets; (9) ADR is a dummy which is assigned a value of 1 if a firm is issuing American Depository Receipts; (10) CG_EXT is a country-level governance index which is computed as the common factor derived from a PCA of five measures of country-level governance mechanisms, and (11) CASH is the ratio of EBITDA minus the sum of tax, interest expenses, and common dividend to total assets.

As uncovered before, our structural system of equations takes into account the mix of two different types of dependent variables in the model, one discrete choice variable (*HEDGE*) and two continuous variables (*CG_INT* and *CAPEX*). This special case of cross-sectional limited dependent models with endogenous explanatory variables is discussed in Amemiya (1978), Maddala (1983), Newey (1987), and Rivers and Vuong (1988).[46] These authors suggest two types of consistent instrumental variables estimators. First, Amemiya's Generalized Least Squares (Amemiya, 1978; Maddala, 1983; Newey, 1987) later on labelled AGLS, and second, Two-Stage Conditional Maximum Likelihood

[46] Most of the discussion of the econometric problems associated with multi-equation models with reciprocal causation has focused on models with continuous dependent variables. However, 2SLS and 3SLS estimators do not formally account for discrete endogenous variables.

(Rivers & Vuong, 1988), labelled 2SCML. Even though simultaneous equations systems that involve limited and discrete dependent variables are used commonly in economics, sociology and the political science literature, it has been rarely applied in the context of hedging literature.[47]

In advance, to test for the presence of endogeneity, we follow Adkins *et al*. (2007) and apply the 2SCML. The idea behind the 2SCML approach is to model the endogenous continuous regressors as a linear function of the exogenous regressors and some instruments. The parameters from these reduced-form equations are then used to generate the residuals, which are included in the structural probit equation as additional variables with corresponding parameters to be estimated at the second-stage probit. Rivers and Vuong (1988) conclude that the 2SCML performs reasonably when compared to the maximum likelihood estimator when instruments are classified as being very strong. However, they did not assess the behaviour of 2SCML estimator when instruments are weak. Alvarez and Glasgow (2000) analysed the properties of 2SCML using Monte Carlo simulations and conclude that the model performs very well in large samples. In addition, the 2SCML model offers an explicit statistical test for endogeneity. Rivers and Vuong (1988) suggest a test analogous to the usual Wald test - the likelihood ratio test - that has a chi-square distribution with degrees of freedom equal to the number of endogenous variables in the probit equation. In effect, the likelihood ratio test will be the test statistic associated with the exogeneity null hypothesis. If the null hypothesis cannot be rejected, we should use the estimates from standard probit in equation (5.1). In contrast, if the null hypothesis that *CG_INT* and *CAPEX* are exogenous is rejected, we then estimate the hedging regression (equation 5.1) by using the AGLS and the 2SCML estimators.

[47] To the best of our knowledge, the two exceptions are Lin and Smith (2008), and Adkins, Carter and Simpson (2007). This last study is applied to financial firms.

Unfortunately, Stata does not run second-stage estimations from the governance model (equation 5.2) and investment model (equation 5.3), so we recovered the structural parameters of these models by using the SUR framework. Within a context of 2SCML estimation, Gilbert and Oladi (2012) have suggested the use of a standard approach to simultaneous equations – 2SLS or 3SLS – to recover the parameters of the additional structural equations. Yet, such models can be combined into multi-equation systems in which the errors share a multivariate normal distribution. The literature has historically focused on multi-stage procedures for estimating mixed models, which are more efficient computationally, if less so statistically (e.g., Maddala, 1983, chapters 7 and 8), than maximum likelihood. While SUR is not a true maximum likelihood estimator, it converges to the same solution as maximum likelihood-based SUR.

The AGLS estimator implies the same first-stage regression as the 2SCML, but the second-stage is somewhat different. As before, the residuals from reduced-form equations are included as additional explanatory variables. In addition, observed values from endogenous explanatory variables are replaced by its reduced-form predicted values. Since the second-stage of AGLS involves the use of predicted values, the standard errors of the second estimates need to be corrected. For this estimation the Stata (version 10.1) is used and it relies on Newey's (1987) formulae to correct for standard errors. Yet, estimation of 2SCML is obtained through Gretl (version 1.9.1).

5.3 Sample selection and descriptive statistics

Our sample consists of all non-financial firms listed in Euronext described in chapter 3 and is the same as that used in the study in chapter 4. Table 5.2 presents summary statistics for proxies related to incentives for hedging and tests the means of these variables for hedgers and non-hedgers.

Table 5.2: **Comparison of means for hedgers and non-hedgers**

Variables	Hedgers (N = 456)			Non-hedgers (N = 111)			*t*-statistic[a]
	Mean	Median	Std. dev.	Mean	Median	Std. dev.	
CAPEX	0.057	0.043	0.054	0.050	0.024	0.086	-0.007
CG_INT	3.482	4.000	1.594	3.135	3.000	1.609	-0.347**
DIV	0.537	1.000	0.499	0.342	0.000	0.477	-0.195***
EXP	0.754	1.000	0.431	0.784	1.000	0.414	0.293
LEV	0.243	0.227	0.182	0.242	0.148	0.521	-0.001
SIZE	17.797	18.414	3.858	16.077	17.319	3.082	-1.719***
TAX	0.014	0.000	0.058	0.026	0.000	0.074	0.012*

Note. The table reports summary statistics for proxies related to incentives for hedging. Statistics reported are obtained through Stata (version 10.1). Variables are as follows: CAPEX is the ratio of capital expenditures to total assets; CG_INT is a firm-level internal governance index comprising seven governance mechanisms that take into account two governance dimensions: (1) board matters and (2) ownership structure; DIV is a dummy which is assigned a value of 1 if the firm dividend yield is greater than the median yield for the sample; EXP is a dummy which is assigned a value of 1 if the firm has either FX, IR or CP exposure above the median exposure for the sample; HEDGE is a dummy which is assigned a value of 1 if a firm reports the use of either external and/or internal hedging instruments; LEV is the ratio of total debt to total assets; SIZE is the natural logarithm of total assets, and TAX is the net operating losses to total assets. *t*-statistics are given for tests of the equality of means between hedgers and non-hedgers. ***, **, and * denote statistical significance of the *t*-test at the 1%, 5%, and 10% levels, respectively.

[a] *t*-tests assume equal variances.

From the analysis, we find that hedgers are larger (*SIZE*), have a higher dividend yield (*DIV*), therefore less liquid assets, and exhibit more quality of firm-level governance (*CG_INT*) than do non-hedgers. Contrary to expectations, we also find that hedgers have less tax losses carry forward (*TAX*). These univariate results provide some preliminary support for a few of our main hypotheses. In the next section more rigorous tests will be performed.

Table 5.3 presents the Pearson correlation matrix for proxies related to incentives for hedging. The pair-wise correlations are generally low. The highest correlation coefficient takes place between firm-level governance index (*CG_INT*) and firm size (*SIZE*), and is around -0.339, which suggests that small firms may have better growth opportunities, and in line with the investment argument, may therefore adopt better governance structures (Beiner *et al*., 2006). Moreover, we also find a negative and

significantly correlation (-0.258) between the tax variable (*TAX*) and the dividend yield dummy (*DIV*). This relation is as expected. Indeed, it is unusual the payment of dividends in companies with tax losses carry forward.

Table 5.3: **Pearson pair-wise correlation coefficient matrix**

Variables	CAPEX	CG_INT	DIV	EXP	LEV	SIZE	TAX
CAPEX	1.000						
CG_INT	-0.012	1.000					
DIV	-0.014	-0.029	1.000				
EXP	-0.020	0.086**	-0.158***	1.000			
LEV	0.047	0.037	-0.015	0.001	1.000		
SIZE	0.004	-0.339***	0.194***	-0.043	0.016	1.000	
TAX	0.058	0.076*	-0.258***	0.032	-0.031	-0.196***	1.000

Note. The coefficients of correlation are obtained through Stata (version 10.1). This table provides the Pearson correlation matrix for the explanatory variables used in probit regression of hedging decision and the associated significance levels. Variables are as follows: CAPEX is the ratio of capital expenditures to total assets; CG_INT is a firm-level internal governance index comprising seven governance mechanisms that take into account two governance dimensions: (1) board matters and (2) ownership structure; DIV is a dummy which is assigned a value of 1 if the firm dividend yield is greater than the median yield for the sample; EXP is a dummy which is assigned a value of 1 if the firm has either FX, IR or CP exposure above the median exposure for the sample; LEV is the ratio of total debt to total assets; SIZE is the natural logarithm of total assets, and TAX is the net operating losses to total assets. The significance levels are indicated by *, **, and *** that represent 10%, 5%, and 1% level, respectively.

Two more interesting results are: (1) the positive and significant correlation (0.194) between firm size (*SIZE*) and the dividend yield dummy (*DIV*), which corroborates Mitton's (2004) view that larger firms have higher dividends, and (2) the negative and significant correlation (-0.196) between firm size (*SIZE*) and the tax variable (*TAX*). In fact, according to Graham and Smith (1999), firms that are most likely to have convex tax functions are small, have expected income near to zero, and alternate between profit and loss.

5.4 Results and discussion

5.4.1 The effect of governance on hedging: Instrumental variables probit approach

Standard probit regression for the hedging model results may be misleading because they ignore the possible interdependences between firm hedging policy, firm-level

governance practices and firm investment policy. Thus, because *CG_INT* and *CAPEX* are believed to be endogenously determined, instrumental variables estimation is used to estimate the hedging model (equation 5.1). As stated before, Stata does not run second-stage estimations from the governance model (equation 5.2) and investment model (equation 5.3), so we use the SUR estimator to recover the structural parameters of these two models. In advance, we must evaluate the validity of the instruments to be used. Then, we analyse explicitly the endogeneity of the instrumented variables (governance and investment) that in general can be misleading if the instruments are not valid.

To put into practice IV estimation we have defined a set of instrumental variables, which affect each endogenous explanatory variable, but not, at least directly, the likelihood of hedging instruments' use. We use two potential variables to instrument *CG_INT*: (1) a dummy variable that assigned the value of 1 if a firm is issuing American Depository Receipts in the US (*ADR*), and 0 otherwise, and (2) a country-level governance index that is computed as the common factor derived from a PCA of five measures of country-level governance mechanisms (see section 3.5.2). Finally, we use cash flow (*CASH*) as a potential instrument for *CAPEX*.

A valid instrument has a strong correlation with the endogenous variable (instrument relevance), but is not correlated with the error term of the structural equation (instrument exogeneity). However, in reality it is extremely difficult to find such instruments. Therefore, most empirical studies work with imperfect instruments. These imperfect instruments are either exogenous, but have a low correlation with the endogenous variable of interest (the so-called weak instruments) or are not exogenous but have a high correlation with the endogenous variable (the so-called quasi-instrumental variables).

In order to test for the relevance (correlation with the endogenous variable) we use the first-stage regression of governance and investment models. Therefore, Table 5.4 presents the summary results from reduced-form governance and investment models.

Table 5.4: **Relevance and exogeneity of the instruments**

	Dependent variables	
Instrumental variables	**CG_INT**[a]	**CAPEX**[a]
ADR	0.228	0.008
CASH	-0.593	0.213***
CG_EXT	0.521***	-0.002
Relevance Tests:		
Shea's Partial R^2	0.16	0.11
F test for IV significance (H_0: The instruments are weak)	17.97***	6.25***
Minimum eigenvalue test (Stock & Yogo, 2005)[b] (H_0: The instruments are weakly correlated to the endogenous variable)	23.40**	
Overidentifying restrictions test:[c]		
Sargan test χ_1^2 (H_0: The error term is uncorrelated with the instruments)	1.17	

Note. The estimates reported here are obtained through Stata (version 10.1). The table summarizes the instrumental variables results as of the reduced-form equations. The endogenous variables are as follows: CG_INT is a firm-level internal governance index comprising seven governance mechanisms that takes into account two governance dimensions: (1) board matters and (2) ownership structure; CAPEX is the ratio of capital expenditures to total assets; The instrumental variables are as follows: ADR is a dummy which is assigned a value of 1 if a firm is issuing American Depository Receipts; CASH is the ratio of EBITDA minus the sum of tax, interest expenses and common dividend to total assets; CG_EXT is a country-level governance index which is computed as the common factor derived from a PCA of five measures of country-level governance mechanisms. The significance levels are indicated by *, **, and *** that represent 10%, 5%, and 1% level, respectively.

[a] The results for the other explanatory variables have been suppressed to preserve space. [b] For a significance level of 5%, two potentially endogenous regressors, three instruments and tolerating a bias of 10% of IV estimator relative to OLS, the critical value is 13.43. [c] We perform a Sargan test based on a two-stage least squares estimator.[48]

We now focus on the results obtained for the reduced-form for each endogenous explanatory variable (*CG_INT* and *CAPEX*). In Table 5.4 we provide the test for the relevance and exogeneity of the instrumental variables. Namely, we report the instrument coefficient estimates, their significance levels, the Shea's partial R^2 and the *F* statistic of the joint test of instrument significance for each reduced-form equation. However,

[48] We are not aware of any similar statistics for testing instruments that explicitly accounts for a dummy endogenous variable.

because our tests include more than one endogenous regressor in the structural model, we should report the minimum eigenvalue of the matrix analogous of the *F* statistic that is defined in Stock and Yogo (2005) as a test of weak instruments. So, the null hypothesis to this test is that instruments are weak against the alternative that they are strong.

Further, we perform the Sargan test as a test of the exogeneity of the instruments. The fact that the number of instruments exceeds the number of endogenous regressors, i.e., the model is overidentified, allows testing whether the instruments are uncorrelated with the error term from the main equation (i.e., they are exogenous). It is tested whether all instruments are exogenous assuming that a least one of the instruments is exogenous. So, the null hypothesis is that the error term is uncorrelated with the instruments, i.e., the instruments are exogenous.

Concerning the relevance tests, the *F* tests of the significance of the instruments for each reduced-form equation reported in Table 5.4 tells us that that the instruments are always significant. Further, the partial Shea (1997) R^2s all exceed the suggested ("rule of thumb") hurdle of 10%. The Stock-Yogo weak identification test has a value of 23.40 (Cragg-Donald *F*-test), which is higher than the critical value of 13.43 for rejection at the 5% significance level.[49] So, the tests indicate that the instruments are correlated with the endogenous variable of interest, because the null hypothesis is rejected. Instead, Table 5.4 also shows that Sargan test statistic is not significant, indicating that we cannot reject the null hypothesis of exogeneity of the instruments and conclude that the overidentifying restriction is valid. To sum, the various statistics suggest that our instruments are valid in explaining the variation of our model's potentially endogenous regressors.

[49] According to Stock and Yogo (2005), when we have two instrumented variables and three instruments, the Cragg-Donald *F* statistic must exceed 13.43 if we are confident at the 5% level, when a less than 10% of the OLS bias is tolerated.

