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Derivatives Reporting Practices by Multinationals

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BACKGROUND

The corporate use of derivatives securities to manage various types of transaction exposure has increased dramatically over the past two decades in both the US and the European Union (EU). The deregulation of the markets for interest rates and exchange rates has stimulated a demand for various risk management tools. Nevertheless, there are a number of contentious issues as to whether corporations should attempt to manage such risks on behalf of their shareholders, particularly given the relative opaqueness of these instruments. As a result, prior research has had to resort to surveys, which are generally plagued by both response bias and subjective interpretation by users.

Direct financial analysis of the value and risk implications of the corporate use of derivatives has become possible, owing to increased efforts to make these exposures more transparent as part of recent efforts to harmonise and standardise financial reporting. Both US GAAP and equivalent IFRS now require firms to recognise the financial impact of these exposures on their balance sheets, income statements and comprehensive income statements. Despite these developments, however, very little is known either about the broader interrelationship between the incidence, magnitude and risk, and earnings implications of corporate use of derivatives, or their broader potential interrelationships with corporate financial policy and various other sources of firm risk.

With the increase in global competition and trade, financial theory suggests that multinational firms are becoming increasingly concerned about the relationship between their investment, financial and risk management policies as they are more internationally oriented and geographically diversified than smaller firms. It is argued, therefore, that multinational firms are much more likely to benefit from managing their diversified operations via derivatives use and risk management procedures.

The existing literature provides little insight into these broader potential inter-linkages between derivatives use, risk management and integrated corporate financial policy. A comprehensive analysis of this issue is not possible without a detailed analysis of the various types of derivatives, their nature and level, together with an analysis of other sources of firms' idiosyncratic risks. Analysis of cross-sectional variation in derivatives use also permits further analysis of the links between such practices and overall variations in firms' earnings and their cost of capital.

THE STUDY

This study assesses the relative and incremental explanatory power of the prediction that firms' derivatives use can be related to specific firms' financial characteristics, as well as to market risk and to idiosyncratic sources of risk. It focuses on choices made about interest rate and/or foreign currency market-related exposure by the largest non-financial firms headquartered in the US or Europe. Since the populations of these geographic regions are ageing, understanding the implications of these choices for corporate risk and performance becomes increasingly important.

The empirical analysis conducted in this study draws on the derivatives reporting practices of a sample of large US and EU multinational firms during 2005–08, a period of regulatory change when globally comparable and relatively standardised derivatives and pension reporting rules were first implemented.

The study develops specific predictions concerning the association between firm-specific factors and derivatives use, the level of use and changes in use over time. It also explores broader connections between these factors and the exposure of firms to interest rate and foreign currency fluctuations, hedge effectiveness, and variations in operating earnings and cash flows.

Furthermore, the study investigates the relation of firm-strategic decisions to various sources of both market risk and to idiosyncratic risks, ie risks that arise from the activities of a particular firm; whereas systemic risks are of a more general nature, and involve the overall operations of the market.

The strength of these relationships for EU and US firms, both separately and pooled together, are examined. The latter allows an analysis of the impact on derivatives use of a range of broader institutional factors related to accounting and regulatory quality. The research design utilises:

- recent innovations in the measurement of discretionary accruals
- segmental information concerning foreign sales
- interest rates
- defined-benefit pension risk and funding
- foreign currency exposures
- the hedging ratio.

To examine further the interrelationship of firm-specific risk and the propensity to use derivatives, the study also estimates the equity cost of capital for the sample firms. These estimates provide a check on the cross-sectional regression results, and allow the study to draw inferences not only concerning the interrelationship between multinationals' risk management policy and the extent of their use of particular types of derivatives, but also from systematic differences in these firms' estimated equity cost of capital. Both standard and full information beta (FIB) cost of capital methodologies are used.

In contrast to previous research, this is the first study to identify incentive problems as a specific alternative justification for the use of derivatives by multinational firms. It is also the first to undertake a direct comparison of the determinants and nature of derivatives use by US- and EU-based multinationals.

This is also the first study to identify corruption, regulatory quality and accounting as being an integral part of these choices, and extends its analysis to include the speculative trading of derivatives. Thus, the study provides a number of new insights into old issues concerning the determinants of derivatives use and their broader risk-management implications.

The scope of the analysis is restricted by a number of issues related to the data set. The study does not consider, therefore, the implications for managerial performance evaluation. The analysis of derivatives use is also restricted by the lack of publicly available information about the quality and extent of risk management systems that are used to implement and evaluate derivatives use. A number of suggestions, for further refining and extending the empirical analysis, are made.

THE FINDINGS

The study finds that there is a relatively strong and robust association between both the propensity to use derivatives and the level of use of derivatives with a range of firm-specific idiosyncratic and financial risk factors. It predicts that these relationships hold for interest rate and foreign currency derivatives and help explain changes in the use level of derivatives. The findings both clarify and condition the results on the overall use of derivatives.

The study estimates the cost of capital for EU firms under various assumptions about the methodology of estimation as well as different currency denominators of the investor in these firms. Using the full information beta (FIB) approach overcomes the limitations of the CAPM and FF3F methodologies in not recognising the differential costs associated with sales when segmented into domestic, EU/US and other markets. The cost of capital for heavy users of derivatives of various types is in many cases significantly higher than for low users of derivatives.

Overall, there are strong traces of support for the view that derivatives use by complex multinationals performs a risk-management role in mitigating sources of idiosyncratic risk and incentive problems. Many of the factors associated with derivatives use also imply that the capital structure policy of large conglomerates can be best viewed from an integrated and dynamic corporate financial perspective.

Overall, the study finds a fairly robust relationship between both the propensity to use derivatives and the amount of use, and various financial characteristics of firms, although both the statistical strength and direction of these relationships vary considerably across the regions in which these firms are based.

In particular, the finding that EU firms tend to view derivatives use much more liberally than that implied by the relatively narrow and specific focus on derivatives qualified for hedging treatment raises important questions concerning the corporate governance and accountability of these organisations to their shareholders and other stakeholders.

These findings must be viewed with caution, however, given the relatively short time-frame between the initial adoption of IAS by large European firms, and the implementation of costly and complex associated requirements of derivatives reporting. The sample period was not sufficiently long to undertake robustness tests on the effects of changes in fundamental economics affecting the provision of and demand for derivatives use, and various accounting and regulatory factors which control and mitigate the overall predicted relationships. Further research is needed to update and validate the overall results reported, particularly in the light of more recent changes to derivatives reporting after the latest financial crisis.

FURTHER RESEARCH

While the study has paid much attention to understanding the sources and nature of derivatives use by multinationals, and their broader linkages to corporate financial policy, the results and analysis can be further extended in a number of dimensions. Further research is needed to identify better measures for foreign currency and interest rate exposure of multinationals that have complex and interacting exposure to both types of instrument. More research is also needed to identify sources and the nature of idiosyncratic risk and discretionary accruals, both of which contribute to the opaqueness of reporting by these large entities. Finally, more work is needed to tease out the implications and interrelationships between overall corporate financial policy, including risk management related to derivatives, and other sources of retained capital, such as pension funds and other post-retirement benefits.

The findings of this report also bear on current deliberations by the IASB concerning the use of cash flow hedge accounting approaches to derivatives reporting. It also has implications for the transparency of derivatives used by multinationals, in particular the role of over-the-counter versus exchange traded derivatives. Further research is still needed on these issues.

1. Introduction

Financial risk management is broadly defined as the process by which management identifies, measures and controls financial risk exposure to large losses and the firm's vulnerability to them (DeMarzo and Duffie 1991). A number of industrial firms have taken advantage of various types of derivative instruments to mitigate various sources of financial risk exposure. Recent reporting requirements for financial instruments do not fully take account of these new financial innovations, leading to potential opportunities for regulatory arbitrage, earnings mismanagement and the use of financial derivatives for non-economic or cosmetic accounting reasons.

In this study, we analyse the extent to which these exposures are also interrelated with other aspects of firms' financial policies, including institutional factors associated with industry and/or accounting GAAP and GAAP application. In addition, we seek to understand the broader links between risk management, corporate financial policy and sources of idiosyncratic, or firm-specific, risk, such as exposure to largely unhedged defined benefit pension plans and other related unfunded post-retirement benefit obligations.

The main purpose of our research is to assess the relative and incremental explanatory power of the prediction that firms' derivatives use can be related to specific firms' financial characteristics, as well as to market risk and to idiosyncratic sources of risk. We focus on choices made about interest rate and/or foreign currency market related exposure by the largest non-financial firms headquartered in the US or Europe. Since the populations of these geographic regions are ageing, understanding the implications of these choices for corporate risk and performance becomes increasingly important. Our analysis focuses on a stratified sample of European and US firms that populate the FTSE 500 index of the largest global non-financial firms, which are subject to either US GAAP in this area, or have recently implemented relatively new and comparable standards on derivatives reporting contained in IFRS, effective in EU countries on 1 January 2005.

In undertaking this research, we make a number of contributions to the existing literature. First, our empirical analysis of derivatives use by multinationals was motivated by the developing theoretical literature concerning the need to resolve incentive problems associated with decentralised decision making and control of large and complex organisations. In particular, Froot et al. (1993) and Froot (1995) depart from standard corporate finance theory by arguing that derivatives use by firms should be viewed from a broader functional perspective. These arguments imply that both the level and magnitude of derivatives use is associated with various sources of idiosyncratic or firm-specific risk, rather than with an institutional perspective, as codified by existing rules to focus narrowly on mitigating specific market risks. The implementation of comprehensive risk management programmes, and current controversies about their adequacy in changing regulatory environments, also affords an opportunity to compare derivatives use by US and EU firms, where regulatory and accounting quality differ significantly.

Investigating the cost of capital implications of derivatives use is important for a number of reasons. First, from a theoretical perspective, estimating the cost of capital has become an important deduction from accounting profit in arriving at 'residual income', and for performance measurement and reporting. Many corporate managers' remuneration is conditioned by a cost of capital calculation that in turn potentially affects the size of their bonus. Business units are often bought, sold, closed down or expanded on the basis of whether they meet their cost of capital. Many financial analysts' corporate valuation models feature the cost of capital as an input. Estimating the cost of capital for the conglomerate firm may not capture idiosyncratic risks unique to the individual divisions constituting the firm, including both sources of transferable capital (eg derivatives) or retained capital (pensions). Jin et al. (2006) develop cost of capital estimates that 'correct' for the failure of current procedures to incorporate both the value and risk of pension plans. Previous researchers examining the sources of derivatives use (eg Bodnar at al. 2003) have not attempted to identify how developments in pension accounting rules can either enhance or obscure these interrelationships. An important contribution of this study is to examine the interrelationship of these choices the extent of firm discretion over obscure pension accounting rules, and consider their implications for estimating the cost of capital.

Prior research on this topic to date has focused largely on specific earnings-management incentives for derivatives. Zhang (2009) is the only previous study that has comprehensively examined the linkage between interest rates and foreign currency derivatives by reference to standardised disclosures for a limited sample of US firms, under the SFAS 133 (FASB 1998) regime. That study is restricted to examining derivatives use by new users of risk-management programmes, and does not examine the broader strategic, cultural and institutional factors affecting derivatives use by firms. In addition to considering the empirical implications of a relatively comparable and distinct set of multinational firms, this study develops new measures of risk that can be associated with derivatives use, including idiosyncratic risk, the hedging ratio and discretionary accruals. By developing a relatively comprehensive database of derivatives, pensions and financial disclosures related to foreign sales by these large enterprises, we provide new insights into old issues by exploring how cross-sectional variations in derivatives use may be affected by broader cultural and regulatory quality issues, and by the use of derivatives by multinationals for both hedging and speculative trading purposes.

Consistent with a broader financial perspective, we predict and find associations between the propensity to use derivatives and a range of firm-specific financial factors. We develop and test predictions concerning how these factors also affect not only levels of use of specific types of

derivatives, but also changes in use of derivatives over time since the new rules were implemented. We conduct further tests on the robustness of these posited linkages by reference to firms' exposure to interest rate and foreign currency risk, determinants of the hedging ratio, and of co-variations in operating income and cash flows. We explore the incremental and relative association of factors associated with derivatives use, by controlling for regulatory quality and accounting quality factors, and for the use of speculative derivatives. The main finding of this study is that there is a positive association between the propensity to use derivatives and a range of firm and market risk measures. The level of use is related to earnings at risk, and changes in derivatives use vary across the geographical regions and regulatory environments. We also find that firms' use and level of use of derivatives is positively associated with their cost of capital estimates; although we find that using a robust methodology that allows for full information concerning the mix of domestic, EU/US and other sales is important in conditioning our findings in this respect.

The remainder of this report is organised as follows. Chapter 2 provides the institutional background and research. Chapter 3 develops the hypotheses. Chapter 4 discusses the data and sample. Chapter 5 reports the results of empirical tests. Chapter 6 develops various cost of capital estimates. Chapter 7 provides a conclusion.

2. Institutional background and research

This section provides the institutional background needed to understand the reporting environment. We also briefly discuss prior published research that bears on this topic.

2.1 INSTITUTIONAL BACKGROUND

This section comprises a brief overview of the major features of financial instruments and the relevant applicable accounting standards. A financial instrument is any contract that gives rise to a financial asset of one entity and a financial liability or equity instrument of another entity.[1] The need for a specific standard on financial instruments such as derivatives arose from the apparent inadequacy of traditional accounting practices, which are founded on principles developed when the primary focus in accounting was on manufacturing, eg accruing costs to be matched with revenues. Financial instruments arise at the point of revenue realisation, ie the need to transform these inputs into cash or claims to cash. Enterprises can use derivatives either to monitor changes in financial risks or to speculate.

The definition of a financial instrument is very broad, and includes interest rate swaps, Treasury bond options, credit swaps, equity swaps, bonds, receivables, loans and shares. The increasing complexity of the variety and nature of these instruments has, in turn, led to greater difficulties faced by firms in recognising, measuring, presenting and disclosing such instruments in the financial statements. It is recognised that the traditional realisation and cost-based measurement concepts are generally inadequate for the recognition and measurement of financial instruments.[2] In 1997, accounting standard setters in the UK, the US and internationally, combined forces to develop an integrated and harmonised standard on financial instruments; a joint working group was created to develop a fair value approach for financial instruments. The draft standard eventually drawn up by the joint working group proposed that all financial instruments would be recorded at fair value, with corresponding gains and losses reported in income (IASB 2000b). This implied that the fair value of an entity's own debt would take account of changes in the entity's credit risk and that hedge accounting would no longer be allowed.