Since our instruments appear to be valid, we proceed in order to explicitly assess if *CG_INT* and *CAPEX* are indeed endogenous with regard to *HEDGE*. To this end, we carry out the likelihood test of exogeneity proposed by Rivers and Vuong (1988). Table 5.5 shows that the likelihood ratio test for the 2SCML model versus a similar model without the two parameters for the reduced-form errors yields a χ^2 of 35.18, which is larger than the critical value of 5.99 at a significance level of 5% and two degrees of freedom, showing the joint significance of these parameters. Also, the Wald test performed when we estimate AGLS allows the rejection of exogeneity null hypothesis at conventional level of significance. Therefore, potential endogeneity between firms' hedging and investment policies and firm-level governance practices seems to be evident and needs to be accounted for. Moreover, *t*-statistics on the residuals (Table 5.5, column 1) of each of the endogenous variables clearly indicate that an endogeneity problem arises in the governance (*CG_INT*) and the investment (*CAPEX*) variables.

Given that the governance (*CG_INT*) and investment (*CAPEX*) are really endogenous, we proceed to estimating the hedging structural equation (equation 5.1) using AGLS and 2SCML, while the governance and investment structural equations (equations 5.2 and 5.3) are estimated through the SUR estimation method. Table 5.5 reports the results of the structural equations of hedging using 2SCML estimation (column 1), hedging using AGLS estimation (column 3), firm-level corporate governance (column 4), and investment (column 5).

Table 5.5: **Second-stage hedging, governance and investment model results**

		Dependent variables				
		(1/2)		(3)	(4)	(5)
Independent variables	**Predicted Influence**	**HEDGE**[b] **Coeff.**	$\partial Y / \partial x_i$	**HEDGE**[c] **Coeff.**	**CG_INT**[d] **Coeff.**	**CAPEX**[d] **Coeff.**
HEDGE[a]	na | na | + | +/-				0.758***	0.016**
					(4.91)	(2.42)
CG_INT[a]	+ | + | na | -	0.817***	0.187	0.810***		-0.003*
		(6.72)		(5.32)		(-1.68)
CAPEX[a]	+ | + | + | na	-0.494	-0.113	-0.483	-1.557	
		(-0.16)		(-0.13)	(-1.64)	
DIV	+ | + | na | na	0.193	0.044	0.187		
		(1.29)		(1.03)		
EXP	+ | + | na | na	-0.239	-0.051	-0.237		
		(-1.52)		(-1.17)		
LEV	+ | + | + | -	-0.342	-0.078	-0.342	0.623***	0.008
		(-1.13)		(-1.32)	(2.95)	(0.90)
SIZE	+/- | +/- | +/- | -	0.192***	0.044	0.192***	-0.057***	-0.002**
		(7.45)		(5.60)	(-2.66)	(-2.56)
TAX	+ | + | na | na	-0.186	-0.043	-0.154		
		(-0.18)		(-0.12)		
ADR	na | na | + | na				0.195	
					(1.29)	
CASH	na | na | na | +					0.138***
						(6.08)

Table 5.5: **Second-stage hedging, governance and investment model results** *(cont.)*

		Dependent variables				
		(1/2) HEDGE[b]		(3) HEDGE[c]	(4) CG_INT[d]	(5) CAPEX[d]
Independent variables	**Predicted Influence**	**Coeff.**	$\partial Y / \partial x_i$	**Coeff.**	**Coeff.**	**Coeff.**
CG_EXT	na | na | +/- | na				0.476*** (8.70)	
CG_INT_error[e]		-0.758*** (-5.84)				
CAPEX_error[e]		2.016*** (3.63)				
Constant		-5.158*** (-6.59)		-5.134*** (-5.04)	-2.627*** (-2.63)	0.057*** (3.63)
Four-digit ICB code dummies		Yes		Yes	Yes	Yes
Pseudo R^2/ Wald test / R^2		0.179 / 85.54***		52.39***	0.263	0.110
Observations		567		567	567	567
Exogeneity tests						
Wald test (χ^2_2) (H_0: CG_INT and CAPEX are exogenous)				32.66***		
Rivers-Vuong test (H_0: CG_INT and CAPEX are exogenous)		35.18***				

Table 5.5: **Second-stage hedging, governance and investment model results** *(cont.)*

Note. The table exhibits the results from structural equations - equations (5.1) to (5.3). Column 1 reports the results of hedging model using the 2SCML estimator, column 3 the results of hedging model using the AGLS estimator, column 4 the results of governance model, and column 5 the results of investment model both obtained through the SUR estimator. The hedging model estimation using the AGLS estimator, and the governance and investment models using the SUR estimator are obtained through Stata (version 10.1), and the estimation using 2SCML is obtained through Gretl (version 1.9.1). Column 2 reports marginal effects from 2SCML (probit regression of the relationship between the likelihood of hedging instruments' usage, firm-level corporate governance practices and several other firm characteristics). The marginal effects are calculated as the change in the probability of using hedging instruments that comes from a change in the independent variable of interest, where all the variables are evaluated at the mean. In the predicted influence column, v | w | x indicates that the corresponding variable is predicted to have v, w, and x influence on HEDGE, CG_INT, and CAPEX, respectively (na means that there is no prediction). Variables are as follows: ADR is a dummy which is assigned a value of 1 if a firm is issuing American Depository Receipts; CAPEX is the ratio of capital expenditures to total assets; CASH is the ratio of EBITDA minus the sum of tax, interest expenses, and common dividend to total assets; CG_EXT is a country-level governance index which is computed as the common factor derived from a PCA of five measures of country-level governance mechanisms; CG_INT is a firm-level internal governance index comprising seven governance mechanisms that take into account two governance dimensions: (1) board matters and (2) ownership structure; DIV is a dummy which is assigned a value of 1 if the firm dividend yield is greater than the median yield for the sample; EXP is a dummy which is assigned a value of 1 if a firm experiences FX, IR and/or CP exposure; HEDGE is calculated as a dummy variable which is assigned a value of 1 if a firm uses either external or internal hedging instruments, and zero otherwise; LEV is the ratio of total debt to total assets; SIZE is the natural logarithm of total assets, and TAX is the net operating losses to total assets. *t*-values of the regression coefficients are in parentheses below the coefficients. The significance levels are indicated by *, **, and *** that represent 10%, 5%, and 1% level, respectively.

[a] Treated endogenously - using predicted values from the reduced-form estimates. [b] Estimated using 2SCML estimator. [c] Estimated using AGLS. [d] Estimated using the SUR estimator. [e] Error indicators are the term errors from reduced-form regressions.

We use the 2SCML estimator to analyse the relationship between a firm's hedging profile, proxied by the hedging dummy (*HEDGE*), and the firm-level governance index (*CG_INT*), and also several others firm-specific characteristics, namely the firm investment level (*CAPEX*). Results in Table 5.5, column 1, show that the firm-level governance index (*CG_INT*) is positively and significantly (0.817, t=6.72) related to the likelihood of hedging. This result indicates that the higher the firm-level governance index, which is indicative of strong governance structures as well as low agency costs in the firm, the more the chance that firms use risk management instruments for hedging purposes. This result is highly associated to Tufano's (1998) prediction. He predicts that the severity of managerial agency conflicts may be associated with more hedging. Nevertheless, this hedging is frequently against the wealth and the value of shareholders. Along this line, Lel (2012) posits that strong governed firms, that is firms with a strong monitoring of managers' activities, use derivatives in a way consistent with shareholder value-maximization. Regarding the marginal effect calculated in the 2SCML estimation, when the firm-level governance increases its scoring by one point, the probability that firm uses hedging instruments will increases by 18.7%. Clearly, our findings support our governance-related hypothesis (hypothesis 1a) that better governed firms are more likely to use hedging instruments in line with the interests of shareholders.

In turn, the coefficient from the variable *CAPEX*, which we use to proxy for the level of investment spending, is negative and statistically insignificant at conventional levels, which indicates that hedging is not related with the current level of investment. Thus, the results do not support hypothesis 1b.

As for the remaining firm-specific variables in the estimation, one variable turned out significant and with the same sign as the theory predicts, while the others were not. In fact, the economies-of-scale-in-hedging argument – hypothesis 1f – is for now the only

additional hypothesis supported. The coefficient (*t*-statistic) is 0.192 (7.45). So, we support the hypothesis that larger firms, that probably have more access to risk management expertise or that have economies of scale in hedging costs, are most likely to use hedging instruments. This result is consistent with Nance *et al.*'s (1993) hypothesis discussed previously and with the findings of several researchers, for example, Graham and Rogers (2002) and Géczy *et al.* (1997).

In general, the results for the other exogenous variables in the hedging model (column 1) are not as expected. Our results do not support the liquidity-based hypothesis (hypothesis 1c). Also, the tax argument – hypothesis 1g – isn't supported by the results from the 2SCML estimation. Finally, the results also show that the exposure (*EXP*) and leverage (*LEV*) variables do not have a significant explanatory power in the decision to hedge (hypothesis 1d and hypothesis 1e, respectively).

The overall fit of the hedging model is very good, in particular considering its relatively parsimonious specification. Regarding the summary statistics for this regression presented at Table 5.6, we observe that of the 567 firms in our sample, the estimated model predicts 459 (81% of the total) of the observations correctly, i.e., 19 of the 111 firms that do not disclose the use of hedging instruments are correctly predicted by our model, and 440 of the 456 firms that disclose the use of some type of hedging instrument are also correctly predicted by our model.

Table 5.6: Percentage of cases correctly predicted in the 2SCML hedging estimation

	Predicted dependent variable		
Actual dependent variable	**0**	**1**	**Total**
0 (discloses no use of hedging instruments)	19	92	111
1 (discloses use of hedging instruments)	16	440	456
Total	15	552	567

In general, the results for the hedging model achieved through AGLS estimator (column 3) exhibit the same patterns and statistical significances as the ones from the 2SCML estimation. We verify that the differences in the point estimates are within the range of estimated standard errors.

Summarizing the results for the hedging model (equation 5.1), we find a few results which are consistent with expectations with regard to firm characteristics: (1) firms with a higher quality of governance are more likely to use risk management instruments with hedging purposes, and (2) larger firms that have access to risk management expertise, or that have economies of scale in hedging costs, are more likely to hedge.

As formerly discussed, estimating a simultaneous system of equations allows us to analyse the interdependences between a firm's hedging, governance and investment decisions. In line with this, the coefficient estimates of the endogenous variables in the line labelled *HEDGE* in Table 5.5 reveal that reverse causality is leading the relation between hedging and firm-level governance structure (column 4). As stated before, from the 2SCML and AGLS results for the hedging equation it is very clear that the firms with better firm-level governance hedge more. Now we corroborate also hypothesis 2a: firms that hedge are associated with a better quality of governance. The coefficient (*t*-statistic) is 0.758 (4.91). This is in line with the argument suggested by Lel (2012). If hedging promotes the lowering of firm risk, it can encourage managers to invest larger stakes in the firm and by this means ownership structure changes. Indeed, when managers accumulate stock, the capability of outside investors to monitor managerial non-value activities decreases; so, they are in a better position to become entrenched. In that way a firm may be forced to improve their governance structure.

As observed in Table 5.5, column 5, firms that hedge should have a higher level of investment spending (*CAPEX*). This positive and significant (0.016, *t*=2.42) relation is

consistent with the arguments of Lin and Smith (2008) that hedging can influence the firm investment programme through their effect on the firm's ability to finance its investments. Therefore, our results support hypothesis 3a.

Furthermore, the results of the governance equation (Table 5.5, column 4) suggest that poorly country-level governance structures (*CG_EXT*) are associated with poorly firm-level corporate governance structures (the coefficient and *t*-statistic for this variable are 0.476 and 8.70, respectively). Indeed, La Porta *et al.* (2002) suggest that firms located in countries with a weak legal environment may not have enough flexibility to improve their own investor protection and thereby rely on weak firm-level governance structures. With regard to firm leverage and its effect on firm-level governance structures, the results in Table 5.5, column 4, confirm that firms wishing to obtain external financing have to improve their governance structures (the coefficient and *t*-statistic for this variable are 0.623 and 2.95, respectively). This is in accordance with Klapper and Love's (2004) argument that better governed firms increase investors' willingness to provide financing. Also as expected, small firms may have better growth opportunities, and in line with the investment argument, may therefore find it optimal to improve their governance (the coefficient and *t*-statistic for this variable are -0.057 and -2.66, respectively). This result is in accordance with Beiner *et al*. (2006). These results are largely consistent with predictions: hypothesis 2d, hypothesis 2e, and hypothesis 2f, respectively.

The other firm level factors, such as firm investment level (hypothesis 2b) and firm American Depository Receipts issuance (hypothesis 2c) do not appear to be important in the decision about firm-level governance structures.

Turning to the investment equation (column 5) results, we verify, in line with Lin and Smith (2008), that smaller firms (*SIZE*) and firms with a higher level of funds available (*CASH*) should have a higher level of investment spending (the coefficients and

t-statistics for these variables are -0.002 and -2.56, and 0.138 and 6.08, respectively). These results corroborate hypothesis 3e and hypothesis 3c. Additionally, we verify that firm-level governance (*CG_INT*) has a negative and significant impact (-0.003; t=-1.68) on the firm investment decision (*CAPEX*), which corroborates our prediction (hypothesis 3b) that firms with higher overall scores on corporate governance should be more prudent on investment spending. This result is in accordance with Bauer *et al.* (2008). Instead, the firm financing decision is not significantly related with the firm investment decision, which means that hypothesis 3d is not corroborated.

Table 5.7 summarizes the results of the predicted hypotheses inherent to our system of equations.

Table 5.7: **Summary of the results of the predicted hypotheses**

Hedging model		**Evidence**
HYPOTHESIS 1a:	Better governed firms are more likely to use hedging instruments in a way that is consistent with value-maximizing theories of hedging.	Yes
HYPOTHESIS 1b:	Firms with a higher level of investment spending are more prone to hedge.	No evidence
HYPOTHESIS 1c:	Firms with a lower dividend level are less likely to hedge.	No evidence
HYPOTHESIS 1d:	Firms indicating a higher level of exposure to financial risk have a chance of greater potential benefits from hedging.	No evidence
HYPOTHESIS 1e:	Firms with a greater degree of financial distress, thereby with a higher level of debt, are more likely to engage more often in hedging activities.	No evidence
HYPOTHESIS 1f:	Firm size is expected to be associated with the likelihood of hedging.	Yes
HYPOTHESIS 1g:	If the firm incurs tax losses which will be carried forward, the probability of the firm's engagement in hedging will be higher.	No evidence
Corporate governance model		**Evidence**
HYPOTHESIS 2a:	Firms that hedge are associated with a higher quality of firm-level governance structures.	Yes
HYPOTHESIS 2b:	Firms with more growth options are expected to improve their governance structures.	No evidence
HYPOTHESIS 2c:	Firms issuing American Depository Receipts are expected to have better governance ratings.	No evidence
HYPOTHESIS 2d:	Country-level governance provisions influence firm-level governance performance.	Yes

Table 5.7: **Summary of the results of the predicted hypotheses** *(cont.)*

Corporate governance model		**Evidence**
HYPOTHESIS 2e:	Firms with more external financing are expected to improve their governance structures.	Yes
HYPOTHESIS 2f:	The size of the firm is expected to influence firm-level governance performance.	Yes
Investment model		**Evidence**
HYPOTHESIS 3a:	The implementation of a hedging programme at the firm level should have an impact in its investment spending.	Yes
HYPOTHESIS 3b:	Firms with higher governance ratings should be more prudent on investment spending.	Yes
HYPOTHESIS 3c:	Firms with a higher level of cash should have a higher level of investment.	Yes
HYPOTHESIS 3d:	Firms with higher leverage should have an incentive for underinvestment.	No evidence
HYPOTHESIS 3e:	Small firms have probably more future investment opportunities.	Yes

Note. The table lists the theoretical predictions and the corresponding empirical evidence. Those empirical studies whose findings provide significant evidence for the theoretical prediction appear after the word "Yes"; those whose findings provide significant evidence but are contrary to the theoretical prediction appear after the word "No"; those studies that do not support the theoretical prediction appear after the words "No evidence".

5.5 Conclusions and further directions

In this study we provide a comprehensive analysis of the characteristics of corporations that engage in hedging activity, emphasizing the importance of a stricter control for managerial activities. While most previous studies used US and UK data to analyse hedging determinants, we analyse a broad sample of nonfinancial firms from Continental Europe.

As a primary assertion we rely on the fact that corporate governance policy and several other firm characteristics affect the decision to hedge. Nonetheless, we bring in the thought that these decisions can be simultaneously undertaken. Hence, we expand the existing literature by applying the AGLS and the 2SCML estimators to simultaneously assess effects across several variables.

The results of this study confirm the widespread hypothesis that firms which guarantee a high level of monitoring for managerial actions, throughout the

implementation of better corporate governance structures, are most likely to pursue value-maximizing risk management strategies. Further, firms that use risk management instruments are generally larger than non-user firms. This last result is in line with the economies-of-scale-in-hedging argument. Finally, the two groups of firms in examination – hedgers and non-hedgers – are comparable in terms of exposure to financial risks, shape of the firms' tax schedules, and investment, financing and dividend policies.

On the whole, there seems to be some important interrelationships between firms' hedging, corporate governance and investment policy choices, which again emphasize the advantage of the development of a simultaneous equation framework in the investigation of hedging determinants. Explicitly, we find that the hedging and firm-level governance decisions are simultaneously undertaken. Moreover, regarding the relationship between hedging and investment, while our premier assertion suggests that the causality runs from investment to hedging, we find that causality runs the other way round.

Despite the existence of market imperfections which constitute a necessary condition to justify the need to undertake risk management, nevertheless, this is not a sufficient condition. In addition, we must evaluate the size of the risk management exposure and the costs associated with hedging this exposure (Géczy *et al*., 1997). It is not enough to know that the market recognizes the effect of hedging activities on a stock's exposure to exchange rate, interest rate or commodity prices, and neither to know the characteristics of companies that implement hedging strategies, to state that this or that company maximizes its value through hedging. The key question is to assess whether the hedging activities undertaken at the firm level actually increase its value. Accordingly, in the next section we pursue a third empirical perspective that examines directly the relationship between the hedging activities set and firm value.

CHAPTER 6

Corporate governance and the value of hedging

6.1 Introduction

Recently, a strand of research has attempted to examine the direct impact of corporate risk management on firm value (e.g., Allayannis & Weston, 2001; Hagelin *et al.*, 2007), looking for the value premium inherent to hedging activities. It is explicitly recognized that corporate hedging might be ineffective if it fails to add value or even counterproductive by destroying value. Hence, with regard to this strand of research the key question is whether hedging activities undertaken at the firm level actually increase its value. Despite the straightforwardness of the risk management-value argument, a prominent feature of previous empirical research is that the existence of a value premium associated with hedging is still an unresolved question.

It is well known that theories developed on the basis of shareholders' value maximization suppose that risk management activities pursued by the firm align the interests of managers and shareholders. However, when there is no proper control over managers' behaviour, they may be following hedging activities looking to maximize their own interests. Also, in this strand of analysis, the control of managers' behaviour must be a central issue. Accordingly, Allayannis *et al.* (2012) suggest that a firm's high governance level reduces managerial agency costs, thereby increasing the likelihood of the use of derivatives for hedging purposes, and as a result leading to more valuable hedging activities. So, while previous risk management research, made mostly

with US data, focus on the unconditional value effect of risk management, Allayannis *et al.* (2012) highlight the idea that value through risk management could be conditional to corporate governance structures.

It is likely that part of the inconsistent results reported in previous risk management-value empirical studies (e.g., Guay & Kothari, 2003; Hagelin *et al*., 2007; Jin & Jorion, 2006; Lookman, 2004) is due to methodological aspects. One possible explanation could be related to the hedging definition frequently used (Clark & Judge, 2008). Indeed, hedging activities tend to be associated with the use of derivatives, ignoring the fact that hedging can be pursued by other means. Furthermore, a problem which frequently concerns empirical studies on those matters is endogeneity. The question is whether proper hedging instruments use causes higher firm valuations. Alternatively, because firms with better growth opportunities are likely to hedge and better growth opportunities mean higher valuation, it is likely that firms with a higher value engage more often in hedging (Allayannis *et al*., 2012). Also, it is straightforward that good corporate governance causes higher firm valuations. However, firms with higher market values could simply be more likely to choose better governance structures (e.g., Beiner *et al.*, 2006). While some hedging-related studies deal with the endogeneity issue by applying simultaneous equations models (e.g., Hagelin *et al*., 2007) or sample selection (e.g., Allayannis *et al*., 2012; Jin & Jorion, 2006), most of the empirical studies do not account for the endogeneity implicit in the value-hedging relationship.

This study analyses the issue of hedging premium conditional to corporate governance structures. The implicit hypothesis underlying our analysis is that better corporate governance will assure hedging activities are undertaken with value-maximization purposes, thereby leading to an incremental hedging-related value. The notion behind this is that agency problems may affect the value of companies through

"bad" risk management strategies.[50] In order to test the hypothesized relationship, we construct a firm-level corporate governance index that reflects seven alternative governance rules related to ownership and board, which are recommended, but not (yet) legally required. This approach has become popular in the literature only recently. Moreover, we carry out an extensive analysis of the general risk management from 567 non-financial firms in the four countries with stocks traded in Euronext - Belgium, France, The Netherlands, and Portugal.

Our study differs in several ways from previous studies relating firm value and hedging matters. Firstly, we use a dummy variable that accounts simultaneously for the use/non-use of internal and external hedging instruments, which is hand-collected from the firms' annual reports. Secondly, we redesign the model proposed by Allayannis *et al.* (2012) to also take into account the potential endogeneity implicit in the relationship between firm value and its corporate governance structure. Thirdly, by looking into the impact of corporate governance on the value derived from the implementation of a hedging programme, this study seeks to contribute to the increasing governance-based literature that argues that improving corporate governance structures is essential to controlling managers' actions, specifically when it reveals a direct mechanism by which governance can enhance firm value. Finally, we add to the empirical literature by making use of a diverse sample, more so than the standard samples from the US and UK.

The chapter is set out as follows: the next section describes the research framework, which includes the development of the hypotheses and the definition of the proposed models. Sample and data description takes place in section 6.3. Section 6.4 contains the

[50] Risk management can be used for hedging, for managers' self-interests or for speculative purposes. When they are used for managers' self-interests or for speculative purposes we can say that the firm is implementing "bad" hedging strategies. However, speculative uses of derivatives can also be beneficial to shareholders in certain situations, such as when firms are in financial distress (Lel, 2012).

empirical results and its discussion. Finally, section 6.5 summarizes and concludes the study.

6.2 Research framework: Development of the hypotheses and proposed model

As a first step, we consider that the firm value, proxied by Tobin's Q ratio, is driven by firm hedging behaviour, firm-level governance structure, and several other firm characteristics. In addition, by means of an interaction variable, we hypothesize that governance also affects the implementation of valuable hedging strategies. So, we initially run OLS regression as a base case. As a second step, we adjust our methodological approach to take into account the endogeneity concerns described above. Therefore, in subsequent analysis we control for the possible interrelationships between firm value, hedging and corporate governance policies with the development of a comprehensive system of simultaneous equations where we apply the SUR estimator.

6.2.1 The effect of governance on the value derived from hedging

In this section we modelled the relation between firm value, hedging instruments' usage, and firm-level corporate governance structures through OLS. In this estimation we also analysed the hypothesis that better governance leads to a more positive effect of hedging instruments' usage on firm value. Our measure of firm valuation is Tobin's Q (e.g., Allayannis *et al.*, 2012; Allayannis & Weston, 2001; Beiner *et al*., 2006; Belghitar *et al*., 2008; Carter *et al*., 2006; Jin & Jorion, 2006; Klapper & Love, 2004; Lookman 2004), alternatively labelled as *Q*. As stated in chapter 3, section 3.3, we define Tobin's Q as the ratio of market value to book value of assets, and market value of assets is computed as the market value of equity plus book value of assets minus book value of equity. In this specification of Tobin's Q the numerator approximates the market value of

assets and the denominator the replacement costs of assets. This resulting unit less metric is used in many others studies (e.g., Belghitar *et al*., 2008; Klapper & Love, 2004; Lookman 2004), which allows for comparison across firms. As outlined in chapter 3, section 3.6, the distribution of Tobin's Q is skewed, therefore we follow Hagelin *et al.* (2007) and use the natural logarithm of Tobin's Q (*L_Q*) to correct for the skewness. Moreover, using the natural logarithm has the benefit that variations in the value of the variable can be interpreted as percentage changes in firm value.

To be able to document a relationship between firm value and hedging in the presence of agency conflicts, we also need to control for the effects of other possible variables on Tobin's Q. Therefore, in accordance with prior work that investigates the relationship between hedging and firm value (e.g., Allayannis *et al*., 2012; Allayannis & Weston, 2001; Carter *et al.*, 2006; Jin & Jorion, 2006) we use several control variables to explain the cross-sectional differences in the firm value among our sample firms. The following equation describes the main model of the study.

$$\begin{aligned} L\_Q_i = {} & \alpha_0 + \alpha_1 \cdot HEDGE_i + \alpha_2 \cdot CG\_INT_i + \alpha_3 \cdot HEDGE_i \times CG\_INT_i \\ & + \alpha_4 \cdot CAPEX_i + \alpha_5 \cdot DIV_i + \alpha_6 \cdot FS_i + \alpha_7 \cdot INDDIV_i + \alpha_8 \cdot INS_i \\ & + \alpha_9 \cdot LEV_i + \alpha_{10} \cdot ROA_i + \alpha_{11} \cdot SIZE_i + \sum_{j=1}^{8} \alpha_{11+j} \cdot IND_i + \varepsilon_i \end{aligned} \tag{6.1}$$

where:

HEDGE	=	dummy which is assigned a value of 1 if a firm reports the use of either external and/or internal hedging instruments for hedging purposes, 0 otherwise;
CG_INT	=	index that proxies for the firm-level quality of governance;
HEDGE × *CG_INT*	=	interaction variable of hedging versus governance;
CAPEX	=	purchases of fixed assets to total assets;
DIV	=	dummy which is assigned a value of 1 if a firm dividend

yield is greater than the median yield for the sample, 0 otherwise;

FS = ratio of foreign sales to net sales;

IND = dummy which is assigned the value of 1 if the firm's main industry is classified into one of the eight industries according to the 4-digit ICB classification, 0 otherwise;

INDDIV = dummy which is assigned the value of 1 if a firm has at least two business segments with a different ICB 4-digit subsector classification code, 0 otherwise;

INS = number of shares held by officers and directors divided by common shares outstanding;

LEV = ratio of long-term debt plus-short term debt to total assets;

ROA = operating income before interest and taxes scaled by total assets;

SIZE = natural logarithm of total assets.

As we detailed before in chapter 2, sections 2.3.1 and 2.3.2, hedging can increase firm value by reducing volatility and therefore reducing the deadweight costs associated with market imperfections (Smith & Stulz, 1985, among others). Along this line, the first hypothesis to be predicted is as follows:

HYPOTHESIS 1a: Hedging by reducing the volatility of firms' cash flows can be value enhancing.

There is substantial evidence in the finance literature that variations in firm-level governance structures in aggregate affect the market valuation of firms (see chapter 2, section 2.5.1.4). For example Gompers *et al*. (2003) construct a governance index based on takeover defences for a sample of about 1500 US firms. These authors report that firms

with better corporate governance receive higher market valuations. In a similar way, Drobetz *et al.* (2004) document a positive relationship between governance practices and firm valuation for German public firms by constructing a broad corporate governance index. Similarly, Klapper and Love (2004) support these findings for the Credit Lyonnais Securities Asia index using a sample of 374 large firms in 14 emerging markets. Durnev and Kim (2005) examine a broader sample of 859 firms in 27 countries and find that firms with a better corporate governance and better disclosure standards have, on average, higher Tobin's Q. Beiner *et al.* (2006) highlight two distinctive channels by which the effect of governance on firm value can be observed: (1) the expected cash flows accruing to investors and (2) the cost of capital. On the one hand, with better governance more of the firm's profits come back to shareholders. On the other hand, better governance reduces the shareholders' monitoring and auditing costs, thereby reducing the required cost of equity. The implicit hypothesis that leads our analysis is as follows:

HYPOTHESIS 1b: Better firm-level governance structures will increase firm value as measured by Tobin's Q.

We have been considering so far that the effects of the prediction have been additive, that is, the effect of firm-level governance is the same independently of hedging decisions and vice versa. This condition might limit our analysis. Thereby, we hypothesize that better corporate governance, which means lesser managerial agency costs, assuring that hedging activities will be undertaken with value-maximization purposes, leads to an incremental hedging-related value (Allayannis *et al.*, 2012). Instead of splitting up the full sample with regard to the strength of governance as in Allayannis *et al.* (2012), we follow Dittmar and Mahrt-Smith's (2007) approach[51] and introduce an interaction term in the model. Namely, we interact the hedging dummy variable with the firm-level governance

[51] These authors investigated how corporate governance impacts upon firm value by comparing the value and use of cash holdings in both poorly and well-governed firms.

index (*HEDGE*×*CG_INT*) in order to assess the incremental impact on firm value. This is in fact one of the main contributions of our study.

In constructing the interaction variable, firstly, we center the continuous input variable – *CG_INT* – in order to mitigate multicollinearity. Mean centering has been offered as a simple data transformation that minimizes the multicollinearity in OLS regression when interaction variables are present (Cronbach, 1987). Then the two variables – *HEDGE* and *CG_INT* – are multiplied to create the interaction variable. As already noted, in order to have a robust estimation, we include the hedging dummy and governance by themselves in the regression in addition to the interaction effect of interest. The hypothesis to be tested is as follows:

HYPOTHESIS 1c: Better firm-level governance has implicit a higher valuation for firms that hedge.

The theory predicts that firms with more valuable growth opportunities are likely to invest more. We therefore expect investment level to be positively associated with Tobin's Q. In line with Jin and Jorion (2006), we use, as a proxy for investment, the ratio of capital expenditures to total assets (*CAPEX*). The hypothesis to be tested is:

HYPOTHESIS 1d: Firms with higher levels of investment spending are expected to have higher firm value.

To control for financing constraints we use a dummy that is set to 1 if a firm's dividend yield is greater than the median dividend yield for the sample (*DIV*), 0 otherwise. Allayannis *et al.* (2012) argue that the greater the dividend yield, the lower the probability the firm is financially constrained, and firms that are more financially constrained are more likely to have higher firm value because they only undertake positive NPV projects. Therefore, a negative relationship between the dividend dummy and firm value is expected and the hypothesis underlying this argument is:

HYPOTHESIS 1e: Firms with lower dividend yield are more likely to have higher value.