These proposals have proved controversial, however, because they move considerably beyond current practice. Moreover they are conceptually problematic as they require more separation than usual between legal and 'economic' ownership. For example, if an entity buys a quoted share in the financial markets, it may be entitled to the benefits and exposed to the risks in owning the share earlier than the date on which it is registered as the legal owner. There are also questions of derecognising and offset. Under International Financial Reporting Standards (IFRS), the recognition and derecognising of financial assets and financial liabilities is addressed in IAS 39 – Financial Instruments: Recognition and Measurement (IASB 2004), while the offset of financial assets and financial liabilities and presentational disclosures is addressed in IAS 32 – Financial Instruments: Disclosure and Presentation (IASB 2005).[3]

Further, IAS 32, IAS 39, and, when applied, IFRS 7 (IASB 2006), apply to the financial instruments of all entities that are prepared in accord with IFRS. There are no exclusions from the presentation, recognition, measurement or even the disclosure requirements of these standards. Nonetheless, insurance contracts are excluded. The standards identify a number of criteria for financial instruments to qualify as hedging instruments. The standards also set out a number of restrictive conditions and documentation requirements in order to justify the procedure. Finally, the standards discriminate between fair value and cash flow hedges and require separate classification of interest rate, currency and commodity and other hedging derivatives.

A major issue arises over the implementation of these standards by multinational corporations whose shares are cross-listed on various global stock exchanges. First, US-based corporations and those that cross-list in US stock markets are required to reconcile their accounts with those prepared in accordance with US GAAP (ie by submitting either a Form 10K (US domestic firms), or Form 20F (foreign firms) to the Securities and Exchange Commission). Thus these corporations are required to provide detailed disclosures in accordance with SFAS 133 and these are enforceable by registration and via the Sarbanes–Oxley Act (s. 404) internal control enforcements. In contrast, multinational firms that cross-list in non-US exchanges face considerably less stringent requirements. Multinationals based in the European Union (EU) are required to adopt IFRS as required by the European Commission (but with explicit carve-outs for hedge accounting). Even so, there is no uniform enforcement of these disclosures as they are subject to disclosure-based

1. IAS 32, Paragraph 11.

2. 'Recognition' is the inclusion of financial instruments in financial statements.

3. IAS 32 has both presentation and disclosure issues. IFRS 7 – Financial Instruments, issued in August 2005, will replace the disclosure requirements of IAS 32, and requires entities to provide more comprehensive disclosures in their financial statements that enable users to evaluate both the significance of financial instruments for the entity's financial position and performance, and the nature and extent of risks arising from financial instruments to which the entity is exposed during the accounting period and at the reporting date, and how the entity manages those risks. IFRS 7 was not, however, fully effective for annual periods commencing before 1 January 2007; therefore there is only limited scope within this project to study the impact of this standard on disclosure and derivatives use practices.

regulatory monitoring by national securities regulators.[4] Therefore, an interesting issue addressed by this study is to examine to what extent the use of derivatives is conditioned by market or firm-specific risk factors, after controlling for likely variations in the strength of regulation and enforcement in the various regions where multinational firms may be based.

There are situations, however, where the unintended or unanticipated accumulation of risks may be a simple consequence of inadequate accounting principles that conceal risk itself. For example, the demise of Enron has demonstrated the lack of transparency of leverage, and risk taking, by firms that move liabilities and risk exposures off their balance sheets by using complex special-purpose partnerships and derivatives. The same financial engineering tools that have served well in the efficient transfer of risks across otherwise incompatible institutional systems may also be used to hide large risks and value losses from even the most diligent investor. An important issue identified by Froot (1995), in particular, is the role and purpose of derivatives exposure in resolving incentive problems related to informational asymmetries within the dynamic strategic financial corporate management of risk and capital by large and complex multinational firms. To our knowledge, previous research has not really attempted to make such connections, as explored in our literature review below.

2.2 LITERATURE SURVEY – DERIVATIVES USE

The existing literature suggests that risk management is the main motivation for the use of derivatives. Previous US survey-based research suggests that firms that face challenges to manage their firms' exposure to various sources of market risk are more likely to use derivatives (eg Geczy et al. 1997; Haushalter 2000), while Guay (1999) suggests that firms experience significant volatility reduction after using derivatives. By contrast, Petersen and Thiagarajan (2000) and Hentschel and Kothari (2001) find little evidence of any relationship between derivatives use and firm risk. Huang et al. (2007) find that price exposure for a sample of UK firms for the period 2003–05 is lower for a sample of UK firms with derivatives. However, they also find that derivatives use does not increase firm risk.[5]

Most recently, Zhang (2009) discusses the effect of SFAS 133 on corporate risk management behaviour of US firms by hypothesising that the standard's effect varies depending on the hedge effectiveness of the derivative instruments. New derivatives users are identified and then are classed as either 'effective hedgers' (EH) or 'ineffective hedgers/speculators' (IS) depending on whether their risk exposures increased or decreased relative to the 'expected level' after the initiation of the derivatives programme. He finds that risk exposures relating to interest rate, foreign currency rate and commodity price decrease significantly for IS firms but not for EH firms following the adoption of SFAS 133.

Zhang (2009) studies only new users of the standard and, thus, risk exposures may vary considerably cross-sectionally, depending on when the firm initiated the programme. The study is based on a large sample, where most firms hold no more than one of the three types of risk exposure. By contrast, most multinational firms in our study have exposure to both changing interest rates and foreign currency derivatives. Further, in common with other studies, Zhang (2009) focuses only on hedged derivatives use, and ignores the broader corporate use of derivatives for speculative trading. Finally, in common with other studies reviewed above, Zhang (2009) does not examine the likely effect of idiosyncratic risk, pension risk and other industry and cultural effects on cross-sectional variation in derivatives use.

In summary, the existing literature provides little insight into how the adoption of fair-value oriented reporting of derivatives exposure is related to firms' strategic decisions to use derivatives securities for risk management purposes and its consequences for cost of capital and shareholders' wealth. While risk management is now a feature of many developed economies, perfect markets finance theory, upon which accounting standards are premised, provides little rationale for why multinational firms would seek to expend scarce resources to hedge unsystematic risk. The development of financial innovations in risk transfer, however, means that various market imperfections can create opportunities for such firms to maximise market value through hedging. In fact, there are a range of value, cash flow and accounting rationales for risk management.

The above discussion highlights the importance of the hedging versus non-hedging distinction in the context of the use of derivatives. The existence of hedge accounting highlights the limitations of the accounting framework in representing a firm's underlying economic exposure.[6] This is because the reported accounting exposure – based on exposure of fixed obligations to floating interest rates or foreign currency rates – may, for reasons associated with the application of fair value measurement principles, either understate or overstate the firm's true underlying economic exposure.

4. Multinationals based in non-US or non-EU environments are subject to even looser requirements. For example, firms based in APEC (Asia-Pacific Economic Community) countries typically must adhere to local or domestic variants of IFRS (eg Australian IFRS), IFRS as implemented, and/or national GAAP (eg Japan and Canada). While APEC plans to adopt more uniform financial regulation in future, these have not yet been implemented in any standardised way.

5. Hentschel and Kothari (2001) and Huang et al. (2007) attempt to control for industry effects by deflating all variables by an average of two SIC code industry averages. This procedure assumes, however, that firms with higher equity volatility have a higher incentive to hedge. As we find no evidence of any such relationship, and since our sample comprises firms that raise their equity in various capital markets that suffer from different implied volatilities, equity volatilities are not comparable and we do not adopt this procedure in this study.

6. Ahmed et al. (2006) show that disclosure versus recognition affects the value relevance of derivatives reporting.

Cornell and Landsman (2006) analyse various aspects of SFAS 133. They criticise SFAS 133 for classifying fair value hedges, changes to which are charged to income, separately from cash flow hedges, which are charged against comprehensive income. Shrand (1997) further identifies interest rate sensitivity as an important issue in analysing the impact of new accounting rules on financial instruments. The broader literature, which draws on accounting disclosure and measurement to explain firms' risk-management policies, has mainly sought to examine such policies through the analysis of 'accounting quality'. Viewed from this perspective, firms attempt to manage earnings and their financial leverage by exercising managerial discretion over variations in GAAP application, the use of accruals, conservative accounting and by accounting-based bonus plans (Jones 1991; Dechow et al. 1995). The extent to which firms can exploit these factors is limited by the choices available under GAAP, audit quality, tax and enforcement, litigation by shareholders and enforcement of covenants by lenders. Since a firm's decision to use derivatives that qualify for hedge accounting treatment involves discretion over the application of GAAP, one would need to control for other firm-specific factors, or idiosyncratic risks.

In addition, it is likely that firms' operating and financial activities are exposed to market-wide financial risk. The increasing globalisation and integration of product, insurance and financial markets highlights the importance of the ability or inability of the firm to manage market or non-diversifiable risk, and their inability to do so is increasingly being exploited by powerful hedge funds and other speculative investors. Nonetheless, until relatively recently, efforts by corporations to hedge against the negative impact of these exposures on cash flows, earnings and capital structure by using derivatives were not even recognised in their balance sheets or performance.

Previous empirical research has not examined whether the ability of firms to manage financial risks is systematically associated with their discretionary choices in managing accruals, reporting accounting exposures, and other firm, industry or cultural factors. Instead, it simply reflects the underlying economic exposures.

To our knowledge, current literature on the impact of derivatives use is based on survey data, which may not be representative owing to the low response rates that are typical of such an approach. An important exception is the study by Zhang (2009). In addition, existing literature normally examines the impact of financial instrument use by comparing that for an individual country to use in the US. In contrast, we use data for a broader sample of both US and European FTSE Global 500 firms.

Under the restrictive assumptions of a perfect capital market, Modigliani and Miller (1959; 1963) show that capital structure is irrelevant to a firm's intrinsic value and the cost of capital. There is, therefore, little rationale for the firm to hedge these risks by using any derivative securities for fund raising or asset exposure.

Nonetheless, with market frictions, such as taxes and the cost of financial distress, there may be an optimal combination of different financial securities to finance the needed assets (Stulz 1985). While there is a trade-off between the benefit of a tax shield and the cost of bankruptcy when firms issue debt financing, interest rate risk still exists. For example, when the interest rate goes down, a firm can issue cheap debt. The old debt represents an opportunity cost. Change in financial leverage implies change in the cost of capital. There is little empirical evidence for the cost of capital and firm risk effects associated with the use of derivatives. Moreover, there is little or no evidence for an association between the propensity and incidence of derivatives use by firms and their exposure to other sources of idiosyncratic risk, such as pensions. This literature is reviewed below.

2.3 LITERATURE REVIEW – PENSIONS

The existing literature (eg Barth 1991) continues to adopt 'traditional' views, which includes corporate income taxation (Bulow 1982; Bulow et al. 1987), and asserts that pension liabilities can be valued in a similar way to corporate debt. Klumpes and McMeeking (2007) examine whether the abnormal returns of firms that voluntarily used market-based pension discount rates are significantly different from the abnormal returns of industry-matched pair samples of firms that retained traditional cost-based valuation assumptions during the period surrounding the release of the related exposure draft (FRED 20). UK stock price returns incorporate the effect of unexpected interest changes on sources of pension earnings for firms that voluntarily switch to market-based assumptions, but do not incorporate these effects for firms that do not switch. Their evidence is consistent with a risk-management explanation for pension exposure. This implies that a replicating hedge portfolio approach to analysing pensions is more strongly associated with share price returns. The unhedged component approach can also lead to more consistent analysis of pension impact relative to hedging activity on the firms' interest rate exposure.

The research findings add to the existing empirical evidence that the systematic equity risk of UK firms as measured by beta from the cost of capital does not reflect the underlying risk of their pension plans (Jin et al. 2006).

3. Development of hypotheses

In this chapter, we briefly discuss the costs and benefits of hedging for a multinational firm. We then develop hypotheses concerning specific types of derivatives used to hedge foreign currency and interest rate risk, and their association with various sources of market, firm and institutional risk respectively. In order to explore these interactions, we distinguish between systematic risk and specific or idiosyncratic sources. For example, focusing on leverage (for interest rate risk) and earnings from foreign operations (affecting the management of foreign currency risk). We focus specifically on relating these factors to the firm's overall reported accounting exposure.[7]

3.1 COSTS AND BENEFITS OF USING DERIVATIVES

Derivatives have generally lowered the cost and increased the precision with which financial markets are able to unbundle and distribute both interest rate and foreign currency risk. There are various arguments for the use of hedging by firms. In particular, various 'market imperfections' may create a solid case for corporate hedging. We consider a number of different arguments for hedging, each of which justifies our predictions in the following sections. The literature (eg Stulz 1985; Froot et al. 1993) has shown a number of ways in which hedging on corporate account can increase shareholder value. The substantial gains produced by hedging result from the fact that risk affects the expected cash flows that corporations can deliver to their shareholders because of taxes, transaction costs, bankruptcy and other sources of market imperfections. For most of these, a shareholder's hedging on their own account cannot reduce the firm's financial distress or change its expected liability.

The major reasons for using derivatives securities are to manage, firstly, the exposure of assets and liabilities, and secondly, of internal operating cash flows and operating income. Myers and Majluf (1984) develop a pecking order theory which suggests that firms find that raising external capital is relatively costly in the presence of transaction and incentive problems. Froot (1995) extends this theory by arguing that the major reasons for using derivatives securities are primarily related to incentive problems and information asymmetries between a firm's managers and its external capital providers. Informational asymmetries arise because incentive problems within multinationals generate frictional costs that also make externally raised funds relatively costly. Froot (1995) argues that corporate risk management programmes allow a multinational firm to use its cash flow more effectively by permitting it to shift the internal funds.

While the costs of implementing hedging instruments can be high for any firm, we believe that for multinational firms these costs are low, relative to the benefits of reducing information asymmetries and for ameliorating incentive problems.

An important attribute of high-reputation firms is their ability to maintain high levels of sustainable or high-quality earnings over time. Another important attribute is their ability or willingness to engage in hedging activities to mitigate risk. However, empirical research has not so far examined whether the ability of firms to manage financial risks through reducing their cost of equity or enhancing their performance is systematically associated with their discretionary choices, which include managing accruals, reporting accounting exposures, other firm, industry or culture-specific factors, or whether it simply reflects the underlying economic exposures.

This study contributes to both the accounting and risk management literature by examining the incremental explanatory power of recent financial instrument disclosures over fair value hedging and cash flow hedging on the cost of equity capital, earnings and stock returns, in addition to the above established firm-specific, idiosyncratic risk-related determinants of equity return.

3.2 HYPOTHESES

We now discuss several hypotheses concerning the various testable empirical implications of incentive problems related to financial contracting within multinationals. Our hypotheses cover the following areas.

- The overall propensity of firms to use derivatives, and changes in their overall derivatives use over time.
- The specific types of derivatives used to hedge foreign currency and interest rate risk.
- The association between changes in firms' performance over time, and changes in financial risk and firm risk. We focus specifically on the exposure of firms to foreign currency and interest rate risk.
- The association of increases or decreases in derivatives use with operating cash flow and operating earnings at risk.
- The global variations in industry, GAAP, GAAP application, enforcement and institutional factors affecting derivatives use.
- The use of derivatives by European firms for speculative purposes.

7. For the remainder of this report we focus only on the use of derivatives solely for hedging purposes. Therefore, we do not seek to analyse the use of derivatives that do not qualify for hedge accounting treatment.

It is likely that firms' operating and financial activities are exposed to market-wide financial risk. The increasing globalisation and integration of product, insurance, and financial markets highlights the importance of the ability or inability of firms to manage market or non-diversifiable risk, and their inability to do so is increasingly being exploited by powerful hedge funds and other speculative investors. Until relatively recently, however, corporations were seeking to hedge against the deleterious impact of these risks on cash flows, earnings and capital structure by using derivatives that were previously not even recognised in their balance sheets or performance. In developing our hypotheses below, we specifically control for cross-sectional variation in both market-related factors (beta, book-to-market) as well as firm-specific factors (idiosyncratic risk, financial leverage, financial distress). We also control for internal sources of risk capital and cash flow, such as pension funding and risk, since the concurrent implementation of IFRS and US GAAP over the period of the study required firms to be more transparent about the sources of pension funding and risk on their balance sheets. Below, we separately specify specific hypotheses (H) relating to both (a) the propensity to use derivatives, and (b) the extent of use of interest rate and foreign currency derivatives. All these hypotheses include the assumption that all other factors are held constant.

3.2.1 Foreign currency risk

Following Froot's (1995) arguments concerning the need to reduce incentive problems, we initially predict that the propensity of firms to use derivatives is primarily related to the desire of multinational firm managers to manage the exposure of their existing assets, liabilities and internal cash flows better. To reduce incentive problems, increased use of foreign currency derivatives can be beneficial for firms subject to idiosyncratic risk affecting their global operations. We posit a positive association between usage of derivatives and specific sources of firm risk.

H1a: The propensity to use derivatives is positively associated with specific sources of firm risk.

H1b: There is a positive association between levels of use of foreign currency derivatives and specific sources of firm risk.

3.2.2 Interest rate risk

Firms can also be subject to interest rate exposure. A change in interest rates has a direct impact on firms' net financial assets or liabilities, and an indirect second-order effect on operating assets and sources of earnings. Failure to take account of unexpected market variations in interest rate changes can also have a serious effect on firms' net cash flows arising both from their existing assets and from real options and contingent capital. Firms can manage these factors either by issuing contingent equity or by managing derivatives, such as swaps, futures and options. Firms may seek to mitigate the effects on their shareholders by diversifying their borrowings from fixed to floating rates, or otherwise engaging in swap transactions or forwards. We posit that the level of interest rate derivatives use is primarily associated with sources of market risk.

H2a: The propensity to use derivatives is positively associated with specific sources of firm-specific risk.

H2b. There is a positive association between the use of derivatives to mitigate the negative effects of changes in interest rates, and specific sources of firm-specific risk.

3.2.3 Changes in firms' market risk exposure over time

We also examine, for a given level of disclosure and use, the propensity of firms to increase or decrease their use of derivatives over time. Zhang (2009) argues that changes in derivatives use following the implementation of new GAAP can help us to discriminate between cosmetic and cash flow rationales for hedging.

Following Zhang (2009), we first separate effective hedgers from ineffective hedgers by identifying the propensity of firms to either increase or reduce their use of risk management programmes over time. We specify the relationship between the propensity to increase or decrease derivatives use and factors affecting firms' market, idiosyncratic and financial business risk, their pensions risk and their exposure to hedged or unhedged interest rate derivative instruments.

H3a. The propensity to increase the level of derivatives use over time is positively associated with specific sources of firm-specific risk.

H3b. The level of increase in derivatives use over time is positively associated with specific sources of firm-specific risk.

3.2.4 Cultural, institutional and regulatory influences on derivatives use

The above predictions assume that the propensity of multinational firms to use derivatives is primarily related both to firm-specific and market-specific factors. Nonetheless, there are strong reasons to believe that there are also significant industry and cultural or institutional factors associated with the use of derivatives. We have not examined whether the ability of firms to manage financial risks is systematically associated with their discretionary choices in managing accruals, reporting accounting exposures, other firm, industry or culture-specific factors.

Traditionally, firms have attempted to 'manage' these exposures by variations in GAAP application, the use of accruals, conservative accounting and by accounting-based bonus plans. The extent to which firms can exploit these factors is limited by the availability of choices under GAAP, audit quality, tax and enforcement, litigation by shareholders and enforcement of covenants by lenders. Since a multinational firm's decision to elect to use derivatives that qualify for hedge accounting treatment involves discretion over the application of GAAP, one would control for other firm-specific factors identified by the literature as being associated with firm accounting choices (eg bonus policy, profit margin, asset turnover, return on equity, firm size).

Research (eg Bodnar at al. 2003) shows considerable variation in the use of derivatives both within and between the US and the Netherlands. Factors involved include culture, regulation quality, enforcement and audit quality incentives. Earnings management and the discretion over accruals are also frequently cited as motivations for hedging (eg Zhang 2009).

Since multinational firms can choose where to locate their businesses, we argue that the factors listed above are an integral part of firms' broader strategic choices concerning the location and timing of specific market, business and financial risk factors associated with derivatives use.[8] Variations in the quality of US GAAP versus IFRS, both in the application and their enforcement, have been cited in the literature as major impediments to capital issuance by firms. In addition, firms' behaviour has been associated with broader institutional factors (Leuz and Hail 2006). Also, industry-sector factors may be important, since manufacturing firms are more directly exposed to these, and are less flexible than service firms in using alternative techniques (such as relocating or outsourcing).

H4: The use of derivatives by multinational firms is related to industry, enforcement and accounting-quality factors.

We test these predictions by combining the EU and US firms into a single pooled sample and adding specific variables related to industry (manufacturing), US GAAP versus IFRS, a corruption index, and a Jones-modified measure of opaqueness, or discretionary accruals.

In addition to the general institutional variations related to accounting, industry and institutional legal factors, there are also reasons for believing that European firms have a much broader view of risk management than do US firms. While the relevant accounting standards appear to assume that risks are to be hedged or reported for specific portfolios of assets or liabilities, there is anecdotal evidence that European firms tend to use macro-based approaches to hedging, rather than hedging specific assets or liabilities. This is reinforced by the European Union's decision to opt out of IAS 39 for hedging. Glaum (2000) finds that use of derivatives is related to the European firms' strategic decision to take a more speculative view of managing risk on behalf of shareholders than do US firms. Thus it is predicted that European firms are less likely to be constrained than US firms by hedge accounting rules. They are more likely to be prepared to engage in speculative risk-management activities by undertaking active risk management of exposures through a combination of hedged and unhedged risk-management instruments.

H5: European firms are more likely than US firms to manage their exposure by using both speculative and non-speculative derivatives.

Our final hypothesis concerns the interrelationship of cost of capital estimation and the firms' choice of hedged or unhedged interest and/or foreign exchange derivatives exposure. Consistent with the adverse selection argument, we predict that firms that choose to insure against idiosyncratic risk sources by engaging in derivatives exposure will have higher cost of capital estimates than firms that do not, and we predict the following.

H6: Firms that engage in speculative and/or non-speculative derivatives exposure will have higher cost of capital than firms that do not.

We test these predictions by running regressions for the above hypotheses, where relevant, on both hedging and combined hedging and unhedged instruments, and then comparing the overall goodness of fit of the model for the firms in the US and European samples.

8. Multinational firms can exercise discretion over where they choose to raise capital, and are effective in lobbying governments and accounting bodies wherever their interests are adversely affected by economic consequences associated with a new accounting rule or where they bear the costs of compliance. For example, a number of EU firms have recently delisted from the US following unsuccessful lobbying of the SEC. US firms have also cross-listed in European and Asian markets. The integration of stock markets (the merger of the NYSE and Euronext), as well as the standardisation of over-the-counter derivatives, and the trading of credit debt has also facilitated greater globalisation trends.

4. Sample selection and data collection

4.1 SAMPLE SIZE

Table 4.1 outlines the sample selection process. The sample was based on all existing constituents of the FTSE Global 500 firms as at 31 December 2006. Constituent firms had to have been on the FTSE Global 500 index for at least five years, and had all relevant available financial, stock market and credit ratings data on Compustat, Global Insight and DataStream and Ratings Direct, respectively, to qualify for inclusion in the analysis. After deducting financial firms, there were 222 industrial firms remaining, comprising 133 US firms and 89 European Union firms.[9] In order to generate a reliable inference, we exclude firms with extreme percentiles in return on equity and the Taffler-Tishaw (TT) measure of liquidity. We excluded, therefore, a further 22 US firms and 15 EU firms. After excluding these firms, the final sample size was reduced to 111 US firms and 74 EU firms.

Table 4.1: Sample selection

	Filtered firms	No. of firms in the sample
Starting point		450
Financial firms	(123)	
Non-financial firms		327
Firms with no required data	(105)	
Firms with insufficient criteria	37	
Final sample size		185
Regional breakdown of the final sample		
US	111	
EU	74	
Total		185

Note: The sample consists of non-financial constituents of the FTSE Global 500 firms as of 31 December 2006. Constituent firms had to have been included in the FTSE Global 500 index for at least five years. In addition, sample firms needed to have all available financial, stock market and credit ratings data on Compustat Global Insight, DataStream and Ratings Direct, respectively, to qualify for inclusion in the analysis. Firms were also excluded from the sample if they did not meet the liquidity or positive earnings criteria required to exclude alternative tax or financial distress incentives for derivatives use.

9. We excluded APEC firms because of the problems identified in footnote 4.

4.2 STUDY PERIOD

The period of the analysis of the data was from 1 January 2005 until 31 December 2008. This period allows us to analyse the status of financial instruments during the first two full financial reporting years when both IAS 32 and IAS 39 were implemented (ie for annual reporting periods beginning on or after 1 January 2005).[10]

4.3 RESEARCH DESIGN

4.3.1. Classification of firms' derivatives use and changes in use over time

For the purposes of empirical testing of the hypotheses developed in Chapter 3, firms' use of derivatives was classified primarily in terms of the following criteria:

- the use of derivatives that are qualified for hedging purposes or for non-hedge, trading purposes
- the use of either interest rate or currency hedges, or both[11]
- increases or decreases in the amounts of derivatives used during the fiscal years 2005 to 2008,[12] and
- whether the firm was US or EU based.

The primary purpose of this classification was to derive a comparable measure to that used by Zhang (2009), who classifies firms as either effective hedgers or ineffective speculators depending on the change in type of exposure between the first period they were known to initiate a risk management programme and the second period, where the exposure was defined relative to an 'expected level' of a given risk. However, Zhang (2009) defined the expected level of derivatives use only during the period immediately preceding the initiation of the derivatives programme, which can vary considerably across firms. Since all EU firms were required to adopt IFRS for the first time at the 2005 year end, and because the euro and the relevant interest rate regime were only fully adopted in 2002 in most EU states (apart from Switzerland, Denmark, Norway, Sweden and the UK), and owing to the lack of standard GAAP or accounting treatment of financial instruments prior to this period, this study adopts the more rudimentary 'increase' or 'decrease' in derivatives use in

10. We have not addressed the issue of measurement of changes in exposure as a result of changes in interest rates. These disclosures were first required to be reported for financial periods for which IFRS 7 is effective (ie on or after 1 January 2007) and, therefore, fall outside the period of our study.

11. A number of firms used a combination of interest rates and currency swaps, forwards or options. These were classified as foreign currency if the base currency was non-domestic to the listing headquarters of the firm, and as interest rate otherwise.

12. For the purposes of analysis, firms which had no derivatives, or where derivatives use levels did not change over the period, were classed as increasing their use of derivatives.

2008. The third full year of mandatory implementation of IFRS, relative to 'period 1', defined as fiscal year, 2006, ie the year immediately preceding the first fiscal year of full adoption of IFRS (effective for reporting periods ending on or after 31 December 2005, ie in 2006). In this study it is therefore assumed that the 'treatment group' of EU firms initiate their risk-management programmes after foreign currency and interest rate harmonisation. For the purposes of analysis, the US sample of multinational firms is the 'control' group.

4.3.2 Choice of explanatory control variables

Market-related factors included in x-vector variables include beta, book-to-market and idiosyncratic risk, which Ferreira and Laux (2007) define as 1 minus the R^2 of a regression of the market model for firm i in year t, divided by R^2.[13]

Firm-specific risk measures included in y-vector variables include the main predicted determinants of derivatives use of primary interest to this study (foreign sales).[14] A number of control variables are included in the standard regression analysis. In addition to firm size, which is defined in terms of either sales or market capitalisation, we also consider various proxies for financial risk, including leverage.[15] We also measure a proxy for financial distress, which Taffler and Tishaw (1977) define as the weighted average of various measures of short-term distress.[16]

In vector y variables we also include both pension funding ratio of pension assets to projected benefit obligations, and the percentage of pension portfolio assets invested in 'risky' asset classes such as equities, property and other non-duration liability matched asset classes. The inclusion of pension risk and funding ratio is important given that many firms have effectively under-funded their defined-benefit obligations. Firms are more likely to view their under-funded defined-benefit schemes as financial subsidiaries and treat them from a risk management perspective rather than from a corporate finance perspective, as is the case for US firms (Picconi 2006). Consequently, under this broader capital structure or integrated financial perspective, the pension fund is equivalent to a non-transferable source of internal risk capital (Bodie et al. 1987). This, in turn, may have serious first-order consequences for the interest rate and/or foreign currency exposure of the (presumably unhedged) pension fund assets and liabilities. It can also have negative second-order operating cash flow implications arising from the need for the corporate sponsor multinational firm to 'top up' contributions regularly to meet any periodic shortfall.[17] Whether or not the financial slack and/or deficit implied by the pension fund has any bearing on the demand for derivatives in an economy described in Froot (1995), where incentive problems prevail, is an empirical issue; we therefore incorporate these measures into our set of y-vector control variables.[18]

13. Analogous to the issue raised in footnote 11, it is likely that the market model is not a sufficient model to capture idiosyncratic risk for firms exposed to significant interest rate and/or foreign currency exposure.