Doukas and Lang (2003), and several other researchers suggest that geographic diversification is value-enhancing. We follow Allayannis and Weston (2001), and we use the percentage of sales from non-domestic operations (*FS*) as a proxy for geographic diversification. So, we hypothesize:

HYPOTHESIS 1f: Firms with a higher geographic diversification have higher firm value.

Inversely, previous empirical research suggests that industrial diversification is value destroying; that is to say, firms with multiple industrial segments have lower value when compared to single segment firms. As in Allayannis and Weston (2001), we control for industrial diversification (*INDDIV*) with a dummy variable which equals 1 if the firm has at least two business segments with a different ICB 4-digit subsector classification code, 0 otherwise. The hypothesis underlying this argument is as follows:

HYPOTHESIS 1g: Firms with multiple industrial segments have lower value.

Whereas the convergence-of-interest hypothesis predicts that insider holding and economic performance are positively related, the entrenchment hypothesis predicts a negative impact on firm value (Morck *et al.*, 1988). Indeed, at first, as managers' stock ownership increases, managers' interests become more closely aligned with those of shareholders, which leads to agency costs decreasing and consequently to an increase in firm value. However, high ownership by managers may result in a greater degree of managerial control, which gives rise to the entrenchment hypothesis. Consequently, governance theory cannot specify the relation between insider ownership and performance. To test this argument, we include the level of insider ownership (*INS*) and hypothesize:

HYPOTHESIS 1h: The level of insider ownership is associated with firm value.

We also include leverage (*LEV*) to control for firm capital structure and expect a positive relationship between this variable and Tobin's Q (Jin & Jorion, 2006). In fact, if

the firm increases leverage, this will lead to an increase in interest deductions, which in turn generates incremental tax shield benefits that can increase value. Leverage is computed by the ratio of long-term debt plus-short term debt to total assets (Carter *et al.*, 2006). The implicit hypothesis to be tested is:

HYPOTHESIS 1i: Firms with higher leverage have a higher firm value.

In addition, a profitable firm is likely to trade at a premium relative to a less profitable one, therefore we expect profitability to be positively associated with Tobin's Q (Allayannis & Weston, 2001). As a proxy for profitability, we use the operating income before interest and taxes scaled by total assets, that is to say, return on assets for the current year (*ROA*). The hypothesis to be tested is as follows:

HYPOTHESIS 1j: More profitable firms are expected to have a higher valuation.

Also, we control for firm size by using the natural logarithm of total assets (*SIZE*). In fact, Allayannis and Weston (2001) found differences in Tobin's Q for large firms as compared to small firms. Namely, large firms were associated with lower Tobin's Q. The hypothesis to be tested is as follows:

HYPOTHESIS 1k: Larger firms are expected to have lower Tobin's Q.

Lastly, we control for differences in the firm value behaviour between industries and include eight industry dummy variables (*IND*).

Summing up, according to the arguments presented above, α_1, α_2, α_3, α_4, α_6, α_9, and α_{10} in equation (6.1) are expected to be positive. In contrast, α_5, α_7, and α_{11} are expected to be negative, and α_8 could be either positive or negative.

6.2.2 The effect of governance on the value derived from hedging controlling for the endogeneity of hedging and governance decisions

The main implicit hypothesis in the last section is that a well-governed firm leads to a more positive effect of hedging on firm value. However, based on the results of preceding works and on economic reasons, we believe that firm value must be considered simultaneously with hedging and governance decisions.

According to Lin and Smith (2008) among others, firms with better growth opportunities are more likely to hedge. It is straightforward that better growth opportunities mean higher valuation, consequently, it is highly likely that firms with a higher value engage more often in hedging activities. But, the endogeneity concerns are not limited to hedging decisions. Whereas good corporate governance causes higher firm valuations, firms with higher market values could simply be more likely to choose better governance structures (e.g., Beiner *et al.*, 2006).

The two preceding arguments highlight a problem of endogeneity, more specifically reverse causality, between firm value and hedging behaviour, and firm-level governance structures. Clearly, the OLS estimator fails if there is a correlation between some explanatory variables, such as hedging and firm-level governance variables, and the error term. Hence, we test for the presence of correlation between the variables and the error term in order to identify the appropriate estimator procedure. The null hypothesis to be tested is H_0: Cov(x,e)=0. If the null hypothesis is true we use the more consistent estimator, which is the least squares estimator. Inversely, if the null hypothesis is not true, we should use the instrumental variables estimator, which is consistent. One form of the test directly examines the differences between the least squares estimator and instrumental

variables estimator.[52] Specifically, we implement the contrast test applying the Hausman test (e.g., Hermalin & Weisbach, 1991; Himmelberg *et al*., 1999).[53]

Given the possibility that firm-level governance (*CG_INT*) and hedging (*HEDGE*) variables can be endogenously determined, we follow Balli and Sørensen (2012) in instrumenting our interaction variable (*HEDGE*×*CG_INT*). We define analytically our structural system of equations as follows:

$$\begin{aligned} L\_Q_i = {} & \alpha_{10} + \alpha_{11} \cdot HEDGE_i + \alpha_{12} \cdot CG\_INT_i + \alpha_{13} \cdot HEDGE_i \times CG\_INT_i \\ & + \beta_{11} \cdot CAPEX_i + \beta_{12} \cdot DIV_i + \beta_{13} \cdot FS_i + \beta_{14} \cdot INDDIV_i + \beta_{15} \cdot INS_i \\ & + \beta_{16} \cdot LEV_i + \beta_{17} \cdot ROA_i + \beta_{18} \cdot SIZE_i + \sum_{j=1}^{8} \beta_{18+j} \cdot IND_i + \varepsilon_i \end{aligned} \tag{6.2}$$

$$\begin{aligned} HEDGE_i = {} & \alpha_{20} + \alpha_{21} \cdot L\_Q_i + \alpha_{22} \cdot CG\_INT_i \\ & + \beta_{21} \cdot CAPEX_i + \beta_{22} \cdot DIV_i + \beta_{23} \cdot EXP_i + \beta_{24} \cdot LEV_i + \beta_{25} \cdot SIZE_i \\ & + \beta_{26} \cdot TAX_i + \sum_{j=1}^{8} \beta_{26+j} \cdot IND_i + \varepsilon_i \end{aligned} \tag{6.3}$$

$$\begin{aligned} CG\_INT_i = {} & \alpha_{30} + \alpha_{31} \cdot L\_Q_i + \alpha_{32} \cdot HEDGE_i \\ & + \beta_{31} \cdot ADR_i + \beta_{32} \cdot CAPEX_i + \beta_{33} \cdot CG\_EXT_i + \beta_{34} \cdot INS_i + \\ & + \beta_{35} \cdot LEV_i + \beta_{36} \cdot ROA_i + \beta_{37} \cdot SIZE_i + \sum_{j=1}^{8} \beta_{37+j} \cdot IND_i + \varepsilon_i \end{aligned} \tag{6.4}$$

$$\begin{aligned} HEDGE_i \times CG\_INT_i = {} & \alpha_{40} + \alpha_{41} \cdot L\_Q_i + \\ & + \beta_{41} \cdot HEDGE_i \times ADR_i + \beta_{42} \cdot HEDGE_i \times CG\_EXT_i \\ & + \beta_{43} \cdot CG\_INT_i \times EXP_i + \beta_{44} \cdot CG\_INT_i \times TAX_i \\ & + \beta_{45} \cdot CAPEX_i + \beta_{46} \cdot DIV_i + \beta_{47} \cdot INS_i + \beta_{48} \cdot LEV_i \\ & + \beta_{49} \cdot ROA_i + \beta_{410} \cdot SIZE_i + \sum_{j=1}^{8} \beta_{410+j} \cdot IND_i + \varepsilon_i \end{aligned} \tag{6.5}$$

Equation (6.2) is already defined in section 6.2.1 as being our base case (equation 6.1). Further, to examine the cross-sectional relation between a firm's hedging decision,

[52] To make an assessment in our empirical setting about the presence of endogeneity we have established in advance several instruments for the variables that are likely to be endogenous.

[53] In advance we test for the possibility of endogeneity by regressing each of the variables suspected to be endogenous on the set of the other endogenous regressors. This procedure gives us a clearly indication of the causal relationships between the possible endogenous variables. The regressions estimated are as follows:

$$L\_Q_i = \alpha_0 + \alpha_1 \cdot HEDGE_i + \alpha_2 \cdot CG\_INT_i + \varepsilon_i$$
$$HEDGE_i = \alpha_0 + \alpha_1 \cdot L\_Q_i + \alpha_2 \cdot CG\_INT_i + \varepsilon_i$$
$$CG\_INT_i = \alpha_0 + \alpha_1 \cdot HEDGE_i + \alpha_2 \cdot L\_Q_i + \varepsilon_i$$

The coefficients from the regressors are all statistical significant at the 5% or 10% level. Therefore, in a first approach, we confirm our endogeneity suspicions.

firm value, and their governance and financial characteristics, the dependent variable in equation (6.3) is *HEDGE*. The explanatory variables are the key firm-level characteristics that, in line with the optimal hedging theory, influence hedging decisions. In this sense, it is predicted that hedging can enhance firm value if it can decrease the agency costs of debt. It was suggested that these agency costs of debt are more evident in firms with more growth options, as these firms could have a high probability of underinvestment or asset substitution. Hence, if risk management is used to protect the continued funding of futures investment programs, we expect a positive relationship between hedging activities and the level of investment spending (e.g., Lin & Smith, 2008; Bartram *et al.*, 2009). We use capital expenditures (*CAPEX*) to measure the level of investment (Lin & Smith, 2008). However, better growth opportunities mean higher valuation, thereby it is highly likely that firm with a higher value, as measured by the natural logarithm of Tobin's Q (*L_Q*), engage more often in hedging activities.

In addition, a higher score of the firm-level governance index (*CG_INT*) is expected to represent a higher level monitoring of managerial activities, which appears in better governed firms that are more likely to pursue value-maximizing hedging decisions (Lel, 2012). We measure the firm quality of governance with a firm-level governance index (*CG_INT*) comprising seven governance mechanisms that take into account two governance dimensions: (1) board matters and (2) ownership structure (see section 3.5.1).

Nance *et al.* (1993) predict that firms with lower dividend payouts have probably more internal funds available. It is worth noting that the presence of liquid assets could reduce the need for hedging. Therefore, when controlling liquidity through dividend yield (*DIV*), that is to say gross dividend per share by closing stock price, the authors suggest that firms with lower dividend payouts are less likely to hedge.

Moreover, it is expected that firms with greater variation in cash flows have typically greater potential benefits from hedging, that is why we provide the test for this last argument by using the general exposure (*EXP*), a dummy which is assigned a value of 1 if a firm experiences any of the following exposures: foreign exchange, interest rate and commodity price exposure, 0 otherwise (Bartram *et al.*, 2009).

Corporate hedging literature frequently assumes that firms with higher leverage ratios (*LEV*) face higher probabilities of encountering financial distress and interpret a positive leverage coefficient as evidence that greater expected financial distress costs increase the likelihood of hedging activities (e.g., Lel, 2012). We also need to control for firm size because larger firms having the access to risk management expertise, or having economies of scale in hedging costs, are more likely to hedge than smaller firms (Nance *et al*., 1993). However, there are circumstances where smaller firms have more incentive to hedge than larger firms; for instance, smaller firms will hedge more because they face greater bankruptcy costs. Thus, the effect of firm size on hedging activities is ambiguous and shall be empirically determined.

Finally, we use the ratio of net operating losses to total assets (*TAX*) as a proxy for the convexity of firms' tax schedules (e.g., Géczy *et al.*, 1997). Usually, the hypothesis tested is as follows: the greater the firm's probability of incurrence in tax loss which will be carried forward, the greater the probability of the firm's engagement in hedging should be. Therefore, we expect a positive coefficient for the tax variable.

In line with the arguments presented above, the coefficients of the endogenous variables (α_{21} and α_{22}) in equation (6.3) are expected to be positive. Regarding the exogenous control variables, β_{21}, β_{22}, β_{23}, β_{24}, and β_{26} are expected to be positive, and β_{25} could be either positive or negative. The hypotheses to be tested are as follows:

HYPOTHESIS 2a: Firms with a higher value are expected to engage more often in hedging activities.

HYPOTHESIS 2b: Better governed firms are more likely to use hedging instruments in a way that is consistent with value-maximizing theories of hedging.

HYPOTHESIS 2c: Firms with a higher level of investment spending are more prone to hedge.

HYPOTHESIS 2d: Firms with a lower dividend level are less likely to hedge.

HYPOTHESIS 2e: Firms indicating a higher level of exposure to financial risk have a chance of greater potential benefits from hedging.

HYPOTHESIS 2f: Firms with a greater degree of financial distress, thereby with a higher level of debt, are more likely to engage more often in hedging activities.

HYPOTHESIS 2g: Firm size is expected to be associated with the likelihood of hedging.

HYPOTHESIS 2h: If the firm incurs tax losses which will be carried forward, the probability of the firm's engagement in hedging will be higher.

Equation (6.4) uses the firm-level governance index (*CG_INT*) as the dependent variable. As already discussed, firms with higher market values could simply be more likely to choose better governance structures (e.g., Beiner *et al.*, 2006).

In addition, we expect that *CG_INT* depends on the firm's hedging behaviour, because hedging by decreasing the firm's financial risk can induce a higher level of insider shareholding and in that way a firm's governance structure can be changed (Lel, 2012). Indeed, in accordance with the management entrenchment hypothesis, when managers accumulate stock, the capability of outside investors to monitor managerial non-value activities decreases; so, they are in a better position to become entrenched. In that way a firm may be forced to improve their governance structure. Therefore, we expect that hedging instruments' use (*HEDGE*) has a positive effect on *CG_INT*.

We also expect that *CG_INT* depends on the firm's investment and financing choices. Firms with good growth opportunities are expected to need to raise external financing; but to obtain any external financing they are forced to improve their governance structure. This is because better firm governance increases investors'

willingness to provide financing and this should be reflected in lower costs and greater availability of external financing (Klapper & Love, 2004). As for *HEDGE*, we expect again a positive relationship between *CG_INT* and investment (*CAPEX*), and financing (*LEV*) proxies.

Firms issuing American Depository Receipts in the US are subject to stricter governance listing requirements, so these firms are expected to have better corporate governance rankings. To test this prediction, we include a dummy variable that is assigned a value of 1 if a firm is issuing American Depository Receipts in the US (*ADR*), and 0 otherwise (Beiner *et al.*, 2006).

In addition, we include as a control variable a country-level corporate governance index (*CG_EXT*). This index is computed as the common factor derived from a principal component analysis of five measures of country-level governance mechanisms (see section 3.5.2). La Porta *et al.* (2002) point out the view that firms located in countries with a weak legal environment may not have much flexibility to improve their own investor protection and consequently have weak firm-level governance structures. In reverse, according to Klapper and Love (2004), it is possible to observe better firm-level governance in countries with bad legal systems as these firms would be more in "need" of good governance mechanisms to compensate for the bad legal systems.

To capture a possible interrelation between operating performance and *CG_INT*, we include the returns on assets (*ROA*), and expect that more profitable firms may have better governance structures (Klapper & Love, 2004).

In line with the convergence-of-interest hypothesis, whereas the primary governance function is to monitor management, larger insider stakes could reduce the need for such control (Bohren & Odegaard, 2006). We test this hypothesis making use of the level of insider ownership (*INS*) and expect a negative relation between *INS* and *CG_INT*.