14. Our measure of foreign sales is taken from the Compustat segmental reporting database. The database gives a geographic breakdown of sales. For US (EU) firms, we capture both domestic sales as a percentage of total sales, EU (US) regional sales, and all non-domestic and non-EU (US) sales. The purpose of this is to develop an enhanced measure of the hedge ratio, which is discussed in Chapter 5.

15. Debt covenants can also specify the maximum levels of debt to tangible assets (captured by leverage) and maintaining a minimum amount of capital expenditure. This second restriction is effectively a minimum investment constraint. A capital constraint can serve as a sign of impending financial distress. Froot (1995) argues that being able to stay within such a constraint may allow a company to invest more in positive NPV investments. In unreported tests, we also develop a measure concerning the rate of undertaking new investments, which captures the incentive to use hedging as way of ensuring a minimum rate of undertaking new investments, a second form of financial debt covenant that is imposed by lenders in addition to the financial leverage constraint. .

16. The TT model is a multiple attribute single measure of liquidity risk, defined as 53% x (operating profit/current liabilities) + 13% x (current assets/total assets) + 8% x (current liabilities/total assets) + 16% x ((immediate assets – current liabilities)/operating expenses). A range of other measures of financial distress could have been used, including the classic Altman (1968) z-score model, which indicates the relative likelihood that a firm will not go bankrupt. A high TT or Z score indicates bankruptcy is less likely. However, full implementation of Altman's model requires identifying a sample of control firms that went bankrupt in the past. Insufficient data is available from this sample to perform a full-scale z-score analysis.

17. The corporate finance and accounting literature has previously treated pension funds as off-balance sheet debt, notwithstanding the recent requirement in FRS 17, SFAS 158 (US) and IAS 19 (IFRS) to require recognition of deficits or surpluses. Nonetheless, the differential treatment accorded to changes in value over time whereby firms can elect to use a corridor approach to amortise any shortfall under IAS 19 and US GAAP, means that the full funding implications are only observed in the footnotes. Coronado et al. (2008) argue that these are insufficient, and that analysts regularly under-price pension shortfalls.

18. Many multinationals in our sample operate multiple pension fund schemes for the various geographical regions in which they operate. In contrast to previous research, we incorporate all sources of pension funding and risk where possible and where disclosed; otherwise we use the domestic pension fund. We also incorporate into our pension funding measure unfunded health care and related post-employment retirement benefits, where these are sufficiently disclosed.

The pooled, cross-EU and US regression also includes a number of institutional and corporate governance variables that may explain variations in multinationals' use of derivatives. If, as previously argued in Chapter 3 section 1, the more sophisticated firms have a relatively greater propensity to seek to overcome market imperfections by hedging risk, we also predict an association between earnings quality, cash flow quality and derivatives use. We define earnings quality as the extent to which management is able to manipulate reported earnings, which we operationalise as the modified Jones discretionary accruals measure.[19]

The institutional factors include a dummy variable representing whether the firm is a manufacturer (=1) or not, since manufacturers are likely to be highly exposed to foreign currency risk. Other institutional variables include GAAP quality, represented by the firm's use of either US GAAP (=1) or IFRS (=0). Quality of accounting GAAP application is measured by the extent of discretionary accruals (using the modified Jones index). Finally, to study the effect of the overall legal environment, a corruption index is constructed following Kaufman et al. (2006), who define 'regulatory quality' as measures of incidence of market-unfriendly policies such as price controls or inadequate bank supervision, as well as perceptions of the burdens imposed by excessive regulation in areas such as foreign trade and business development.[20]

4.3.3 Surveys and questionnaires

To verify the observed association between derivatives use and various explanatory factors, we discuss survey and questionnaire evidence to examine the robustness of the predictions developed in section 3.2. Specifically, the survey and questionnaire examined whether multinational EU and US firms:

- experienced significant growth in their monitoring mechanisms
- reported trends and determinants of their use of derivatives
- reported views on the relevance and salience of derivatives use.

We provide a brief summary of the survey and interviews conducted to further corroborate and clarify the results of the empirical analysis conducted in Chapter 5. These comprised a survey of derivatives use, and a questionnaire concerning management of derivatives by multinational firms.

A survey of derivatives use was issued to a sample of 77 EU firms. The survey was based on the Bodnar et al. (2003) survey, which is reproduced in the appendix to their paper. The purpose was to establish the use of derivatives of a sample of EU firms, from a treasury management point of view. The survey was administered to small sample of EU firms.

The response from the questionnaire indicated that most firms used derivatives to manage interest rate and foreign currency risk. Some firms used derivatives to manage commodity risk.

A questionnaire concerning various aspects of their internal control departmqent was sent to 40 firms. The purpose of the questionnaire was to establish views about the adoption of IFRS and its implications for hedge accounting. Two responses were received. The responses generally supported the predictions.

19. We follow the Dechow et al. (1995) modified Jones (1991) model, where abnormal accruals proxy is the residual from a linear regression of total accruals on gross property, plant and equipment and change in sales minus the change in accounts receivable. The residuals are estimated by industry and fiscal year

$$\frac{WCA_{it}}{A_{it-1}} = \alpha_0 + \alpha_1 \left(\frac{\Delta REV_{it} - \Delta AR_{it}}{A_{it-1}} \right) + \varepsilon_{it}$$

where WCA_{it} is working capital accruals of firm i in year t, A_{it-1} is total assets of firm i in year t–1, ΔREV_{it} is the change in revenues of firm i in year t; and ΔAR_{it} is the change in accounts receivable of firm i in year t.

20. We follow the standard approach where US = 7, UK = 5, and other EU countries range from 0 to 4. We specify alternatively other well-known corruption indices, but do not report the results as they do not affect the overall analysis. All z-vector variables, except for discretionary accruals, are either industry or country-specific. We rerun the z-vector scores only for the combined US and EU samples; these variables will not vary by type of derivatives use, and are separately reported for only hedge derivatives or hedged and unhedged total derivatives exposure.

5. Empirical results

This section reports the results of a descriptive analysis of the overall use of derivatives and then provides multivariate analysis of the hypotheses.

5.1 DESCRIPTIVE STATISTICS

5.1.1 Derivatives use

Our empirical results examine, for a given level of disclosure and use, the total value of 'qualified for hedging' derivatives use. Various measurement bases can be used:

(a) the ratio of notional amount based on historical cost

(b) fair value of all hedging instruments; and

(c) a mixture of amortised cost and fair value.

In addition, hedging instruments can be either to offset interest rate risk, or foreign currency risk, or both. Further, firms can vary in the extent to which they use derivatives for hedging or unhedged risk. Finally, firms can use cash flow or fair value hedging, and other types of foreign hedging. In this study, we examine only the use of the notional value of derivatives, since anecdotal evidence suggests that notional values are more robust predictors of patterns and trends in derivatives use by firms than fair values. This is not surprising given that the reported fair value is simply a summarised, netted-off figure.

Various data were collected on derivatives use by firms in each of the two major geographic regions, the US and the EU. The data obtained are separated for interest rate and foreign currency categories, and are further decomposed by notional value and by fair value. There is also separate reporting for non-hedged exposures. These data are further broken down by designation of instruments (hedges or non-hedges), type of cover to primary market risks (currency or interest rate), and financial magnitude (notional amount versus fair value). We also collect data for both qualified for hedging and not-qualified for hedging exposure.[21] Yearly descriptive statistics for these main variables of interest for our samples of US and EU firms over the study period 2005–08 are reported in Table 5.1.

Various data were collected to examine financial derivatives use by industrial firms in two major geographic regions: the US and Europe. Data are broken down by the purpose of derivatives use (hedges or non-hedges), type of cover to primary market risks (currency or interest rate), and financial magnitude (notional amount versus fair value). Variable definitions are set out below.

InterRt-$_{H}$ N = Notional value of derivatives that are used to avert interest rate risks, qualified for hedge accounting

InterRt-$_{H}$ FV = Fair value of derivatives that are used to avert interest rate risks, qualified for hedge accounting

Forex-$_{H}$ N = Notional value of derivatives that are used to avert foreign currency risks, qualified for hedge accounting

Forex-$_{H}$ FV = Fair value of derivatives that are used to avert foreign currency risks, qualified for hedge accounting

InterRt-$_{NH}$ N = Notional value of derivatives that are used to avert interest rate risks, not qualified for hedge accounting

InterRt-$_{NH}$ FV = Fair value of derivatives that are used to avert interest rate risks, not qualified for hedge accounting

Forex-$_{NH}$ N = Notional value of derivatives that are used to avert foreign currency risks, not qualified for hedge accounting

Forex-$_{NH}$ FV = Fair value of derivatives that are used to avert foreign currency risks, not qualified for hedge accounting

Table 5.1 shows that the notional amounts of derivatives contracts are much higher than their equivalent reported fair values, as we expect it to be, given that the latter are merely netted-off summary figures. US firms tend to have higher measured interest rate exposure than currency exposure, whereas the exposures to interest rate risk and currency risk of EU firms to these exposures are relatively similar in magnitude. In addition, the US firms have a much lower proportion of unhedged derivatives than EU firms. Finally, the average level of interest rate exposure is much lower and decreasing for US firms, while it is increasing for EU firms.[22]

Figures 5.1–5.4, show various breakdowns of trends in derivatives use over time. Panels A and B, respectively, show the use and value of notional derivatives disclosures, while Panels C and D show the equivalent for fair value disclosures. The US sample exhibits higher but declining levels of derivatives use, but this increases in 2008. An increasing number of European firms are using both types of derivatives, and reporting both fair value and notional amounts. Interestingly, while US and European firms' use of derivatives is similar, the value is much higher for the European firms. Thus, it is reasonable to assume that the use of derivatives is sufficiently general and pervasive that it has an impact on European firms, whereas US firms appear to exercise greater discretionary decision over their use of derivatives.

21. We did not analyse derivatives use by type of nominated cash flow versus fair value hedging, since this relates to an accounting (legal) distinction rather than a functional, line of business distinction, and has implications for the measurement and impact of pension exposure on comprehensive versus operating income.

22. Data on US and EU firms are based on common and comparable currencies (USD and euro) so analyses of the amounts are fairly comparable.

Table 5.1: Descriptive statistics: dependent variables for regression of derivatives use

PANEL A: US firms (133)	InterRt-$_H$ N	InterRt-$_H$ FV	Forex-$_H$ N	Forex-$_H$ FV	InterRt-$_{NH}$ N	InterRt-$_{NH}$ FV	Forex-$_{NH}$ N	Forex-$_{NH}$ FV
Fiscal year: 2008								
Mean	1,220.09	46.16	1,244.92	36.14	12.00	1.04	175.99	0.24
Std dev	3,757.76	396.66	3,293.36	230.96	209.38	177.78	1,178.07	179.66
Fiscal year: 2007								
Mean	912.62	–2.51	1,060.20	–7.20	3.52	0.41	89.21	–0.43
Std dev	1,786.89	230.06	3,883.54	57.05	178.15	176.03	377.08	179.66
Fiscal year: 2006								
Mean	953.10	–2.86	822.16	–14.73	16.45	0.05	58.74	–0.30
Std dev	1,608.01	50.15	2,032.56	91.48	100.19	1.28	325.51	4.29
Fiscal year: 2005								
Mean	895.57	–5.92	704.66	0.27	6.76	–0.04	40.40	–0.42
Std dev	1,630.11	28.03	1,630.45	91.49	50.36	0.73	228.33	6.26

PANEL B: EU firms (89)	InterRt-$_H$ N	InterRt-$_H$ FV	Forex-$_H$ N	Forex-$_H$ FV	InterRt-$_{NH}$ N	InterRt-$_{NH}$ FV	Forex-$_{NH}$ N	Forex-$_{NH}$ FV
Fiscal year: 2008								
Mean	11,942.72	192.55	11,968.42	109.50	35,083.39	118.75	5,322.15	–429.32
Std dev	16,055.17	1,635.26	12,520.48	708.02	107,575.37	341.40	7,051.91	1,803.92
Fiscal year: 2007								
Mean	10,266.83	415.40	10,980.41	285.71	36,818.62	161.38	6,371.46	30.70
Std dev	15,484.32	1,763.56	12,966.66	627.58	96,941.87	348.36	6,268.10	125.84
Fiscal year: 2006								
Mean	9,349.56	372.18	10,663.03	310.85	31,305.78	394.44	8,925.77	2,044.38
Std dev	9,609.64	1,515.49	10,982.85	811.85	74,627.29	1,186.14	9,796.58	8,044.37
Fiscal year: 2005								
Mean	9,817.85	356.45	10,953.73	709.10	45,522.57	599.62	9,152.60	2,338.58
Std dev	10,500.03	1,608.67	13,269.41	3127.79	95,230.69	1,722.07	9,556.33	7,908.87

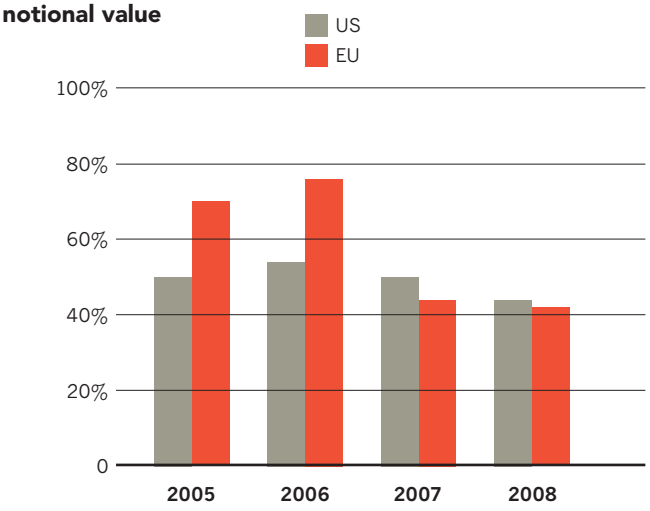
Notes:

H – hedged in accordance with 'qualify for hedge accounting treatment' under FAS 133 or IAS 32/39.