Finally, we analyse the effect of *SIZE* in *CG_INT*. On the one hand, it is recognized that larger firms may have greater agency costs and therefore need to enforce their governance structures; in contrast, small firms may have better growth opportunities, may therefore find it optimal to improve their governance (Beiner *et al.*, 2006).

In accordance with the arguments offered above, the coefficient of endogenous variables α_{31} and α_{32} in equation (6.4) are expected to be positive. With regard to the exogenous control variables, β_{31}, β_{32}, β_{35}, and β_{36} are expected to be positive. In contrast, β_{34} is expected to be negative. Moreover, β_{33} and β_{37} might be either positive or negative. In summary, the hypotheses to be tested are:

HYPOTHESIS 3a: Firms with higher market values could simply be more likely to choose better governance structures.

HYPOTHESIS 3b: Firms that hedge are associated with a higher quality of firm-level governance structures.

HYPOTHESIS 3c: Firms issuing American Depository Receipts are expected to have better governance ratings.

HYPOTHESIS 3d: Firms with more growth options are expected to improve their governance structures.

HYPOTHESIS 3e: Country-level governance provisions influence firm-level governance performance.

HYPOTHESIS 3f: Larger insider shareholdings are expected to reduce the need for additional firm-level governance control.

HYPOTHESIS 3g: Firms with more external financing are expected to improve their governance structures.

HYPOTHESIS 3h: More profitable firms should have better firm-level governance structures.

HYPOTHESIS 3i: The size of the firm is expected to influence firm-level governance performance.

As described above, we use two potential variables to instrument *CG_INT*: the country-level governance index (*CG_EXT*) and the variable representing American Depository Receipts issuance (*ADR*). In instrumenting the firm hedging behaviour

(*HEDGE*) we use also two variables: (1) the general high exposure (*EXP*) and (2) the ratio of net operating losses to total assets (*TAX*) as a proxy for the convexity of a firm's tax schedules. Finally, if the variables described to instrument for *CG_INT* and *HEDGE* are valid instruments, then *HEDGE*×*ADR*, *HEDGE*×*CG_EXT*, *CG_INT*×*EXP*, and *CG_INT*×*TAX* will be valid instruments for the interaction variable (*HEDGE*×*CG_INT*).

Our system of equations includes 16 exogenous, not accounting for the eight industry dummy variables, and four endogenous variables. The order condition for identification states that if an equation is to be identified, the number of predetermined variables excluded from the equation must be greater than, or equal to, the number of the included endogenous variables minus 1. Therefore, at least three of the exogenous variables must be excluded from any single equation to identify the system. Regarding the order condition for identification, all the equations of our system are over-identified.

To verify the rank condition we use Table 6.1, Panel A, in which "×" indicates a variable appears in the given equation and "0" indicates a variable does not appear in the given equation.

We analyse the 4×20 matrix of 0's and ×'s . For each equation *i* we first select the columns corresponding to the variables that do not appear in the equation *i*. From this submatrix we delete row *i*. If the remaining submatrix has rank greater than the number of the included endogenous variables minus 1, then the rank condition is satisfied for the equation and the parameters of the equation are identified.

Table 6.1: **Rank condition for identification**

Panel A. Main matrix of 0's and ×'s																				
	Variables																			
Equations	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Firm value	×	×	×	×	×	×	×	×	×	×	×	×	0	0	0	0	0	0	0	0
Hedging	×	×	×	0	×	×	0	×	0	0	0	×	0	0	×	×	0	0	0	0
Governance	×	×	×	0	×	0	0	×	×	0	×	×	×	×	0	0	0	0	0	0
Interaction variables	×	0	0	×	×	×	0	×	×	0	×	×	0	0	0	0	×	×	×	×
Panel B. Relevant submatrix of firm value equation																				
				0	0	×	×	0	0	0	0									
				×	×	0	0	0	0	0	0									
				0	0	0	0	×	×	×	×									
Panel C. Relevant submatrix of hedging equation																				
	×		×		×		×		0		0		0		0		0			
	0		0		×		0		×		×		0		0		0			
	×		0		×		0		×		0		×		×		×			
Panel D. Relevant submatrix of governance equation																				
		×		×		×		×		0		0		0		0		0		
		0		×		0		0		×		×		0		0		0		
		×		×		0		0		0		0		×		×		×		
Panel E. Relevant submatrix of the interaction equation																				
				×	×	×	×	0	0	0	0									
				×	×	0	0	0	0	×	×									
				×	×	0	0	×	×	0	0									

Note. Panel A Variables are as follows: (1) L_Q is the natural logarithm of Tobin's Q, and Tobin's Q is computed as the ratio of market value to book value of assets, and market value of assets is computed as market value of equity plus book value of assets minus book value of equity; (2) HEDGE is a dummy which is assigned a value of 1 if a firm reports the use of either external and/or internal hedging instruments; (3) CG_INT is a firm-level internal governance index comprising seven governance mechanisms that take into account two governance dimensions: board matters and ownership structure; (4) HEDGE×CG_INT is an interaction variable, which is computed as the multiplication of the mean-centered CG_INT and HEDGE; (5) CAPEX is the ratio of capital expenditures to total assets; (6) DIV is a dummy which is assigned a value of 1 if the firm dividend yield is greater than the median yield for the sample; (7) is the ratio of foreign sales to net sales; (8) LEV is the ratio of total debt to total assets; (9) INS is the number of shares held by officers and directors divided by common shares outstanding; (10) INDDIV is a dummy which is assigned a value of 1 if a firm has at least two business segments with a different ICB 4-digit subsector classification code; (11) ROA is the ratio of EBIT by total assets; (12) SIZE is the natural logarithm of total assets; (13) CG_EXT is a country-level governance index which is computed as the common factor derived from a PCA of five measures of country-level governance mechanisms; (14) ADR is a dummy which is assigned a value of 1 if a firm is issuing American Depository Receipts; (15) EXP is a dummy which is assigned a value of 1 if the firm has either FX, IR or CP exposure above the median exposure for the sample; (16) TAX is the net operating losses to total assets; (17) HEDGE×CG_EXT is an interaction variable, which is computed as the multiplication of HEDGE and CG_EXT; (18) HEDGE×ADR is an interaction variable, which is computed as the multiplication of HEDGE and ADR; (19) CG_INT×TAX is an interaction variable, which is computed as the multiplication of CG_INT and TAX, and (20) CG_INT×EXP is an interaction variable, which is computed as the multiplication of CG_INT and EXP.

Panel B shows the submatrix inherent to firm value equation. Panel C shows the submatrix inherent to hedging equation. Panel D shows the submatrix inherent to governance equation. Panel E shows the submatrix inherent to the interaction equation. From the analysis, we conclude that in each of the submatrix the three rows are linearly distinct. So, in each of the submatrix the rank is 3 and all the equations are identified.

Our structural system of equations takes into account the mix of two different types of dependent variables in the model, one discrete choice variable (*HEDGE*) and three continuous variables (*CG_INT*, *HEDGE*×*CG_INT*, and *L_Q*). In this case, the standard approach to simultaneous equations will be 2SLS or 3SLS. Yet, such models can be combined into multi-equation systems in which the errors share a multivariate normal distribution. The literature has historically focused on multi-stage procedures for estimating mixed models, which are more efficient computationally, if less so statistically (e.g., Maddala, 1983, chapters 7 and 8), than maximum likelihood. Therefore, we test the interrelationships between firm value, hedging behaviour and firm-level corporate governance by using the SUR framework, in Stata (version 10.1). While SUR is not a true maximum likelihood estimator, it converges to the same solution as maximum likelihood-based SUR.

6.3 Sample selection and descriptive statistics

Our sample consists of all non-financial firms listed in Euronext described in chapter 3 and is the same as that used in the studies in chapter 4 and 5. Table 6.2, Panel A, reports summary statistics for the natural logarithm of Tobin's Q when we split the sample

by hedgers and non-hedgers. Panel B reports summary statistics for the natural logarithm of Tobin's Q when we split the sample by well-governed and poor-governed firms.[54]

The results in Panel A show that the mean difference of *L_Q* between hedging and non-hedging firms is statistically significant, which means that hedging firms are rewarded with higher market value than their non-hedging counterparts. This result supports the prediction of Allayannis and Weston (2001) and Allayannis *et al.* (2012), among others. Also in line with Allayannis *et al.* (2012), the results in Panel B show that the mean difference of *L_Q* between well- and poor-governed firms is statistically significant. Therefore, we conclude that well-governed firms have higher valuation when compared with poor-governed firms.

Table 6.2: **Summary statistics of the variables**

Panel A. Comparison of means for hedgers and non-hedgers							
Variables	**Hedgers (N = 456)**			**Non-hedgers (N = 111)**			***t*-statistic**[a]
	Mean	**Median**	**Std. dev.**	**Mean**	**Median**	**Std. dev.**	
L_Q	0.450	0.342	0.420	0.167	0.072	0.399	-0.283***
Panel B. Comparison of means for strong and weak-governed firms							
Variables	**Well-governed (N = 293)**			**Poor-governed (N = 274)**			***t*-statistic**[a]
	Mean	**Median**	**Std. dev.**	**Mean**	**Median**	**Std. dev.**	
L_Q	0.699	0.600	0.446	0.069	0.067	0.204	-0.630***

Note. The statistics reported are obtained through Stata (version 10.1). Panel A reports summary statistics of the natural logarithm of Tobin's Q (L_Q) for hedgers and non-hedgers. Panel B reports summary statistics of the natural logarithm of Tobin's Q (L_Q) for well-governed and poor-governed firms. L_Q is the natural logarithm of Tobin's Q, and Tobin's Q is computed as the ratio of market value to book value of assets, and market value of assets is computed as market value of equity plus book value of assets minus book value of equity. *t*-statistics are given for tests of the equality of means between hedgers and non-hedgers (Panel A), and between well-governed and poor-governed firms (Panel B). ***, **, and * denote statistical significance of the *t*-test at the 1%, 5%, and 10% levels, respectively.

[a] *t*-tests assume equal variances.

Table 6.3 presents the Pearson correlation matrix for variables that are likely to be associated with firm value. Gujarati (2003) suggests that, as a rule of thumb,

[54] When the firm-level governance index is greater than the median value for the sample, a firm is classified as well-governed firm, and poor-governed firm in the otherwise situation.

multicollinearity poses a serious problem if the Pearson pair-wise correlation exceeds 0.6. A visual examination of Table 6.3 reveals the pair-wise correlations are generally low. The highest correlation coefficient takes place between firm geographic diversification (*FS*) and the variable that represents firm hedging decision (*HEDGE*), and is around 0.406, which suggests that firms with a higher level of geographic diversification, as measured by the percentage of foreign sales, engage more often in hedging activities. This is in line with the exposure hypothesis (e.g., Bartram *et al*., 2009). Moreover, we also find a positive and significantly correlation (0.322) between the dividend yield dummy variable (*DIV*) and the return on assets variable (*ROA*). This relation is as expected. Indeed, the payment of dividends in companies with higher returns on assets is common.

Table 6.3: **Pearson pair-wise correlation coefficient matrix**

Variables	CAPEX	CG_INT	DIV	FS	HEDGE	INDDIV	INS	LEV	ROA	SIZE
CAPEX	1.000									
CG_INT	-0.012	1.000								
DIV	-0.014	-0.029	1.000							
FS	0.034	0.086**	0.045	1.000						
HEDGE	0.082*	0.086**	0.155***	0.406***	1.000					
INDDIV	0.013	-0.090**	0.122***	0.051	0.047	1.000				
INS	-0.029	-0.299***	-0.079*	-0.141***	-0.151***	-0.070*	1.000			
LEV	0.047	0.037	-0.015	-0.070*	0.002	0.049	-0.067	1.000		
ROA	-0.019	-0.041	0.322***	0.089***	0.045	0.051	0.019	0.001	1.000	
SIZE	0.004	-0.339***	0.194***	0.120*	0.181**	0.007	0.047	0.016	0.103**	1.000

Note. The coefficients of correlation are obtained through Stata (version 10.1). This table provides the Pearson correlation matrix for the explanatory variables used in OLS regression of firm value and the associated significance levels. Variables are as follows: CAPEX is the ratio of capital expenditures to total assets; CG_INT is a firm-level internal governance index comprising seven governance mechanisms that take into account two governance dimensions: (1) board matters and (2) ownership structure; DIV is a dummy which is assigned a value of 1 if the firm dividend yield is greater than the median yield for the sample; FS is the ratio of foreign sales to net sales and proxies for firm geographic diversification; HEDGE is a dummy which is assigned a value of 1 if a firm reports the use of either external and/or internal hedging instruments; INDDIV is a dummy which is assigned a value of 1 if a firm has at least two business segments with a different ICB 4-digit subsector classification code; INS is the number of shares held by officers and directors divided by common shares outstanding; LEV is the ratio of total debt to total assets; ROA is the ratio of EBIT by total assets, and SIZE is the natural logarithm of total assets. The significance levels are indicated by *, **, and *** that represent 10%, 5%, and 1% level, respectively.

Four more interesting results are: (1) the correlation between firm-level governance index (*CG_INT*) and firm size (*SIZE*) that is around -0.339, which suggests that small

firms may have better growth opportunities, and in line with the investment argument, may therefore adopt better governance structures (Beiner *et al*., 2006); (2) the negative and significant correlation (-0.299) between insider ownership and firm-level governance that corroborates the convergence-of-interest hypothesis (Bohren & Odegaard, 2006); (3) the positive and significant correlation (0.155) between the hedging variable (*HEDGE*) and the dividend yield dummy variable (*DIV*), which corroborates Nance *et al.*'s (1993) view that firms with lower dividend payouts probably have more internal funds, thereby reducing the need for hedging, and (4) also the positive and significant correlation (0.181) between firm size (*SIZE*) and the variable that proxies for hedging decision (*HEDGE*). This result is consistent with Nance *et al*.'s (1993) hypothesis that larger firms, that probably have more access to risk management expertise or that have economies of scale in hedging costs, are most likely to use hedging instruments. Several researchers corroborate this hypothesis (e.g., Graham & Rogers, 2002; Géczy *et al*., 1997).

6.4 Results and discussion

6.4.1 The effect of governance on the value derived from hedging

To draw inferences on the determinants of firm value and whether the hedging instruments' usage and firm-level corporate governance structures impact upon firm value, we run OLS regression to estimate the firm's value profile (model 1, Table 6.4), proxied by the Tobin's Q, specifically using its natural logarithm. In addition, by means of an interaction variable, we hypothesize that better governance leads to a more positive effect of hedging instruments' usage on firm value (model 2, Table 6.4).

Table 6.4: **Firm value determinants**

Variables	M1: OLS Dep.Var.: Q	M2: OLS Interaction model Dep.Var.: Q
HEDGE	0.195*** (4.90)	0.207*** (4.97)
CG_INT	0.175*** (16.76)	0.127*** (5.37)
HEDGE×CG_INT		0.060** (2.40)
CAPEX	0.405* (1.80)	0.420* (1.81)
DIV	0.002 (0.07)	0.002 (0.07)
FS	0.092 (1.26)	0.090 (1.25)
INDDIV	-0.006 (-0.21)	-0.012 (-0.39)
INS	-0.037 (-0.48)	-0.059 (-0.80)
LEV	0.197*** (5.03)	0.208*** (5.32)
ROA	0.621*** (2.78)	0.615*** (2.78)
SIZE	-0.005 (-1.00)	-0.005 (-0.96)
Constant	-0.368*** (-3.76)	-0.221** (-2.06)
Four-digit ICB code dummies	Yes	Yes
N	567	567
R^2	0.50	0.51
F-test	31.44***	30.89***

Note. The estimates reported here are obtained through Stata (version 10.1). The table shows the estimates of OLS (model 1) and OLS interaction model (model 2) for 567 non-financial Euronext firms. Variables are as follows: CAPEX is the ratio of capital expenditures to total assets; CG_INT is a firm-level internal governance index comprising seven governance mechanisms that take into account two governance dimensions: (1) board matters and (2) ownership structure; DIV is a dummy which is assigned a value of 1 if the firm dividend yield is greater than the median yield for the sample; FS is the ratio of foreign sales to net sales and proxies for firm geographic diversification; HEDGE is a dummy which is assigned a value of 1 if a firm reports the use of either external and/or internal hedging instruments; HEDGE×CG_INT is the interaction variable, which is computed as the multiplication of the mean-centered CG_INT and HEDGE; INDDIV is a dummy which is assigned a value of 1 if a firm has at least two business segments with a different ICB 4-digit subsector classification code; INS is the number of shares held by officers and directors divided by common shares outstanding; LEV is the ratio of total debt to total assets; L_Q is the natural logarithm of Tobin's Q, and Tobin's Q is computed as the ratio of market value to book value of assets, and market value of assets is computed as market value of equity plus book value of assets minus book value of equity; ROA is the ratio of EBIT by total assets, and SIZE is the natural logarithm of total assets. Robust standard errors are corrected for heteroscedasticity using Huber-White robust standard errors. *t*-values of the regression coefficients are in parentheses next to the coefficients. The significance levels are indicated by *, **, and *** that represent 10%, 5%, and 1% level, respectively.

Column 2, Table 6.4, reports the results of the model that estimate the main effect of hedging and firm-level corporate governance decisions on firm value (model 1). Results show that the coefficient of the hedging variable (*HEDGE*) is positive and highly significant (0.195, *t*=4.90). The average hedging premium represents 19.5% of firm value. This result supports the hypothesis that hedging by reducing the volatility of firms' cash

flows can be value enhancing (hypothesis 1a) and is in line with Allayannis and Weston (2001), among others.

Regarding the firm-level corporate governance structure, results show that a positive and statistically significant (0.175, t=16.76) relationship exists between corporate governance structure and firm value. Our results seem to support hypothesis 1b, which is consistent with the work of Gompers *et al.* (2003), Beiner *et al.* (2006), and several other researchers.

For the rest of the control variables, some turned out significant and with the expected sign, while others were non-significant. For example, the coefficient on the variable that proxy for investment spending (*CAPEX*) is positive and significant at the 10% level. This result is in line with those of Jin and Jorion (2006). Therefore, we confirm hypothesis 1d.

With regard to the leverage variable (*LEV*), the results show this variable to be significant. Theory predicts that firms with higher levels of leverage have higher Tobin's Q, that is, higher market value. Our results seem to confirm hypothesis 1i and are in line with Beiner *et al*. (2006). Finally, the coefficient on *ROA* is positive and significant, indicating that the higher the profitability, the higher the firm value. This is consistent with the prediction of theory (hypothesis 1j) and other previous empirical studies, such as Allayannis and Weston (2001), Beiner *et al*. (2006) and Hagelin *et al*. (2007).

The remaining control variables, *DIV*, *FS*, *INDDIV*, *INS* and *SIZE* are all statistically insignificant. So, our results do not support the liquidity-based hypothesis (hypothesis 1e). In addition, the geographic diversification argument – hypothesis 1f – is not supported by the results from model 1 estimation. Also, the level of insider ownership does not appear to influence firm value (hypothesis 1h). Finally, smaller firms with fewer industry

segments do not seem to be rewarded with higher market value, that is, we do not support hypotheses 1k and 1g.

To summarize, we find the results to be largely consistent with expectations with regard to firm characteristics: (1) firms that hedge have higher valuation; (2) well-governed firms are more likely to have higher valuation; (3) firms with higher investment level should have higher market valuation; (4) firms with a higher level of leverage should have higher market value, and, finally, (5) more profitability firms should have higher valuation.

In column 3, Table 6.4, we present the valuation effect (using Tobin's Q ratio) of hedging and firm-level governance structures when we introduce the interaction effect of hedging and governance decisions on firm value (model 2). We perform an incremental *F*-test in order to verify the significance of this expanded model (model 2) against the original model (model 1).[55] The incremental *F*-test is then 7.20, which is higher than the critical value of 3.86 for rejection at the 5% significance level. Thereby, we conclude that the interactive model is statistically significant.

Once more the direct effects of hedging and firm-level governance on firm value are positive and highly significant, which corroborates hypotheses 1a and 1b. The hedging premium represents an increase of 20.7 percentage points, on average, in firm market value, and an increase by one point in the firm-level governance index leads, on average, to a 12.7 percentage points increase in firm market value. Moreover, the results show that the coefficient of the interaction term (*HEDGE*×*CG_INT*) is positive and highly significant (0.060, *t*=2.40). By means of this result, the widespread hypothesis of an incremental value premium associated with hedging activities when the firm is well-

[55] The incremental *F*-test formula is as follows: $F = \frac{(R_2^2 - R_1^2)/(k_2 - k_1)}{(1-R_2^2)/(N-k_2-1)}$, where k denotes the number of variables, subscript 1 refers to the original model (model 1) and subscript 2 refers to the expanded model (model 2).

governed is supported (hypothesis 1c). That is to say, capital markets reward hedger firms when they are well-governed. Specifically, the hedging strategy impacts positively upon the firm market value by roughly 18 percentage points when we move from the first quartile (weak governance)[56] to the third quartile (strong governance) of the firm-level governance.[57]

When we think about hedging as a direct mechanism by which governance can enhance firm value, we observe that the impact on firm value of firm-level governance is conditional to hedging decision. So, when a firm decides to hedge (not to hedge) the value premium is around 18.7 (12.7) percentage points.[58]

As for the control variables, we verify that the significance and the sign of the coefficients estimates are comparable with those reported in model 1.

6.4.2 The effect of governance on the value derived from hedging controlling for the endogeneity of hedging and governance decisions

Standard OLS regression for the firm value model results may be misleading because they ignore the possible interdependences between firm value and hedging, and firm-level governance decisions. Thus, because *HEDGE* and *CG_INT* are believed to be endogenously determined, simultaneous equations' estimation is applied through equations (6.2) to (6.5). Beforehand, we are required to evaluate the validity of the variables instrumenting *HEDGE*, *CG_INT*, and *HEDGE*×*CG_INT*. Next, we analyse the

[56] As stated before, our index ranges from 0 to 7. So, we have classified firms with firm-level governance in the first quartile, which ranges from 0 to 2, as weak governed and firms in the top quartile, which ranges from 5 to 7, as strong governed.

[57] We compute the incremental effect of hedging on firm value depending on the strength of governance as follows: $\beta_{HEDGE} + \beta_{HEDGE \times CG\_INT} \times$ the value of *CG_INT* in the third quartile (strong governance) minus $\beta_{HEDGE} + \beta_{HEDGE \times CG\_INT} \times$ the value of *CG_INT* in the first quartile (weak governance).

[58] The impact of firm-level governance on firm value conditional to hedging decision is computed as follows: $\beta_{CG\_INT} + \beta_{HEDGE \times CG\_INT} \times 1$, for hedger firms and $\beta_{CG\_INT} + \beta_{HEDGE \times CG\_INT} \times 0$, for non-hedger firms.

endogeneity of the variables that are believed to be endogenous, that in general can have misleading estimations if the selected instruments are not valid.

Firstly, we define a set of instrumental variables, which affect each endogenous explanatory variable, but not, at least directly, the firm value. A valid instrument has a strong correlation with the endogenous variable (instrument relevance), but is not correlated with the error term of the structural equation (instrument exogeneity). Then, in order to test for the relevance we use the first-stage regression of hedging, governance and interaction models from an instrumental variable estimation.

In Table 6.5 we provide the summary results from reduced-form hedging, governance and interaction models and test for the relevance and exogeneity of the instrumental variables. Namely, we report the instrument coefficient estimates, their significance levels, the Shea's partial R^2 and the *F*-statistic of the joint test of instrument significance for each reduced-form equation. However, because our tests include more than one endogenous regressor in the structural model, we should report the minimum eigenvalue of the matrix analogous of the *F*-statistic that is defined in Stock and Yogo (2005) as a test of weak instruments. So, the null hypothesis to this test is that instruments are weak against the alternative that they are strong.

Table 6.5: **Relevance and exogeneity of the instruments**

	Dependent variables		
Instrumental variables	**HEDGE**[a]	**CG_INT**[a]	**HEDGE×CG_INT**[a]
ADR	-0.008	0.298	0.187
CG_EXT	-0.064***	0.130***	-0.108***
CG_INT×EXP	0.003**	0.885***	0.720***
CG_INT×TAX	0.040***	1.047***	0.320
EXP	-0.003	-2.806***	-2.395***
HEDGE×ADR	0.007	-0.199	-0.054
HEDGE×CG_EXT	0.074***	0.015***	0.257***
TAX	-0.083***	-4.136***	-2.769***

Table 6.5: **Relevance and exogeneity of the instruments** *(cont.)*

	Dependent variables		
Instrumental variables	**HEDGE**[a]	**CG_INT**[a]	**HEDGE×CG_INT**[a]
Relevance Tests:			
Shea's Partial R^2	0.03***	0.04	0.03
F test for IV significance (H_0: The instruments are weak)	109.19***	88.25***	103.40***
Minimum eigenvalue test (Stock & Yogo, 2005)[b] (H_0: The instruments are weakly correlated to the endogenous variable)		1.836	
Overidentifying restrictions test:[c]			
Sargan test χ^2_5 (H_0: The error term is uncorrelated with the instruments)		8.25	

Note. The estimates reported here are obtained through Stata (version 10.1). The table summarizes the instrumental variables results as of the reduced-form equations. The endogenous variables are as follows: CG_INT is a firm-level internal governance index comprising seven governance mechanisms that takes into account two governance dimensions: (1) board matters and (2) ownership structure; HEDGE is a dummy which is assigned a value of 1 if a firm reports the use of either external and/or internal hedging instruments, and HEDGE×CG_INT is an interaction variable, which is computed as the multiplication of the mean-centered CG_INT and HEDGE. The instrumental variables are as follows: ADR is a dummy which is assigned a value of 1 if a firm is issuing American Depository Receipts; CG_EXT is a country-level governance index which is computed as the common factor derived from a PCA of five measures of country-level governance mechanisms; CG_INT×EXP is an interaction variable, which is computed as the multiplication of CG_INT and EXP; CG_INT×TAX is an interaction variable, which is computed as the multiplication of CG_INT and TAX; EXP is a dummy which is assigned a value of 1 if a firm experiences FX, IR and/or CP exposure; HEDGE×ADR is an interaction variable, which is computed as the multiplication of HEDGE and ADR; HEDGE×CG_EXT is an interaction variable, which is computed as the multiplication of HEDGE and CG_EXT, and TAX is the net operating losses to total assets. The significance levels are indicated by *, **, and *** that represent 10%, 5%, and 1% level, respectively.

[a] The results for the other explanatory variables have been suppressed to preserve space. [b] For a significance level of 5%, three potentially endogenous regressors, eight instruments and tolerating a bias of 30% of IV estimator relative to OLS, the critical value is 4.46. [c] We perform a Sargan test based on a two-stage least squares estimator.

Further, we perform the Sargan test as a test of the exogeneity of the instruments. The fact that the number of instruments exceeds the number of endogenous regressors, i.e., the model is overidentified, allows testing as to whether the instruments are uncorrelated with the error term from the main equation (i.e., they are exogenous). It is tested whether all instruments are exogenous assuming that a least one of the instruments is exogenous. So, the null hypothesis is that the error term is uncorrelated with the instruments, i.e., the instruments are exogenous.

Concerning the relevance tests, the *F* tests of the significance of the instruments for each reduced-form equation reported in Table 6.5 tells us that that the instruments are always significant. However, the partial Shea (1997) R^2s do not exceed the suggested "rule of thumb" of 10%. Also the Stock-Yogo weak identification test has a value of 1.836 (Cragg-Donald *F*-test), which is lower than the critical value of 4.46 for rejection at the 5% significance level.[59] So the instruments are weakly correlated with the endogenous variable of interest, because the null hypothesis is not rejected. Table 6.5 also shows that Sargan test statistic is not significant, indicating that we cannot reject the null hypothesis of exogeneity of the instruments, and conclude that the overidentifying restriction is valid. In summary, the various statistics suggest that our instruments are valid (exogenous), but weak in explaining the variation of our model's potentially endogenous regressors.

Since our instruments appear to be valid, despite the fact that they are not relevant,[60] we proceed in order to explicitly assess if *HEDGE*, *CG_INT*, and *HEDGE*×*CG_INT* are indeed endogenous with regard to firm value (*L_Q*). Hence, we test for the presence of correlation between the variables and the error term. The null hypothesis to be tested is $H_0 : Cov(x,e) = 0$. If the null hypothesis is true, both the least squares estimator and the instrumental variables' estimator are consistent. In large samples the difference between them converges to zero. That is, $(\hat{\beta}_{OLS} - \hat{\beta}_{IV}) \to 0$. Naturally, if the null hypothesis is true, we should use the more efficient estimator, which is the least squares estimator. The alternative hypothesis is $H_1 : Cov(x,e) \neq 0$. If the alternative hypothesis is true, the least squares estimator is not consistent, and the instrumental variables estimator is consistent, so $(\hat{\beta}_{OLS} - \hat{\beta}_{IV}) \to c \neq 0$. If the null hypothesis is not true, we should use the instrumental

[59] According to Stock and Yogo (2005), the Cragg-Donald *F*-statistic must exceed 4.46 if we are confident at the 5% level, when a less than 30% of the OLS bias is tolerate.

[60] Earlier studies on corporate governance and hedging matters have relied mostly on weak instruments (e.g., Black *et al.*, 2006) and several studies do not present any evidence on these tests and choose the instruments based solely on economic reasons (e.g., Drobetz *et al.*, 2004; Beiner *et al.*, 2006).

variables' estimator, which is consistent. We use the Hausman test to formally implement the contrast test. The Hausman test statistic yields a χ^2 of 7.03, which is larger than the critical value of 6.25 at a significance level of 10% and three degrees of freedom. This result indicates that instrumental variables' estimation is preferred over OLS at the 10% level of significance. In this case, the null hypothesis of no measurement error is rejected. Hence, potential endogeneity between firm value and hedging, and governance seems to be evident and needs to be accounted for.

We proceed with the estimation of a simultaneous equation system by using the SUR estimation method. As stated before, we follow Balli and Sørensen (2012), and instrument our interaction variable (*HEDGE*×*CG_INT*) of interest. Table 6.6 reports the results of the structural equations system.