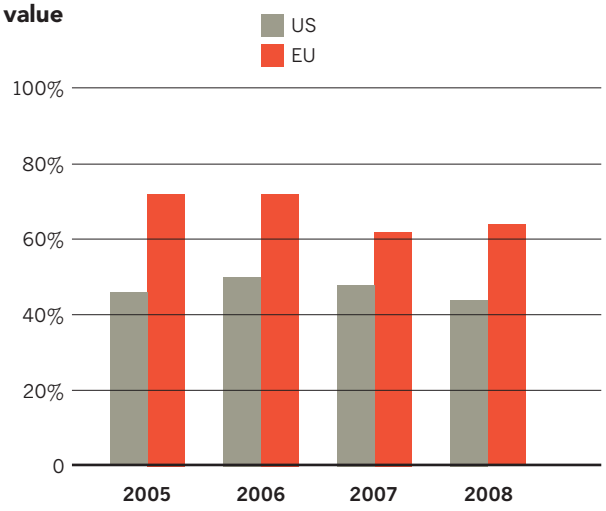
NH – not qualifying for hedge accounting treatment.

Figure 5.1: Trends in derivatives use over time – interest rates (hedged)

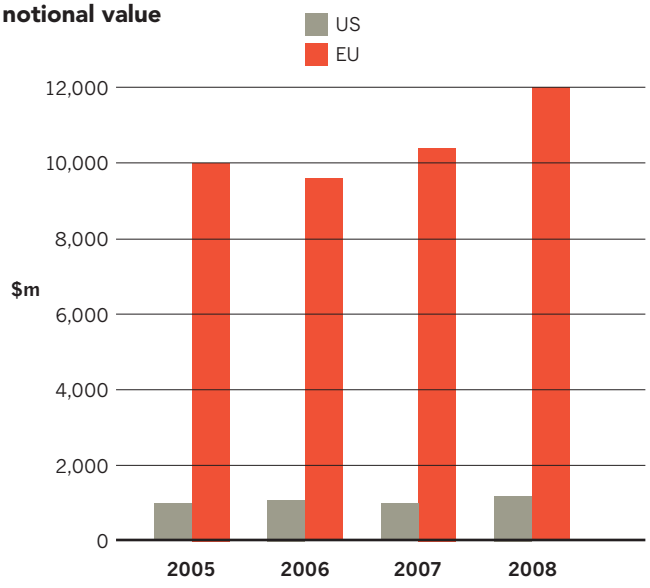
5.1(a): Use of interest rate (hedged) derivatives – notional value



5.1(c): Use of interest rate (hedged) derivatives – fair value



5.1(b): Value of interest rate (hedged) derivatives – notional value



5.1(d): Value of interest rate (hedged) derivatives – fair value

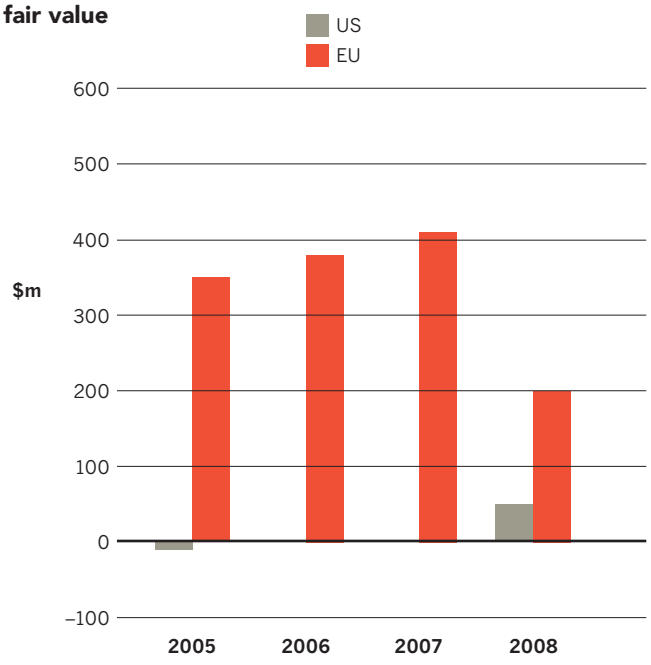
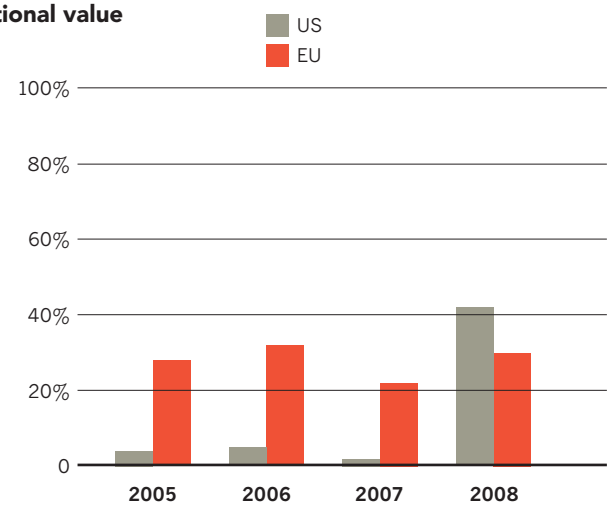
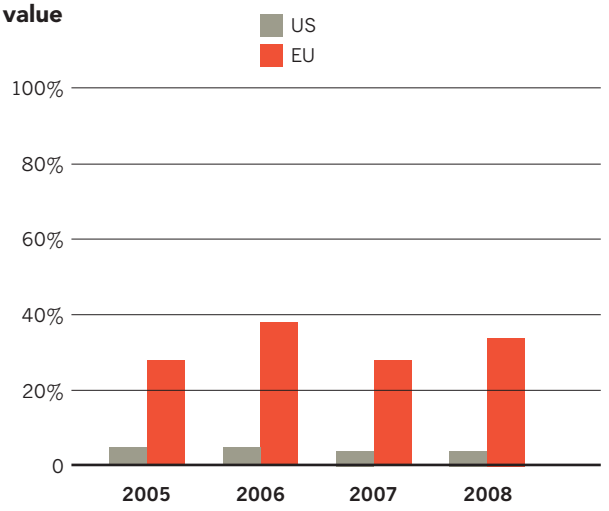


Figure 5.2: Trends in derivatives use over time – interest rates (unhedged)

5.2(a): Use of interest rate (unhedged) derivatives – notional value



5.2(c): Use of interest rate (unhedged) derivatives – fair value



5.2(b): Value of interest rate (unhedged) derivatives – notional value

5.2(d): Value of interest rate (unhedged) derivatives – fair value

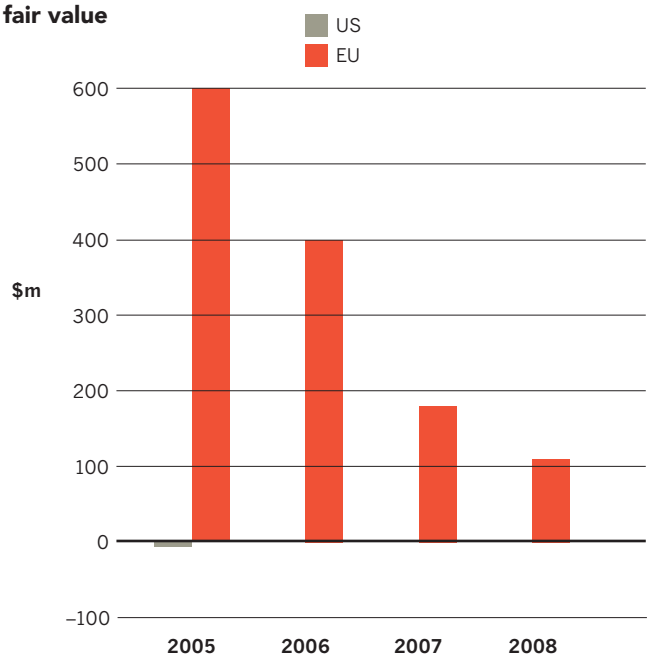
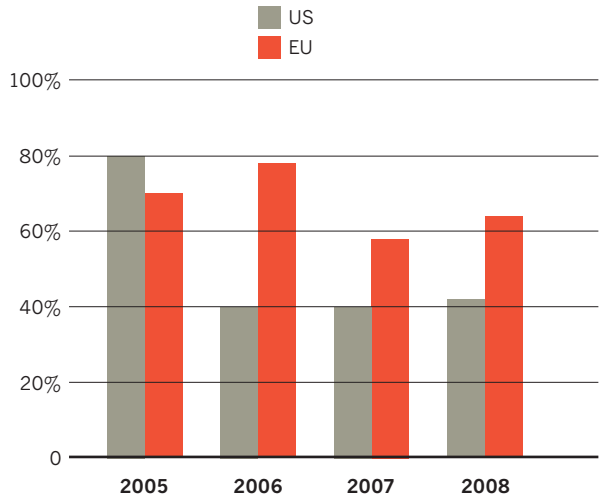
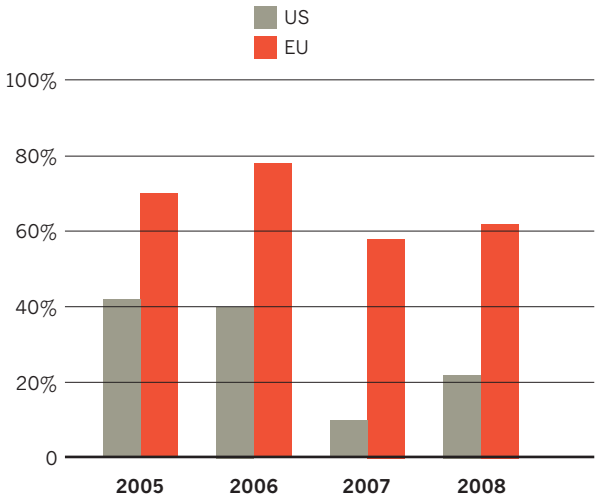


Figure 5.3: Trends in derivatives use over time – FX (hedged)

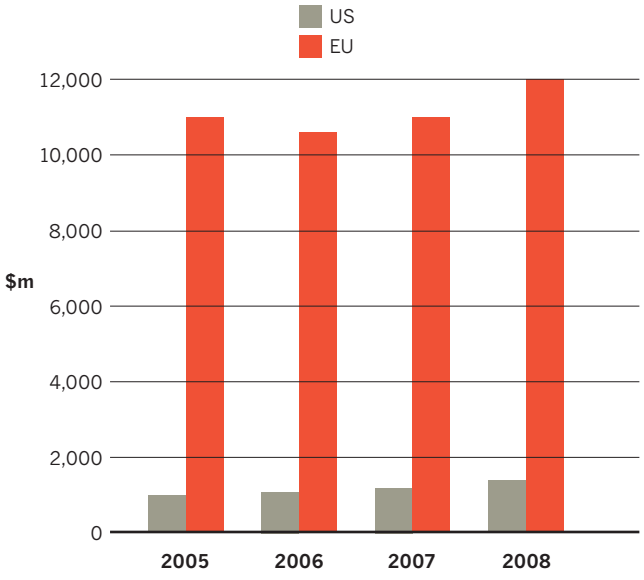
5.3(a): Use of FX (hedged) derivatives – notional value



5.3(c): Use of FX (hedged) derivatives – fair value



5.3(b): Value of FX (hedged) derivatives – notional value



5.3(d): Value of FX (hedged) derivatives – fair value

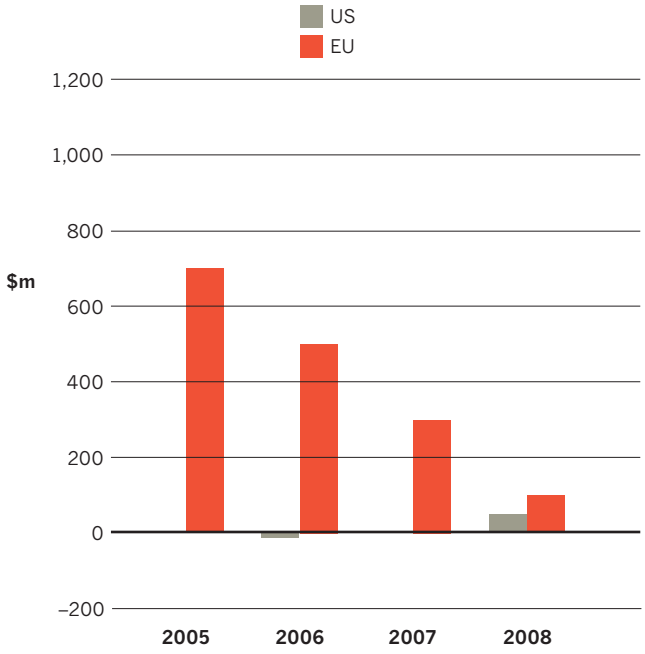
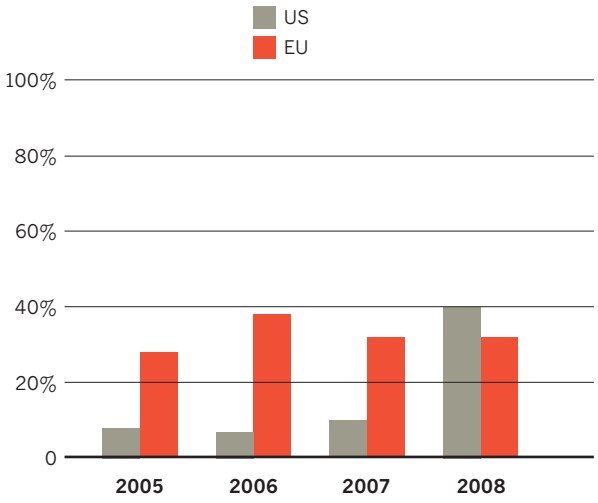
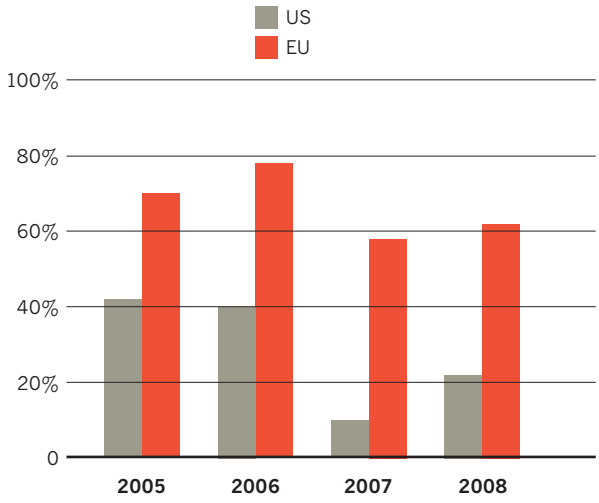


Figure 5.4: Trends in derivatives use over time – FX (unhedged)