Table 6.6: **SUR estimation results**

		Dependent variables			
Independent variables	**Predicted Influence**	**(1) L_Q Coeff.**	**(2) HEDGE Coeff.**	**(3) CG_INT Coeff.**	**(4) HEDGE×CG_INT Coeff.**
L_Q[a]	na | + | + | na		0.413***	2.749***	2.232***
			(9.53)	(28.18)	(24.01)
HEDGE[a]	+ | na | + | na	0.141**		-0.469***	
		(2.10)		(-3.83)	
CG_INT[a]	+ | + | na | na	0.202***	0.036***		
		(12.38)	(2.70)		
HEDGE×CG_INT[a]	+ | na | na | na	0.063***			
		(3.63)			
CAPEX	+ | + | + | na	0.420*	-0.165	-1.467*	-1.392**
		(1.84)	(-0.64)	(-1.94)	(-2.12)
DIV	- | + | na | na	-0.016	0.059*		0.027
		(-0.62)	(1.72)		(0.041)
FS	+ | na | na | na	0.017			
		(0.33)			
INDDIV	- | na | na | na	-0.008			
		(-0.35)			
INS	+/- | na | - | na	0.135		-0.906***	-0.304
		(1.62)		(-3.24)	(-1.25)
LEV	+ | + | + | na	0.187***	-0.110*	-0.278	-0.426***
		(3.69)	(-1.93)	(-1.64)	(-2.91)

Table 6.6: **SUR estimation results** *(cont.)*

		Dependent variables			
Independent variables	**Predicted Influence**	**(1) L_Q Coeff.**	**(2) HEDGE Coeff.**	**(3) CG_INT Coeff.**	**(4) HEDGE×CG_INT Coeff.**
ROA	+ | na | + | na	0.583*** (4.39)		-1.941*** (-4.42)	-2.260*** (-4.79)
SIZE	- | +/- | +/- | na	0.004 (1.06)	0.022*** (4.95)	-0.018 (-1.20)	-0.014 (-1.20)
ADR	na | na | + | na			0.014 (0.14)	
CG_EXT	na | na | +/- | na			0.193*** (6.17)	
EXP	na | + | na | na		0.001 (0.04)		
TAX	na | + | na | na		0.112 (0.42)		
HEDGE×ADR					0.070 (0.73)
HEDGE×CG_EXT					0.214*** (27.79)
CG_INT×EXP					0.028* (1.75)
CG_INT×TAX					-0.503*** (-2.89)

Table 6.6: **SUR estimation results** *(cont.)*

		Dependent variables			
Independent variables	**Predicted Influence**	**(1) L_Q Coeff.**	**(2) HEDGE Coeff.**	**(3) CG_INT Coeff.**	**(4) HEDGE×CG_INT Coeff.**
Constant		-0.747*** (-7.65)	0.307*** (2.93)	0.763 (1.28)	0.148 (0.62)
Four-digit ICB code dummies		Yes	Yes	Yes	Yes
R^2		0.43	0.13	0.49	0.73
Observations		567			

Note. The table exhibits the results from structural equations (6.2) to (6.5). Column 1 reports the results of the value model, column 2 the results of the hedging model, column 3 the results of the governance model, and column 4 the results of the interaction variable model, all are obtained through the SUR estimator. In the predicted influence column, v | w | x | y indicates that the corresponding variable is predicted to have v, w, x, and y influence on L_Q, HEDGE, CG_INT, and HEDGE×CG_INT, respectively. "na" means that there is no prediction. Variables are as follows: ADR is a dummy which is assigned a value of 1 if a firm is issuing American Depository Receipts; CAPEX is the ratio of capital expenditures to total assets; CG_EXT is a country-level governance index which is computed as the common factor derived from a PCA of five measures of country-level governance mechanisms; CG_INT is a firm-level internal governance index comprising seven governance mechanisms that take into account two governance dimensions: (1) board matters and (2) ownership structure; CG_INT×EXP is an interaction variable, which is computed as the multiplication of CG_INT and EXP; CG_INT×TAX is an interaction variable, which is computed as the multiplication of CG_INT and TAX; DIV is a dummy which is assigned a value of 1 if the firm dividend yield is greater than the median yield for the sample; EXP is a dummy which is assigned a value of 1 if the firm has either FX, IR or CP exposure above the median exposure for the sample; FS is the ratio of foreign sales to net sales; HEDGE is a dummy which is assigned a value of 1 if a firm reports the use of either external and/or internal hedging instruments; HEDGE×ADR is an interaction variable, which is computed as the multiplication of HEDGE and ADR; HEDGE×CG_INT is an interaction variable, which is computed as the multiplication of the mean-centered CG_INT and HEDGE; HEDGE×CG_EXT is an interaction variable, which is computed as the multiplication of HEDGE and CG_EXT; INDDIV is a dummy which is assigned a value of 1 if a firm has at least two business segments with a different ICB 4-digit subsector classification code; INS is the number of shares held by officers and directors divided by common shares outstanding; LEV is the ratio of total debt to total assets; L_Q is the natural logarithm of Tobin's Q, and Tobin's Q is computed as the ratio of market value to book value of assets, and market value of assets is computed as market value of equity plus book value of assets minus book value of equity; ROA is the ratio of EBIT by total assets; SIZE is the natural logarithm of total assets, and TAX is the net operating losses to total assets. *t*-values of the regression coefficients are in parentheses below the coefficients. The significance levels are indicated by *, **, and *** that represent 10%, 5%, and 1% level, respectively.

[a] Treated endogenously - using predicted values from the reduced-form estimates.

Column 1, Table 6.6 reports the results of the firm value model. The results are quite similar to the ones reported above in Table 6.4 for model 2. We test if hedging by reducing the firms' cash flows can be value enhancing (hypothesis 1a). Moreover, we also test if firms with a higher quality of firm-level governance have higher quality of governance (hypothesis 1b). Thus, the question to be answered is if, in fact, risk management and higher quality of governance each add value to the firm. But the main hypothesis underlying our analysis is that better corporate governance leads to an incremental hedging-related value (hypothesis 1c). Now, the main question is when risk management and corporate governance add value to the firm.

As in the baseline interaction model (see in section 6.4.1, model 2), the results show that the coefficient of the hedging variable (*HEDGE*) is positive and significant (0.141, t=2.10). Indeed, the magnitude of the hedging premium is significant from an economic point of view: the average hedging premium represents 14.1% of the firm value, that is to say, on average, a firm that hedges is valued about 14.1% higher than a similar firm that does not hedge. This result supports hypothesis 1a and is similar to those of Allayannis *et al.* (2012) that yield an average hedging premium of 15.4% on instrumental variables' specification. Also, regarding the firm-level corporate governance structure (*CG_INT*), results show that a positive and statistically significant (0.202, t=12.38) relationship exists between firm-level corporate governance structure and firm value (*L_Q*), which seems to support hypothesis 1b. This result means that an increase by one point in the firm-level governance index leads, on average, to a 20.2 percentage points increasing in firm market value. This value premium is quite similar to those of Klapper and Love (2004).

Regarding our main hypothesis, the results show that the coefficient of the interaction term (*HEDGE*×*CG_INT*) is positive and highly significant (0.063, t=3.63), which means that hypothesis 1c is also supported. Therefore, we confirm that capital

markets reward firms that hedge when they are well-governed. Specifically, on average, well-governed firms which manage their risks are valued about 18.9 percentage points[61] higher than weakly-governed firms which also manage their risks. That is to say, the hedging strategy impacts positively upon the firm market value by roughly 18.9 percentage points when we move from the first quartile (weak governance) to the top quartile (strong governance) of the firm-level governance.

Moreover, when we follow the recent literature regarding hedging as a direct mechanism by which governance can enhance firm value (Allayannis *et al*., 2012), we observe that the impact on firm value of firm-level governance is also conditional to hedging decision. So, on average, when a firm manages its risk (does not manage its risk) the value premium inherent to the quality of governance is around 26.5 (20.2) percentage points.[62]

As before, several of the control variables are also significant and with the appropriate sign. We find that firms with more growth opportunities (*CAPEX*), high-levered (*LEV*) and more profitable (*ROA*) firms are associated with higher firm value. These results corroborate hypotheses 1d, 1i, and 1j, respectively, and are in line with Beiner *et al.* (2006).

The leftover of the control variables, *DIV*, *FS*, *INDDIV*, *INS*, and *SIZE* are all statistically insignificant. Hence, our results do not support the hypotheses 1e, 1f, 1g, 1h and 1k.

As discussed previously, estimating a simultaneous system of equations allows us to analyse the interdependences between a firm's value and hedging, and governance

[61] The incremental effect of hedging on firm value depending on the strength of governance is computed as follows: $\beta_{HEDGE} + \beta_{HEDGE\times CG\_INT} \times$ the value of *CG_INT* in the third quartile (strong governance) minus $\beta_{HEDGE} + \beta_{HEDGE\times CG\_INT} \times$ the value of *CG_INT* in the first quartile (weak governance).

[62] The impact of firm-level governance on firm value conditional to hedging decision is computed as follows: $\beta_{CG\_INT} + \beta_{HEDGE\times CG\_INT} \times 1$, for hedger firms and $\beta_{CG\_INT} + \beta_{HEDGE\times CG\_INT} \times 0$, for non-hedger firms.

decisions. In line with this, the coefficient estimates of the endogenous variables in the line labelled *L_Q* in Table 6.6 reveal that reverse causality is leading the relationship between firm value and hedging decision (column 2). As stated before, from the hedging equation it is very clear that firms that engage in hedging activities have higher valuation than their non-hedging counterparts. Now, we corroborate also hypothesis 2a: firms with a higher value are expected to engage more often in hedging activities. The coefficient (*t*-statistic) is 0.413 (9.53). This is in line with the argument suggested by Lin and Smith (2008). Also, the relationship between firm value and firm-level governance structures is affected by reverse causality (column 3). Whereas good corporate governance causes higher firm valuation, firms with higher market values could simply be more likely to choose better governance structures. Indeed, the coefficient estimate on *L_Q* in the governance model is positive and significant at the 5% level (2.749, *t*=28.18). This result corroborates our hypothesis 3a and is in line with Beiner *et al*. (2006).

Furthermore, the results of the hedging equation (Table 6.6, column 2) show that the coefficient on firm-level governance index (*CG_INT*) is positively and significantly (0.036, *t*=2.70) related to the likelihood of hedging. This result indicates that the higher the firm-level governance index, which is indicative of strong governance structures as well as low agency costs in the firm, the more the chance that firms use risk management instruments for hedging purposes. Along this line, Lel (2012) posits that strong governed firms use derivatives in a way consistent with shareholder value-maximization. Clearly, our findings support our governance-related hypothesis (hypothesis 2b) that better governed firms are more likely to use hedging instruments in line with the interests of shareholders.

As for the remaining firm-specific variables in the hedging estimation, the economies-of-scale-in-hedging argument – hypothesis 2g – is supported. This hypothesis

suggests that larger firms, that probably have more access to risk management expertise or that have economies of scale in hedging costs, are most likely to use hedging instruments. This result is consistent with Nance *et al.*'s (1993) hypothesis and with the findings of several researchers, for example, Graham and Rogers (2002), and Géczy *et al.* (1997). Our results also support the liquidity-based hypothesis (hypothesis 2d). This is in line with Nance *et al.* (1993) that predict that firms with lower dividend payouts have probably more internal funds available, and the presence of liquid assets reduces the need for hedging.

We find a negative coefficient for the debt variable (*LEV*). Also Allayannis and Ofek (2001), Carter *et al*. (2006), and Hagelin *et al.* (2007) find a negative relationship between leverage and hedging. Carter *et al.* (2006) argue that the financial distress argument is suitable if all the firms face identical costs of distress (if distress occurs). Yet, if firms with greater distress costs optimally choose lower target debt ratios, then the observed result appears more reliable. The results show that this variable is statistically significant at the 10% level, but the sign is contrary to the prediction. So, our hypothesis 2f is not confirmed.

In turn, the coefficient from the variable *CAPEX*, which we use to proxy for the level of investment spending, is negative and statistically insignificant at conventional levels. Thus, the results do not support hypothesis 2c. Also, the tax argument – hypothesis 2h – is not supported by the results from the SUR estimation. Finally, regarding the hedging model, the results also show that the exposure variable (*EXP*) does not have a significant explanatory power in the decision to hedge (hypothesis 2e).

Turning to the governance equation (Table 6.6, column 3) results, we find that poor country-level governance structures (*CG_EXT*) are associated with poor firm-level corporate governance structures. Indeed, La Porta *et al.* (2002) suggest that firms located

in countries with a weak legal environment may not have enough flexibility to improve their own investor protection and thereby rely on weak firm-level governance structures. In addition, larger insider shareholding seems to reduce the need for higher firm-level control of managers' actions (Bohren & Odegaard, 2006). These results are largely consistent with our predictions: hypothesis 3e and hypothesis 3f.

The other firm level factors, such as firm leverage (hypothesis 3g), firms' American Depository Receipts issuance (hypothesis 3c), and the firm size (hypothesis 3i), do not appear to be important in the decision about firm-level governance structures.

With regard to hedging decision and its effect on firm-level governance structures, the results in Table 6.6, column 3, indicate that firms that hedge have weak firm-level corporate governance structures. Indeed, the coefficient estimate on the hedging variable is negative and significant at the 5% level (-0.469, t=-3.83). This is opposite to our prediction in hypothesis 3b, therefore the hypothesis is not corroborated. This result may be consistent with the idea that hedging, by decreasing the firm's financial risk, induces a higher level of insider shareholding and in that way a firm's governance can be changed (Lel, 2012). In addition, in line with the convergence-of-interest hypothesis, whereas the primary governance function is to monitor management, Bohren and Odegaard (2006) document that larger insider stakes could reduce the need for such control. So, this result could indicate a possible substitution effect between insider shareholding and governance.

Finally, firm investment opportunities (*CAPEX*) and profitability (*ROA*) both also conflict with our predictions, which means that hypothesis 3d and 3h are not confirmed. The results in Table 6.6, column 3, indicate that firms with more investment opportunities and higher profitability have weak firm-level corporate governance structures. These results are somewhat surprising and we do not have any persuasive ad hoc explanations. Also Beiner *et al.* (2006) come to the same conflicting results. The authors advanced the

possibility that these firms may have weak governance structures because of their poor past performance and low profitability. However, these firms should have higher capital requirements and, to obtain any external financing, they are forced to improve their corporate governance.

Regarding the interaction equation, we do not present any discussion of the results. It is worth noting that the estimation of this regression occurs because *HEDGE* and *CG_INT* variables are qualified as endogenous, and by consequence the variable representing the interaction between the two variables must also be treated as endogenous.

Table 6.7 summarizes the results of the predicted hypotheses inherent to our system of equations.