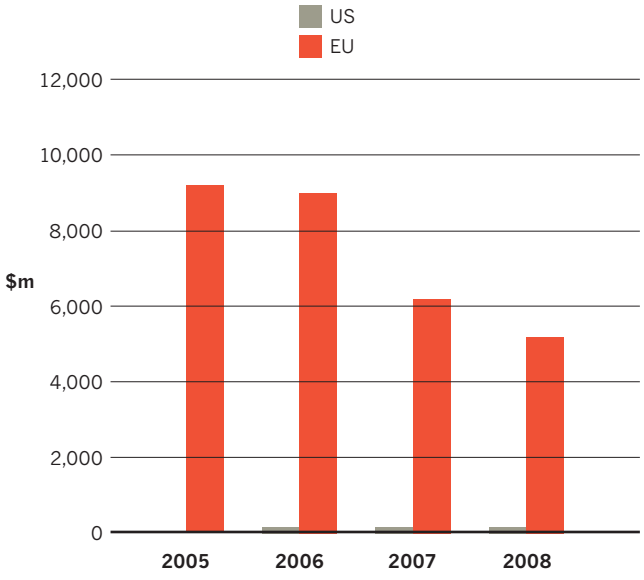
5.4(a): Use of FX (unhedged) derivatives – notional value



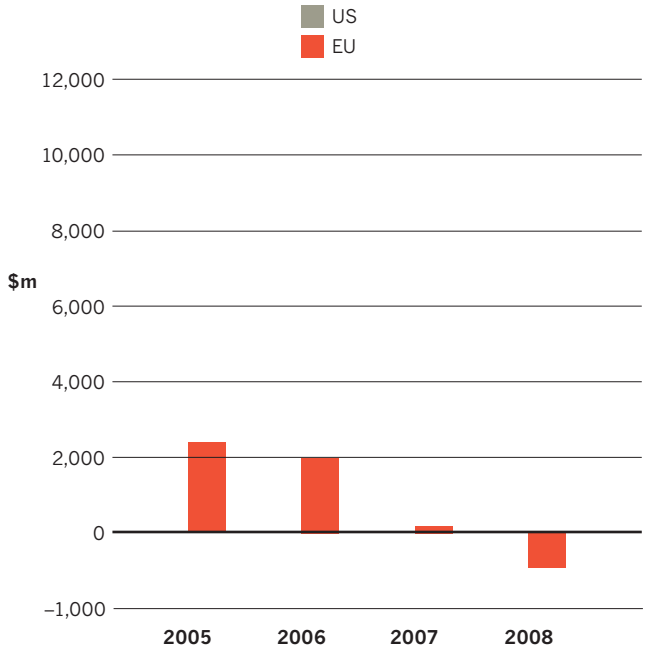
5.4(c): Use of FX (unhedged) derivatives – fair value



5.4(b): Value of FX (unhedged) derivatives – notional value



5.4(d): Value of FX (unhedged) derivatives – fair value



5.1.2 Independent variables

We estimate financial market-related risk including beta, and book-to-market. We also consider credit rating, by discounting the value of firms' outstanding long-term debt in developing measures of hedging effectiveness (see Chapter 3). We develop a measure for firms' exposure to foreign currency risk by obtaining the percentage of foreign sales obtained from segmental reporting information.

The variable definitions used in Tables 5.2 to 5.5 are as follows.

BETA = Beta of stock return to market index, calculated daily over one year

SD = Standard deviation of firm stock returns, calculated daily over one year

IDIO = Log of (1- coefficient of determination)/coefficient of determination of market model

BTM = Ratio of book value of common equity to market value of equity

LEV = Leverage ratio, equals long-term debt divided by long-term debt plus common equity

SIZE = Market value of equity of stock as at 31 December

FORS = Percentage of sales to geographically non-domestic customers

TT = Taffler–Tishaw measure of liquidity

PFUND = Ratio of market value of firm's sponsored defined benefit pension fund assets to projected benefit obligation

PRISK = Percentage of firm's sponsored defined-benefit pension fund assets invested in equity and other risky assets

Table 5.2 provides descriptive statistics on the independent variables for the pooled samples of US (Panel A) firms and EU (Panel B) firms (relating to the four fiscal years 2005–08) for tests of hypotheses 1–4 (see Chapter 3).

The results show an initially increasing but subsequently declining book-to-market, firm size, TT ratio, pension funding ratio and leverage ratio for both European and US firms over time. These trends indicate a significant change in the business environment from 2005.

Table 5.2: Descriptive statistics: independent variables for derivatives use

PANEL A: US firms (133)

	2005		2006		2007		2008	
Variable	**Mean**	**Std dev**	**Mean**	**Std dev**	**Mean**	**Std dev**	**Mean**	**Std dev**
BETA	1.019	0.265	1.032	0.371	0.873	0.231	0.804	0.573
SD	0.231	0.065	0.234	0.077	0.240	0.055	0.027	0.074
IDIO	1.183	0.603	1.381	0.617	0.683	0.637	0.684	0.637
BTM	0.326	0.177	0.321	0.192	0.333	0.251	0.521	0.447
LEV	0.600	2.105	0.450	0.610	0.450	0.183	0.327	0.227
SIZE	52418	56645	54736	63166	61927	69314	44021	53526
FORS	0.327	0.267	0.339	0.268	0.338	0.276	0.559	0.483
TT	0.432	1.283	0.276	1.283	0.513	1.314	–0.120	2.169
PFUND	0.821	0.158	0.892	0.164	0.957	0.167	0.752	0.161
PRISK	70.488	10.747	70.498	11.103	69.204	11.000	64.149	13.784

PANEL B: EU firms (89)

	2005		2006		2007		2008	
Variable	**Mean**	**Std dev**	**Mean**	**Std dev**	**Mean**	**Std dev**	**Mean**	**Std dev**
BETA	0.943	0.444	0.928	0.406	0.928	0.406	0.548	0.323
SD	0.063	0.020	0.054	0.014	0.054	0.014	0.063	0.017
IDIO	0.222	0.160	0.224	0.158	0.251	0.195	0.251	0.195
BTM	0.404	0.221	0.367	0.183	0.479	0.386	0.589	0.460
LEV	0.954	1.272	1.209	4.095	0.339	0.212	0.384	0.232
SIZE	50743	67032	57904	73321	62776	77732	50347	75290
FORS	0.612	0.272	0.633	0.272	0.611	0.271	0.640	0.274
TT	0.377	0.330	0.356	0.333	0.153	0.246	0.090	0.219
PFUND	0.685	0.336	0.728	0.373	0.734	0.346	0.713	0.254
PRISK	56.179	18.013	56.526	19.154	59.522	15.294	51.789	18.039

5.2 CORRELATION AMONG INDEPENDENT VARIABLES

The above graphical analysis does suggest variation in behaviour of the sample in both the use and extent of derivatives between US and EU firms. In order to test the hypotheses using multivariate analysis, we use multivariate analysis to control for other explanations for derivatives use. Table 5.3 reports the correlation among independent variables for the sample by both regions. For the US sample, there is a consistent generally high positive correlation between pension funding ratio and the TT ratio, while there is a significant negative correlation between book-to-market and financial leverage. None of the other variables are significantly correlated with each other. For the EU sample, pension fund is significantly positively correlated with both pension risk and beta. None of the other firm-specific and market-specific variables are significantly associated with each other.

Table 5.3 correlates the independent variables for the pooled samples of US firms (Panel A) and EU firms (Panel B), relating to the four fiscal years, 2005–08.

When we add the institutional factors into the correlation (not reported) we find a significant positive relationship between manufacturing firms' dummy and pension fund risk. This is expected, since such firms are more likely to underfund their pensions owing to union-based arrangements. There is also a positive correlation between the corruption index and foreign sales, confirming that the firms based in countries with relatively lower governance quality are those in smaller continental European countries which depend on higher percentages of foreign sales. Finally, we also find a significant positive correlation between discretionary accruals and leverage, which is consistent with the finding in previous research (eg Dechow et al. 1995) of a strong linkage between incentives to reduce accounting quality via accruals management and leverage.

Table 5.3: Correlations among independent variables

PANEL A: US firms (Pooled 2005–08: n = 520)										
Variable	**BETA**	**SD**	**IDIO**	**BTM**	**LEV**	**SIZE**	**FORS**	**TT**	**PFUND**	**PRISK**
BETA	1.000									
SD	0.395	1.000								
IDIO	–0.087	0.335	1.000							
BTM	0.080	–0.220	–0.127	1.000						
LEV	0.035	0.063	0.012	–0.073	1.000					
SIZE	–0.058	–0.012	–0.196	–0.206	–0.023	1.000				
FORS	0.042	–0.148	–0.114	–0.070	–0.122	0.130	1.000			
TT	0.047	0.124	–0.030	–0.120	–0.013	0.141	0.004	1.000		
PFUND	–0.011	0.192	–0.093	–0.127	0.039	0.040	–0.180	0.108	1.000	
PRISK	0.033	0.258	0.101	–0.100	0.056	0.059	–0.194	0.081	0.182	1.000

PANEL B: EU firms (Pooled 2005–08: n = 222)										
Variable	**BETA**	**SD**	**IDIO**	**BTM**	**LEV**	**SIZE**	**FORS**	**TT**	**PFUND**	**PRISK**
BETA	1.000									
SD	0.533	1.000								
IDIO	0.150	0.108	1.000							
BTM	0.107	0.240	0.176	1.000						
LEV	–0.058	–0.040	–0.081	–0.135	1.000					
SIZE	0.008	0.117	0.099	–0.075	–0.112	1.000				
FORS	0.220	0.219	0.021	0.045	–0.202	0.130	1.000			
TT	0.128	–0.074	–0.011	–0.230	0.011	0.273	0.144	1.000		
PFUND	–0.108	–0.156	0.084	–0.048	0.026	–0.048	–0.027	0.129	1.000	
PRISK	–0.002	–0.184	–0.078	–0.019	0.042	–0.096	–0.061	0.054	0.066	1.000

5.3 MULTIVARIATE ANALYSIS

Multivariate test results of hypotheses 1 to 5 developed in Chapter 3 are reported in Tables 5.4 to 5.8, separately for US firms (Panel A) and EU firms (Panel B). We also report results for the combined sample of US and EU firms (Table 5.8, Panel C) to test the predicted effects on derivatives use of cross-sectional variation in industry, GAAP use, GAAP application (opaqueness) and overall institutional corruption, in hypothesis 4 (see page 14). In addition, we report the results for both hedged and combined hedged and non-hedged derivatives to test predictions concerning the propensity of EU firms to use derivatives more extensively for trading purposes than US firms, in hypothesis 5.

All results are for the pooled sample for fiscal years ending 2005–08.

5.3.1 Overall propensity to use derivatives

We first show the results of logistic regressions of the propensity to use derivatives. Table 5.4 reports the results. This table reports a more detailed breakdown of the results of logistic regressions used to test the first hypothesis, which predicts an association between the propensity for derivatives use and measures of firm risk. Results are reported separately for US firms (Panel A) and EU firms (Panel B).

The regressions used to test hypotheses 1–5, take the following general form.

$$b_{it} = \alpha_i + m_{1i}x_{it} + m_{2i}y_{it} + m_{3i}z_{it} + \varepsilon_{it} \quad (1)$$

where

b_{it} = level or dummy variable of derivatives use of type i,t for firm i in fiscal year t

x_{it} = a vector of variables related to market-related risk for firm i in fiscal year t

y_{it} = a vector of variables related to firm-specific risk for firm i in fiscal year t

z_{it} = a vector of variables related to institutional, cultural or corruption factors (used to test hypothesis 5)

Results are derived from pooled data collected for fiscal years 2005 to 2008. Apart from derivatives used for hedging purposes, we also examine the effect of total derivatives use.

We find that the results given in Table 5.4 are largely consistent with the overall results reported in the earlier tables. In relation to US firms (Panel A), the interest rate (hedging only) model appears to indicate that, in addition to the standard deviation of stock returns (total firm risk) and idiosyncratic risk, the propensity to use foreign exchange derivatives is also positively related to size and negatively related to pension fund risk. The overall model Chi-square statistic and adjusted R-square are also high, and consistent with the predictions of hypothesis H1.

By contrast, the propensity to use interest rate derivatives is much more equivocal for European firms (Panel B). Only leverage and pension fund risk are positively associated with interest rate derivatives use. The use of foreign currency derivatives by European firms is positively related only to leverage funding ratio, providing support for the relationships as predicted hypothesis H1.

Consistent with predictions, there is also a positive relationship between the propensity to use derivatives and the pension funding ratio, but only for US firms. These overall results suggest that for US firms, derivatives use is related to financial distress, while for EU firms, derivatives use is related to various sources of internal financial risk, but not in the way predicted by hypotheses H1a and H2a (see page 13).

Table 5.4: Logistic regression of decision to use derivatives: breakdown by type of derivative

PANEL A: US firms (Pooled 2005–08)

	Interest rates (Hedging only)		Foreign currency (Hedging only)		Interest rates (Hedging and Not for hedging)		Foreign currency (Hedging and Not for hedging)	
Variable	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**
BETA	0.201	0.402	0.028	0.906	0.221	0.358	–0.045	0.850
SD	2.208	0.046	1.721	0.116	2.198	0.047	1.822	0.100
IDIO	–0.439	0.005	–0.304	0.046	–0.411	0.008	–0.290	0.058
BTM	–0.077	0.813	0.077	0.810	–0.057	0.860	0.074	0.819
LEV	–0.106	0.339	0.158	0.382	–0.122	0.314	0.186	0.357
SIZE	0.001	0.282	0.001	0.077	0.000	0.902	0.001	0.029
FORS	–0.106	0.696	–0.037	0.890	–0.156	0.564	0.026	0.925
TT	–0.036	0.549	–0.023	0.694	–0.038	0.528	–0.025	0.681
PFUND	–0.253	0.611	–1.056	0.034	0.017	0.008	–1.353	0.007
PRISK	–0.411	0.192	0.008	0.235	–0.483	0.336	0.009	0.173
Chi-Sq	28.177		16.450		30.159		22.766	
R-Sq	0.070		0.042		0.075		0.057	

PANEL B: EU firms (Pooled 2005–08)

	Interest rates (Hedging only)		Foreign currency (Hedging only)		Interest rates (Hedging and Not for hedging)		Foreign currency (Hedging and Not for hedging)	
Variable	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**
BETA	0.004	0.948	–0.277	0.421	0.353	0.282	–0.248	0.500
SD	0.395	0.530	11.526	0.180	–10.263	0.199	–0.651	0.942
IDIO	1.091	0.296	–0.242	0.708	–0.051	0.937	–1.144	0.099
BTM	0.371	0.542	–0.577	0.117	–0.091	0.793	0.360	0.387
LEV	4.432	0.035	0.784	0.005	1.220	0.001	0.625	0.027
SIZE	0.616	0.433	0.000	0.245	0.000	0.336	0.000	0.690
FORS	0.048	0.826	0.692	0.148	0.278	0.556	1.144	0.026
TT	1.395	0.237	–0.203	0.633	–0.084	0.840	0.141	0.763
PFUND	1.070	0.301	0.267	0.464	–0.319	0.379	0.206	0.587
PRISK	0.134	0.714	0.003	0.521	0.005	0.261	0.153	0.806
Chi-Sq	23.328		21.920		28.554		15.707	
R-Sq	0.086		0.084		0.106		0.065	

5.3.2 Level of derivatives use

Hypotheses H1b and H2b, respectively (see page 13), predict a positive association between the level of interest rate and foreign currency derivatives use, and various firm-specific and market risk factors. Table 5.5 reports the results, separately for interest rate and foreign currency exposures, for both the US firms (Panel A) and EU firms (Panel B). Results are separately reported for interest rate and currency derivatives, and for total derivatives use.

The results in Table 5.5 provide greater insight into the type and nature of derivatives use by US firms (Panel A) and EU firms (Panel B). For US firms, there is a significant and positive relationship between the amount of interest rate derivatives use and some key financial risk factors. While the use of interest rate derivatives is positively associated with pension risk, the use of currency derivatives by US firms is negatively associated with TT funding ratio and pension funding. It is also positively associated with foreign sales and size and the pension funding ratio. The negative association with the TT ratio is consistent with our expectations that derivatives use is positively related to financial distress (where a higher TT ratio implies a lower probability of bankruptcy).

For EU firms (Panel B), there is a positive association between the use of both interest rate and currency derivatives with overall firm risk (standard deviation), book-to-market ratio, size and a negative association with idiosyncratic risk. None of the other factors are statistically significantly associated with derivatives use.

For both US and EU firms, the overall F-statistic for the models is statistically significant at the 10% level, while the model-adjusted R-squares are all greater than 5%. These results provide evidence that is consistent with hypotheses H2a and H2b. However the nature of these relationships varies, both across types of derivative and between US and EU firm samples.

Table 5.5: Determinants of exposure to derivatives by type of derivative: Ordinary Least Squares (OLS) regression

PANEL A: US firms (Pooled 2005–08)

	Interest rates (Hedging only)		Foreign currency (Hedging only)		Interest rates (Hedging and Not for hedging)		Foreign currency (Hedging and Not for hedging)	
Variable	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**
CONSTANT	1106.67	0.003	–535.64	0.263	1097.51	0.003	–392.298	0.425
BETA	235.51	0.399	538.658	1.497	244.35	0.382	532.299	1.437
SD	–237.93	0.852	–148.47	0.928	–282.96	0.824	–287.383	0.865
IDIO	–241.06	0.176	–188.429	0.411	–236.94	0.184	–227.644	0.335
BTM	–336.07	0.382	59.186	0.905	–333.22	0.387	54.967	0.914
LEV	–12.264	0.900	43.528	0.730	–11.186	0.909	34.081	0,.793
SIZE	–0.002	0.299	0.008	0.001	–0.002	0.357	0.008	0.001
FORS	–61.608	0.847	1178.09	0.004	–76.680	0.810	1162.66	0.006
TT	–6.285	0.928	–160.807	0.074	–7.123	0.919	–168.280	0.069
PFUND	–724.87	0.220	–16.964	0.081	12.784	0.090	–13.505	0.177
PRISK	12.667	0.093	2062.86	0,007	–721.506	0.223	1789.41	0.023
F–statistic	0.684		3.931		0.679		3.704	
R–Sq	0.001		0.053		0.001		0.050	

PANEL B: EU firms (Pooled 2005–08)

	Interest rates (Hedging only)		Foreign currency (Hedging only)		Interest rates (Hedging and Not for hedging)		Foreign currency (Hedging and Not for hedging)	
Variable	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**
CONSTANT	2694.03	0.312	–2874.36	0.268	38885.37	2.800	–2890.44	–1.120
BETA	–1571.81	0.341	–692.96	0.667	–7459.74	0.388	–751.46	0.640
SD	96957.43	0.017	109846.67	0.006	425681.52	0.046	110746.31	0.005
IDIO	–4108.75	0.205	–3635/03	0.260	–25181.33	0.137	–3779.65	0.229
BTM	4266.04	0.017	5667.55	0.001	–1953.45	0.835	5628.03	0.001
LEV	171.341	0.529	60.81	0.819	–27.704	0.985	61.288	0.817
SIZE	0.017	0.048	0.013	0.113	0.027	0.620	0.013	0.108
FORS	–5055.45	0.025	1294.58	0.554	–27267.15	0.013	1302.01	0.551
TT	–4552.37	0.030	–607.50	0.765	–16717.86	–1.816	–613.32	0.761
PFUND	–2169.31	–1.236	1160.65	0.499	250.26	0.028	–42.588	0.044
PRISK	25.427	0.241	–43.505	0.040	–53741.61	–4.561	1302.01	0.551
F–statistic	3.889		3.779		4.752		3.785	
R–Sq	0.076		0.073		0.121		0.073	

5.3.3 Propensity to increase use of derivatives over time
We test the predictions of hypothesis H3a using logistic regression analysis of changes in derivatives use over time for US firms and EU firms. The dependent variable is simply whether the firm increases (=1) or decreases (=0) the overall use of derivatives between the fiscal years 2005 and 2008. Independent variables in the regression include beta, idiosyncratic risk and changes in the firm-specific financial variables examined in Tables 5.4 and 5.5 between 2005 and 2008. Results are reported in Table 5.6.

For the US firms (Table 5.6, Panel A), no variables are associated with either interest rate or foreign currency derivatives use. The overall Chi-square statistic and pseudo-R-square are also much lower than for the equivalent foreign currency derivatives use regression results reported in Table 5.5.

By contrast, there is more insight to be garnered from a further breakdown of overall derivatives use of foreign currency derivatives by EU firms (Table 5.6, Panel B). The propensity to use both hedged and unhedged foreign currency derivatives is positively related to changes in firm leverage and TT ratio. These results provide further important insights into how traces of the integrated corporate finance perspective affect the use of derivatives by multinational firms, as specified in hypothesis H3a.

Table 5.6: Logistic regression of propensity to increase use of derivatives

PANEL A: US firms (Pooled 2005–08)

	Interest rates (Hedging only)		Foreign currency (Hedging only)		Interest rates (Hedging and Not for hedging)		Foreign currency (Hedging and Not for hedging)	
Variable	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**
BETA	–0.198	0.553	–0.097	0.771	–0.170	0.641	0.440	0.166
SD	–0.053	0.979	2.738	0.184	0.611	0.775	–0.208	0.911
IDIO	–0.104	0.797	–0.426	0.261	–0.227	0.617	–0.397	0.302
BTM	0.843	0.138	–0.264	0.627	1.347	0.042	–0.340	0.529
LEV	0.232	0.670	0.134	0.739	0.328	0.670	0.088	0.759
SIZE	0.000	0.464	0.000	0.204	0.000	0.379	0.000	0.144
FORS	–0.538	0.557	0.248	0.775	–0.870	0.407	–0.933	0.294
TT	–0.057	0.597	0.021	0.818	–0.064	0.612	–0.072	0.467
PFUND	0.016	0.131	2.004	0.177	0.010	0.402	0.006	0.531
PRISK	–1.134	0.478	–0.272	0.502	–1.228	0.499	2.103	0.160
Chi-Sq	7.136		9.907		7.939		8.751	
R-Sq	0.713		0.073		0.059		0.065	

PANEL B: EU firms (Pooled 2005–08)

	Interest rates (Hedging only)		Foreign currency (Hedging only)		Interest rates (Hedging and Not for hedging)		Foreign currency (Hedging and Not for hedging)	
Variable	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**
BETA	0.973	0.160	–0.747	0.274	–0.350	0.483	–0.437	0.509
SD	–14.056	0.297	10.809	0.440	7.702	0.559	0.235	0.987
IDIO	2.903	0.078	2.302	0.159	2.089	0.177	3.807	0024.
BTM	–0.284	0.636	–0.842	0.199	–0.519	0.379	–0.752	0.224
LEV	0.183	0.439	1.102	0.022	0.175	0,419	–0.013	0.949
SIZE	0.000	0.424	0.000	0.247	0.000	0.854	0.000	0.245
FORS	2.001	0.290	–1.580	0.433	2.386	0.204	–0.916	0.637
TT	0.338	0.621	1.887	0.058	0.160	0.807	1.223	0.122
PFUND	0.008	0.570	0.492	0.569	1.104	0.280	0.500	0.556
PRISK	0.047	0.904	0.016	0.283	0.011	0.435	0.013	0.382
Chi-Sq	11.150		21.891		8.219		12.869	
R-Sq	0.159		0.218		0.118		0.231	

Table 5.7: OLS regression: increase in use of derivatives

PANEL A: US firms (Pooled 2005–08)

	Interest rates (Hedging only)		Foreign currency (Hedging only)		Interest rates (Hedging and Not for hedging)		Foreign currency (Hedging and Not for hedging)	
Variable	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**
BETA	81.252	0.880	158.62	0.533	35.238	0.948	14.968	0.963
SD	–475.88	0.878	581.26	0.693	–350.80	0.910	1352.40	0.463
IDIO	–659.31	0.308	–86.837	0.777	–662.22	0.306	783.007	0.839
BTM	355.604	0.694	–331.55	0.441	368.91	0.684	–323.730	0.549
LEV	–34.811	0.842	–6.380	0.939	–34.911	0.842	10.692	0.918
SIZE	0.002	0.848	–0.004	0.487	0.002	0.850	–0.003	0.656
FORS	–811.768	0.573	–647.330	0.343	–854.23	0.553	–437.578	0.609
TT	–27.993	0.857	–28.375	0.701	–24.627	0.874	–19.451	0.834
PFUND	5.222	0.763	2.301	0.780	5.779	0.739	3.788	0.714
PRISK	3302.66	0.524	566.527	0.629	1935.295	0.434	260.029	0.850
F-statistic	0.251		0.306		0.256		0.222	
R-Sq	0.001		0.024		0.001		0.001	

PANEL B: EU firms (Pooled 2005–08)

	Interest rates (Hedging only)		Foreign currency (Hedging only)		Interest Rates (Hedging and Not for hedging)		Foreign currency (Hedging and Not for hedging)	
Variable	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**
BETA	3189.48	0.679	866.51	0.676	1615.60	0.870	–3402.74	0.339
SD	–6248.33	0.948	–3402.88	0.063	–90160.65	0.655	135436.62	0.065
IDIO	21545.31	0.040	135443.779	0.063	7640.78	0.724	14656.19	0.063
BTM	9.359	0.998	14656.79	0.519	–263.34	0.975	–1863.66	0.539
LEV	372.23	0.794	–1863.80	0.363	–686.61	0.818	981.49	0.363
SIZE	–0.009	0.782	981.61	0.809	–0.013	0.845	–0.006	0.809
FORS	1871.67	0.886	–0.006	0.621	717.58	0.979	4878.90	0.621
TT	3398.31	0.475	5974.87	0.098	–7063.58	0.478	5974.82	0.098
PFUND	–5347.81	0.360	839.23	0.845	–20222.11	0.094	839.40	0.845
PRISK	66.330	0.497	–0.609	0.993	39.842	0.845	–0.608	0.993
F-statistic	0.717		1.050		0.415		1.050	
R-Sq	0.001		0.410		0.001		0.006	

Table 5.7 reports the results of the changes in the levels of derivatives use over time. The results are consistent with those reported in Table 5.6.

For US firms (Table 5.7, Panel A), there is no relationship between the level of increase in derivatives use over time and any predictive factor. This suggests a capital-constrained motivation for use of derivatives by US firms, consistent with hypothesis H3b. For European firms, however, there is a positive relationship between increase in derivatives use and change in idiosyncratic risk.

5.3.4 Cultural effects

It is important to gain further insight into the potential incremental impact of institutional and cultural variations in sources of demand for derivatives use by US versus EU multinationals discussed above. Table 5.8 reports a more detailed breakdown of the results of logistic regressions used to test the first hypothesis reported in Table 5.4, which predicts an association between the propensity for derivatives use and measures of firm risk. Results are reported for an aggregated sample of US and EU firms.

Panels A to D of Table 5.8 also report the propensity to use derivatives by the pooled sample of EU and US firms. For Panel A, US firms and the corruption index of regulatory quality are important determinants of the demand for derivatives. In addition, pension funding and pension risk variables are robust to the inclusion of these variables in explaining the propensity to hedge. The overall Chi-square and R-square of Panel A is also considerably higher than it is for Panels A and B of Table 5.4, suggesting that the institutional factors are adding explanatory power to the model. These results support hypothesis H4 (see page 14).