Table 6.7: **Summary of the results of the predicted hypotheses**

Firm value model		**Evidence**
HYPOTHESIS 1a:	Hedging by reducing the volatility of firms' cash flows can be value enhancing.	Yes
HYPOTHESIS 1b:	Better firm-level governance structures will increase firm value as measured by Tobin's Q.	Yes
HYPOTHESIS 1c:	Better firm-level governance has implicit a higher valuation for firms that hedge.	Yes
HYPOTHESIS 1d:	Firms with higher levels of investment spending are expected to have higher firm value.	Yes
HYPOTHESIS 1e:	Firms with lower dividend yield are more likely to have higher value.	No evidence
HYPOTHESIS 1f:	Firms with a higher geographic diversification have higher firm value.	No evidence
HYPOTHESIS 1g:	Firms with multiple industrial segments have lower value.	No evidence
HYPOTHESIS 1h:	The level of insider ownership is associated with firm value.	No evidence
HYPOTHESIS 1i:	Firms with higher leverage have a higher firm value.	Yes
HYPOTHESIS 1j:	More profitable firms are expected to have a higher valuation.	Yes
HYPOTHESIS 1k:	Larger firms are expected to have lower Tobin's Q.	No evidence
Hedging model		**Evidence**
HYPOTHESIS 2a:	Firms with a higher value are expected to engage more often in hedging activities.	Yes
HYPOTHESIS 2b:	Better governed firms are more likely to use hedging instruments in a way that is consistent with value-maximizing theories of hedging.	Yes

Table 6.7: **Summary of the results of the predicted hypotheses** *(cont.)*

Hedging model		**Evidence**
HYPOTHESIS 2c:	Firms with a higher level of investment spending are more prone to hedge.	No evidence
HYPOTHESIS 2d:	Firms with a lower dividend level are less likely to hedge.	Yes
HYPOTHESIS 2e:	Firms indicating a higher level of exposure to financial risk have a chance of greater potential benefits from hedging.	No evidence
HYPOTHESIS 2f:	Firms with a greater degree of financial distress, thereby with a higher level of debt, are more likely to engage more often in hedging activities.	No
HYPOTHESIS 2g:	Firm size is expected to be associated with the likelihood of hedging.	Yes
HYPOTHESIS 2h:	If the firm incurs tax losses which will be carried forward, the probability of the firm's engagement in hedging will be higher.	No evidence
Corporate governance model		**Evidence**
HYPOTHESIS 3a:	Firms with higher market values could simply be more likely to choose better governance structures.	Yes
HYPOTHESIS 3b:	Firms that hedge are associated with a higher quality of firm-level governance structures.	No
HYPOTHESIS 3c:	Firms issuing American Depository Receipts are expected to have better governance ratings.	No evidence
HYPOTHESIS 3d:	Firms with more growth options are expected to improve their governance structures.	No
HYPOTHESIS 3e:	Country-level governance provisions influence firm-level governance performance.	Yes
HYPOTHESIS 3f:	Larger insider shareholdings are expected to reduce the need for additional firm-level governance control.	Yes
HYPOTHESIS 3g:	Firms with more external financing are expected to improve their governance structures.	No evidence
HYPOTHESIS 3h:	More profitable firms should have better firm-level governance structures.	No
HYPOTHESIS 3i:	The size of the firm is expected to influence firm-level governance performance.	No evidence

Note. The table lists the theoretical predictions and the corresponding empirical evidence. Those empirical studies whose findings provide significant evidence for the theoretical prediction appear after the word "Yes"; those whose findings provide significant evidence but are contrary to the theoretical prediction appear after the word "No"; those studies that do not support the theoretical prediction appear after the words "No evidence".

6.5 Conclusion

In this study we analyse if the use of hedging instruments is valuable and, specifically, if strong corporate governance structures lead to an incremental value for hedger firms. In analysing these issues, we build on prior research and on economic

reasons, and highlight the idea that hedging and corporate governance decisions are endogenously determined. Indeed, firms with high market values may be more likely to engage in hedging activities or to adopt good governance practices, rather than vice versa (reverse causality). To properly address the endogeneity problem described and to avoid spurious regression results, we develop a comprehensive system of simultaneous equations and apply the Seemingly Unrelated Regression (SUR) estimator.

Our results support the widespread hypothesis of a value premium associated with hedging activities. This premium represents an increase of 14.1 percentage points, on average, in firm market value. We interpret this as evidence that, on average, the Euronext non-financial firms are using hedging instruments efficiently. Most important is that capital markets reward hedger firms that are well-governed when weighed against those that are poorly-governed. Specifically, the hedging strategy impacts upon firm market value by roughly 18.9 percentage points when we move from the first quartile (weak governance) to the third quartile (strong governance) of the firm-level governance. On average, the whole hedging premium conditional on firm-level governance quality represents an increase of 35.6 percentage points in firm market value. These results are robust to possible endogeneity, i.e., our analysis confirms that causation runs for hedging and firm-level corporate governance to firm value, but also we find evidence of reverse causality, with higher valued firms engaging more often in hedging activities and adopting improved firm-level corporate governance practices.

We also report a number of other interesting results on the simultaneous estimation between firm value, hedging and firm-level governance. Namely, firm-level corporate governance is positively associated with the hedging decision, which means that well-governed firms have a higher probability of undertaken hedging activities seeking to maximize shareholder value. Inversely, hedging impacts negatively upon firm-level

governance. This result is consistent with the idea that hedging, by decreasing the firm's financial risk, induces a higher level of insider shareholding, which indicates a possible substitution effect between insider shareholding and governance. Ultimately, we also find that firms with a higher investment level, with a higher leverage and that are profitable are more likely to pursue value-maximizing decisions.

On the whole, our results show that well-governed firms use risk management instruments in a way that is favourable to firm value. As a result, we add to corporate governance literature by revealing evidence via a specific channel by which governance can enhance firm value.

CHAPTER 7

Conclusion

In spite of controversial arguments in the finance literature concerning the irrelevance of risk management activities, in recent years, an increasing number of companies have committed substantial funds to risk management. This seems to bring to light the potential for risk management to preserve and even to increase firm value.

Based on the main objective of risk management programmes, that is hedging against financial risks, previous empirical studies have investigated the hedging effect on shareholder value focused solely on the characteristics of firms that engage in these kinds of programmes. Further, a number of studies have attempted to provide evidence on the existence of a value premium inherent to hedging activities. While there has been some evidence in support of the theoretical predictions in examination, in general the empirical tests have met limited success. It is argued that due to information asymmetries investors cannot discriminate between alternative uses of risk management instruments (hedging, speculation or managerial self-interests). A recent strand of research argues that investors can appeal to corporate governance mechanisms to control the managerial agency costs and in that way ultimately control the alternative uses of risk management instruments. Indeed, several questions regarding firms' risk management remain unresolved.

The main objective of this dissertation is to provide a deeper understanding of the puzzling issues in the hedging-value-related literature outlined above. To accomplish this

we performed three empirical studies on risk management and its relation with corporate governance and firm value based in a sample of 567 non-financial firms listed in Euronext.

In this chapter, we review the results from the three studies developed in the former chapters, discuss the relationships and describe the contributions of these studies to the exposure, hedging and corporate governance literature. Finally, we discuss the limitations of these studies and the possible extensions for future research.

7.1 Overview of key findings

In the first study, our main propose was to analyse if firms use risk management instruments for hedging or for alternative purposes, namely speculation or seeking managerial benefits. We first examined the relationship between the firm's stock returns and financial risks, such as exchange rate, interest rate and commodity price risk. From this analysis we assess the level of financial risk exposure for each firm of our sample. Further, taking into consideration the use of both internal and external hedging instruments and the firms' operating profiles, we investigate the determinants of such exposures. We extend the recent research on the exposure determinants by incorporating the view that firms that hedge have higher levels of exposure, which means that probably firms with a higher level of exposure self-select themselves into the group of firms that hedge.

We have observed that the firms of our sample display higher percentages of exposure in the three categories of risk analysed when weighed against some preceding empirical studies. Moreover, our empirical findings confirm that the use of hedging instruments significantly reduces the level of the underlying financial exposure. This result holds for all the categories of risk in analysis. Regarding, the influence of the firm's

operating profile in the inherent exposure, we only found evidence on the matter in the scope of interest rate risk. We also found that self-selection is an important issue, which means that the firm characteristics that induce hedging are indeed positively associated to the firm's financial exposures. We have consistently verified that firms that hedge are larger and well governed, and have a higher dividend level.

The evidence up to now clearly indicates that risk management instruments' usage by Euronext non-financial firms is done for the purpose of hedging. But to draw a picture of a firm's hedging behaviour regarding our data, we must proceed with the analysis of hedging decision determinants. Therefore, in our second study our main objective was to investigate the causal relationship between firms' use of hedging instruments and the quality of firm governance structures, which was proxied by a firm-level governance index. The use of firm governance indexes is an innovative methodology that proxies for the effective control over managers' actions within the firm. Specifically, we conducted tests to assess if a firm's hedging decision is undertaken in simultaneity with governance choices and other financial decisions made by the firm.

Indeed, the results of the second study reconfirm that firms which assure a high level of control of managerial actions, specifically with the improvement of governance structures, are most likely to pursue value-maximizing hedging strategies. Again we have corroborated the economies-of-scale-in-hedging argument. Finally, we confirm the advantage of the implementation of a simultaneous equation framework in the examination of hedging decision determinants, since we have found that the firm's hedging and corporate governance decisions are simultaneously undertaken, and that the causality in the hedging-investment relationship runs the other way round, that is from hedging to investment decision.

According to positive hedging theories, the costs of establishing and maintaining a hedging programme can be justified only in imperfect capital markets and in a way that they do not exceed the expected benefits of risk management. So, it is not enough to know that the market recognizes the effect of hedging activities on a stock's exposure to financial risks, or to know the characteristics of companies that implement hedging strategies, to state that a firm maximizes its value through hedging. The key question is to assess whether the hedging activities undertaken at the firm level actually increase its value. With this in mind, in our third empirical study we aimed to analyse the issue of hedging premium conditional to firm-level quality of governance. The main hypothesis to be tested was that well-governed firms assure hedging activities are undertaken for value value-maximization purposes, thereby leading to a higher hedging-related value when matched up to those firms that also hedge, but instead have weak governance structures.

The results of the third empirical study support the widespread hypothesis of a value premium associated with hedging activities. Most importantly, our results support the recent literature regarding the role of corporate governance and agency costs on hedging decisions, which documents that hedging is more valuable when firm-specific governance is strong. In addition, we confirm the advantage of the implementation of a simultaneous equation framework in the examination of the relationship between firm value, hedging and firm-level governance. In fact, we have confirmed that causality runs for hedging and firm-level governance to firm value, as measured by Tobin's Q, but we also found evidence of reverse causality, that is, higher valued firms being more likely to engage in hedging and adopting improved governance structures. We also found that well-governed firms have a higher probability of undertaking value-maximization hedging activities. Inversely, hedging impacts negatively upon firm-level governance, which may be because hedging, by decreasing the firm's financial risk, induces a higher level of insider

shareholding. This idea indicates a possible substitution effect between insider shareholding and governance. Finally, we also found that firms with a higher investment level, with a higher leverage and those that are more profitable are more likely to pursue value-maximizing decisions.

The overall results of the three empirical studies can be summarized as follows: risk management is a particularly important tool in shielding firm value from financial risk, such as exchange rate, interest risk and commodity price risk. Our results consistently show that risk management strategies are most common in large firms and firms with lower agency costs, i.e., in firms with strong firm-level corporate governance structures, which indicates that risk management is actually driven by hedging proposes. Furthermore, our results show that risk management is a value increasing strategy for the firm. In particular, when hedging firms are well-governed they outperformed their weak-governed counterparts that also hedge.

7.2 Contributions

This dissertation contributes to the literature in a number of ways and it has enhanced theoretical and empirical understanding of hedging-value-related literature.

Firstly, this dissertation focuses on financial risk as a whole and uses a large sample of non-financial firms across all industries, whereas the majority of the prior literature focuses on only one type of financial risk and on small industry-specific samples.

Secondly, while previous studies used mostly US and UK data to analyse the relationship outlined above, we investigated a broad sample of Euronext non-financial firms. We find that the objectives that we stated for this research are useful and timely because the analysed European countries have recently experienced several corporate governance developments that illustrate a trend towards specialized rules for listed

companies, which is a direct result of the European Parliament and Council Directive 2006/46/CE, of 14th June 2006. Moreover, regarding risk management matters, we have assisted the mandatory adoption of more rigorous standards, such as the IAS 32 and IAS 39, which undoubtedly improves the information disclosed by companies and facilitates the data collection on the subject of risk management activities from firms' annual reports. Indeed, only a few published studies enclose risk management matters by means of data from Continental Europe, namely with data subsequent to IAS 32 and IAS 39. To the best of our knowledge, this is the first study that uses this kind of data based on a sample formed by the four selected countries.

Thirdly, we use a *full* hedging variable, which means that we use a hedging measure that accounts for the use of internal and external hedging instruments. In this we contrast with most of the previous studies that frequently consider derivatives' use as a proxy for risk management activities.

Further, in the three studies our contribution is also methodological. To the best of our knowledge, our first study is one of the few studies that explicitly incorporate the wide range of financial risks in Jorion's (1990) augmented market model. In addition, we add to exposure-based literature by addressing the endogeneity of the hedging decision through a treatment effect methodology. Moreover, we bring new evidence to the hedging-based literature on the use of instrumental variables probit estimators. Namely, in our second study, we use the AGLS and 2SCML, two simultaneous equations systems that involve limited and discrete dependent variables and that are commonly used in the economics, sociology and political sciences literature, but rarely applied in the context of hedging literature. Further, in the third empirical study, in order to analyse the impact of hedging on firm value depending on the strength of governance, we add to the hedging-value-

related literature by explicitly addressing the endogeneity of firms' hedging and corporate governance choices for the first time.

Finally, we add to corporate governance literature by bringing to light a specific channel by which corporate governance can enhance firm value.

7.3 Limitations of the study and opportunities for future research

Finally, we would like to mention some limitations of this study. Firstly, we are conscious that annual reports may not be the best source of information. Despite, our close examination of the information provided in the annual reports, errors may still have occurred. This limitation is clearly inherent to the research technique adopted in the collection of data used in the specification of hedging, firm-level corporate governance and foreign involvement variables.

Secondly, the main limitations of our study are also related to the specification of corporate hedging, firm-level governance and exposure variables. Without a doubt, providing an adequate measure for corporate hedging is a necessary element to the success of empirical tests. It is a fact that the use of notional value of hedging contracts has some advantage over the dummy variable that we used, as it provides information about the level of risk management, whereas the dummy variable provides information solely about the decision to hedge. However, in general, the data is often incomplete and differs greatly from firm to firm, even though the quality of disclosure has improved with the adoption of IAS 32 and IAS 39 in January, 2005. So, we do not have enough information to build a continuous measure of hedging instruments.

As mentioned before, the method of collecting data for the construction of the variable that proxies for financial risk exposure needs further improvement. In fact, the measure of financial risk exposure used seeks to already represent a net exposure, that is,

the exposure that remains after the firm has engaged in some hedging activity. Regarding the firm-level corporate governance, we are aware of the limited information collected on the matter of the board of directors' structure.

An interesting avenue for further research would be the generation of a continuous corporate hedging variable, as it is expected that in recent years improvements in the derivative disclosures have happened as a consequence of IAS 32 and IAS 39. Additionally, regarding the firm-level corporate governance index, it might be interesting for further research to build an improved index that accounts for more information considered important in assessing the corporate governance quality.

Another interesting path for further research would be the enlargement of the sample, namely by including a new set of European countries that are classified in the Anglo-Saxon corporate governance system. Following these lines of thought, an additional advantage of making a comparative study of corporate governance across Europe is given by the possibility to investigate the influence the institutional environment might have in the relationship between hedging premium and firm-level governance.

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