Table 5.8: Detailed breakdown of the results of logistic regressions used to test the first hypothesis reported in Table 5.4

Panel A: Logistic regression of decision to use derivatives: breakdown by type of derivatives – combined US and EU firms

	Interest rates (Hedging only)		Foreign currency (Hedging only)		Interest rates (Hedging and Not for hedging)		Foreign currency (Hedging and Not for hedging)	
Variable	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**
MANU	–0.677	0.000	0.062	0.739	–0.616	0.001	0.132	0.409
US	–0.702	0.062	–0.707	0.035	–1.038	0.001	–0.493	0.132
CORRUPT	–0.167	0.007	–0.208	0.002	–0.116	0.074	–0.105	0.132
DISCACC	0.189	0.842	0.249	0.099	0.242	0.794	0.511	0.599
BETA	0.126	0.486	0.162	0.370	0.128	0.491	–0.155	0.416
SD	2.203	0.039	0.957	0.327	2.415	0.018	2.129	0.037
IDIO	–0.429	0.005	–0.257	–0.073	–0.431	0.004	–0.308	0.034
BTM	–0.122	0.603	0.004	0.987	–0.388	0.333	0.151	0.549
LEV	0.085	0.282	–0.003	0.944	0.050	0.605	0.365	0.029
SIZE	0.002	0.299	0.001	0.443	0.002	0.132	0.001	0.187
FORS	–0.022	0.973	–0.210	0.363	0.024	0.918	0.251	0.298
TT	–0.060	0.520	–0.003	0.959	–0.048	0.442	–0.019	0.738
PFUND	0.020	0.003	–0.004	0.201	0.011	0.001	–0.007	0.116
PRISK	0.009	0.039	0.005	0.271	0.009	0.042	0.007	0.116
Chi-Sq	58.780		43.654		73.669		74,594	
R-Sq	0.087		0.066		0.109		0.001	

Panel B: OLS regression – combined EU and US firms

	Interest rates (Hedging only)		Foreign currency (Hedging only)		Interest rates (Hedging and Not for hedging)		Foreign currency (Hedging and Not for hedging)	
Variable	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**
CONSTANT	4796.89	0.001	1169.52	0.029	3518.48	0.204	1154.79	0.031
MANU	–220.166	0.582	–6273.62	0.01	–14040.16	0.011	–6112.75	0.001
US	–4151.149	0.001	–519.72	0.015	–5040.57	0.001	–529.44	0.013
CORRUPT	–1074.75	0.001	–2600.33	0.399	–25143.63	0.112	–2862.39	0.361
DISCACC	–1293.74	0.677	266.07	0.670	–3310.46	0.304	250.15	0.689
BETA	–559.13	0.372	3955.95	0.250	19610.91	0.268	3812.35	0.267
IDIO	–514.32	0.307	–491.52	0.328	–3056.52	0.230	–527.12	0.295
BTM	2346.93	0.004	3104.44	0.001	–1021.0	–0.243	3072.35	0.001
LEV	211.972	0.170	99.95	0.516	786.96	0.322	99.010	0.521
SIZE	0.007	0.061	0.013	0.001	0.005	0.799	0.013	0.001
FORS	–1141.29	0.156	1503.09	0.061	–13958/40	0.001	1508.43	0.061
TT	–172.898	0.396	–180.66	0.374	–1022/16	0.330	–188.44	0.355
PFUND	37.020	0.013	5.250	0.624	–14.956	0.787	5.699	0.596
PRISK	–0.959	0.928	–34.080	0.022	235/61	0.002	–33.009	0.026
F-statistic	7.002		8.743		4.63		8.450	
R-Sq	0.088		0.111		0.059		0.107	

Panel C: Logistic regression of propensity to increase use of derivatives – combined EU and US firms

	Interest rates (Hedging only)		Foreign currency (Hedging only)		Interest rates (Hedging and not for hedging)		Foreign currency (Hedging and Not for hedging)	
Variable	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**
MANU	–0.277	0.376	0,447	0,174	–0.313	0.338	0.281	0.377
US	–0.988	0.059	–0.246	0.642	–1.147	0.046	–0.498	0.325
CORRUPT	–0.080	0.507	0.087	0.522	0.096	0.506	0.151	0.200
DISCACC	0.353	0.837	5.772	0.005	1.297	0.462	5.167	0.009
BETA	0.197	0.503	–0.103	0.714	0.098	0.738	0.327	0.223
SD	–1,515	0,453	2,966	0.135	–0.242	0.906	–0.169	0.652
DBTM	0.054	0.088	–0.410	0.313	0.133	0.764	–0.328	0.406
IDIO	0.239	0.535	–0.314	0.396	0.251	0.494	0.049	0.711
LEV	0.227	0.296	–0.410	0.303	0.240	0.243	0.000	0.120
SIZE	0.000	0,834	0.650	0.030	0.001	0.906	–0.781	0.316
FORS	9,196	0.893	0.001	0.065	0.006	0.994	–0.055	0.565
TT	–0.075	0.460	–0.177	0.823	–0.088	0.449	0.009	0.010
PFUND	0.013	0.217	0.022	0.057	0.008	0.479	0.006	0.652
PRISK	0.008	0.558	0.017	0.277	0.011	0.414	0.016	0.284
Chi-Sq	10,703		30.901		21.275		19.526	
R-Sq	0.066		0.179		0.092		0.116	

Panel D: OLS regression: increase in use of derivatives – combined EU and US firms

	Interest rates (Hedging only)		Foreign currency (Hedging only)		Interest rates (Hedging and not for hedging)		Foreign currency (Hedging and Not for hedging)	
Variable	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**	**Coeff**	**p-value**
MANU	–190.67	0.926	3645.32	0.001	–50.060	0.987	22.888	0.984
US	784.73	0.600	1169.52	0.029	–807.22	0.867	270.11	0.822
CORRUPT	–381.00	0.874	–6273.62	0.000	–741.04	0.512	–19.836	0.965
DISCACC	430.00	0.765	–519.73	0.016	–3099.67	0.859	6813.73	0.268
BETA	–2650.92	0.744	–2600.33	0.399	–976.03	0.704	379.51	0.694
SD	–4832.75	0.562	266.07	0.670	1214.78	0.942	856.66	0.782
IDIO	1038.31	0.545	–491.50	0.328	–182.31	0.948	1294.72	0.318
BTM	–40.049	0.982	3104.44	0.001	–349.555	0.922	–568.59	0.670
LEV	192.29	0.658	99.947	0.517	–98.20	0.910	218.09	0.507
SIZE	–0.004	0.843	0.013	0.001	–0.006	0.852	–0.006	0.643
FORS	804.07	0.222	1503.09	0.061	138.78	0.987	1013.97	0.712
TT	28.093	0.066	–180.66	0.374	–169.16	0.842	50.920	0.874
PFUND	–5.339	0.911	5.250	0.625	10.403	0.914	–0.197	0.996
PRISK	75.119	0.249	–34.080	0.022	13.933	0.916	–5.153	0.916
F-statistic	0.225		9.732		0.050		0.244	
R-Sq	0.001		0.111		0.003		0.016	

Table 5.8, Panel B shows that US firms are less likely to use hedged foreign currency derivatives. The book-to-market, size and pension risk factors are positively associated with interest rate and foreign exchange derivatives use, suggesting that these factors remain robust to the inclusion of additional cultural and institutional controls.

Panel C of Table 5.8 demonstrates that the level of use of foreign currency (hedged and/or non-hedged) derivatives is greater for non-US GAAP firms, and is positively related to the corruption index and the exercise of discretionary accruals. The overall Chi-square statistic is higher than for either US or European firms.

These results suggest that companies based in common law countries (ie US and UK) are more associated with extensive total interest rate derivatives use than those based in civil code law (ie Continental European) countries. Further, both market and firm financial risk factors (book-to-market) are positively associated with interest rates qualified for hedging derivatives. These results lend further support to the predictions of hypotheses H2a and H2b, respectively, which suggest that the amount of derivatives use is associated with firm-specific financial factors, even after controlling for other market and institutional factors associated with derivatives use.

Taken together, the results of the pooled analysis in Table 5.8 support hypothesis H4. However, the industry factor does not appear to be influential.

Discretionary accruals is positively associated with the propensity to increase foreign currency derivatives over time (Table 5.8, Panel C). The results in Table 5.8 therefore support the earlier results by suggesting that firms are less likely to be influenced by cross-sectional variations in institutional frameworks and regulatory environments in making relatively short-term changes to their derivatives use strategies. By contrast, no institutional factors affect changes in the level of total hedge derivatives over time, as reported in Table 5.8, Panel D. Thus, the results remain equivocal on this issue and suggest that institutional factors are not strongly related to changes in derivatives use, although they do contribute to explaining overall usage of derivatives during the period.

Speculative effects

Hypothesis H5 predicts that European firms are more likely to consider the use of derivatives more broadly than US firms, for risk management purposes. To test these predictions, we expect to find that derivatives use is more likely to be strongly associated with a broader range of factors, and that the explanatory power of the overall model will be higher for EU firms than the equivalent model for hedging derivatives use alone.

This requires a comparison of the results discussed above, which focus on qualified for hedging derivatives only, with the equivalent results for total (hedged and unhedged) derivatives, reported in the columns at the right-hand side of these tables.

Table 5.4 appears to suggest that, at least for EU firms (Panel B), only book-to-market is significantly (and negatively) associated with the use of total (hedged and unhedged) derivatives. For the pooled sample (Panel C of Table 5.8), the use of total (hedged and unhedged) derivatives is mainly related only to institutional factors (US GAAP and corruption). The overall model Chi-square statistics and R-squares are also significantly lower for the total (hedged and unhedged) derivatives regressions than for the equivalent qualified for hedging derivatives regressions. Thus the predictions implied by hypothesis H5 are not supported, at least in analysing the propensity of EU firms to use derivatives.

By contrast, the predictions are more strongly supported when the sample is analysed by the total amount of derivatives use by type (see Table 5.5). For the use of foreign currency derivatives by EU firms (Panel B), the same factors that are associated with the use of hedged derivatives are also associated with total derivatives use. The overall model F-statistics and adjusted R-square are also higher. These findings contrast with the relatively lower explanatory power of the equivalent regressions for interest rate derivatives, and for US firms, as expected. The increased explanatory power of the pooled regression (Table 5.8, Panel C) mirrors that obtained for the EU firms alone (Table 5.5, Panel B). These results suggest that, at least in relation to the use of foreign currency derivatives, EU firms are likely to use a broader range of (hedged and unhedged) derivatives to manage their economic exposure, as predicted by hypothesis H5.

Analysis of the propensity to increase the use of total (hedged and unhedged) derivatives over time (Table 5.7, Panel B) provides even stronger evidence that EU firms use a broader range of derivatives for economic reasons than do US firms. Panel B of Table 5.6 indicates that idiosyncratic risk is associated with the increase in the use of foreign exchange derivatives.

Nonetheless, when the equivalent analysis is performed for changes in the total level of derivatives use by EU firms (Table 5.7, Panel B), there is a significantly higher explanatory power of firm risk and idiosyncratic risk only for total foreign currency derivatives use. In this case, idiosyncratic risk is positively associated with increases in the level of derivatives use by EU firms. Again, the significant increase in explanatory power in the regressions related to the changes in the propensity and level of use of derivatives, also contrast with the relatively lower explanatory power of analysing derivatives use by US firms. The results further support the predictions of hypothesis H5 (see page 14). They also provide strong support for the predictions of hypothesis H3 (see page 13), at least for EU firms.

6. Estimating the cost of capital

In this chapter, we test hypothesis H6 (see page 14) by developing cost of capital estimates, using various methodologies, for US and EU firms which either did or did not use interest rate or foreign exchange derivatives. Cost of capital estimates are developed for firms which are partitioned as to whether or not they used derivatives, and the extent to which they used the derivatives. Tests are conducted separately for hedged only, and hedged and unhedged derivatives use. T-tests are then used to infer the statistical significance of the findings.

6.1. COST OF CAPITAL METHODOLOGIES

This section outlines the cost of capital estimation methodologies utilised in this part of the paper. The discussion briefly summarises each model and provides details of the estimation techniques; the reader should refer to Cummins and Philips (2005) for a more extensive discussion of the various approaches that are used in this section to estimate the cost of equity capital.

6.1.1 The Capital Asset Pricing Model (CAPM)

The CAPM cost of capital is given by formula (2).

$$E(r_i) = r_f + \beta_i[E(r_m) - r_f] \quad (2)$$

where $E(r_i)$ = the CAPM cost of capital for firm i

r_f = the expected return on a default risk-free rate asset

$E(r_m)$ = the expected return on the market portfolio

β_i = firm i's 'beta coefficient' for systematic market risk

The CAPM cost of capital estimation is conducted using the usual two-stage approach. In the first stage, returns on specific stocks in the sample are regressed on a market risk factor proxied by an index return to obtain the beta coefficient for each firm. In the second stage, the beta coefficients are inserted into equation (2) along with the estimated market risk premium to obtain the cost of capital estimate for each firm. The estimated market premium for systematic risk, $E(r_m) - r_f$, is the average value-weighted excess return on NYSE stocks relative to the 30-day Treasury Bill Rate from 1926 to 2006.

To control for potential biases caused by infrequent trading, the CAPM beta is also estimated using the widely accepted sum-beta approach, based on the following augmented regression (3).

$$r_{it} - r_{ft} = \alpha_{it} + \beta_{i0}(r_{mt} - r_{ft}) + \beta_{i1}(r_{mt-1} - r_{ft-1}) + \varepsilon_{it} \quad (3)$$

The estimated sum beta coefficient is obtained by adding the contemporaneous and lagged beta estimates from equation (3), ie $\beta_i = \beta_{i0} + \beta_{i1}$

6.1.2 The Fama–French Three-Factor (FF3F) Model

Fama and French (1995), provide evidence that the CAPM does not provide an adequate explanation of the cross-sectional variation in average stock returns. They find that a three-factor model – which retains the CAPM risk-premium for systematic market risk but adds risk premia for two additional factors to capture the effects of firm size and book-to-market equity (BE/ME) ratio – provides a much better explanation of the cross-sectional variation in stock returns. The implication of their results is that reliance on the CAPM overlooks significant common risk factors that play a role in determining expected stock returns and thus is likely to lead to inaccurate cost of capital estimates.

Accordingly, we also estimate the cost of capital using the FF3F model.

The FF3F formula for the cost of capital is shown in equation (4).

$$E(r_i) = r_f + \beta_{mi}[E(r_m) - r_f] + \beta_{si}SMB + \beta_{bpi}HML \quad (4)$$

where

β_{si} = firm i's beta coefficient for the size factor

SMB = the expected market risk premium for firm size

β_{hi} = firm i's beta coefficient for the book-to market (BE/ME) equity factor

HML = the expected market risk premium for the book-to-market (BE/ME) equity factor

The size factor controls for the 'small stock effect' – the tendency of stocks with small market capitalisation to have higher costs of capital than large capitalisation stocks. The book-to-market equity factor is usually interpreted as a 'value factor' or measure of a firm's growth prospects. Firms with high growth prospects tend to have relatively low BE/ME ratios and lower costs of capital than firms with relatively low growth prospects. The BE/ME factor is also often interpreted as providing a market risk premium for financial distress (Fama and French 1995).

The first stage regression in the Fama–French (FF3F) methodology is given in equation (5).

(5)

$$r_{it} - r_{ft} = \alpha_i + \beta_{mi}(r_{mt} - r_{ft}) + \beta_{si}SMB_t + \beta_{bpi}HML_t + e_{it}$$

where

SMB_t = return differential between small and large stocks in period t

HML_t = return differential between high BE/ME stocks and low BE/ME stocks in period t

The model augments the CAPM regression to include variables representing market excess returns for size and financial distress, based on the differential returns between 'small' and 'large' stocks and 'high' and 'low' BE/ME stocks, respectively. These return series are derived using the procedures described in Fama and French (1995).

As in the case of the CAPM, it is also important to correct for infrequent trading bias when estimating the FF3F model. Accordingly, we also calculate FF3F beta estimates using a sum beta regression which includes contemporaneous and lagged values of each of the Fama–French return series. Analogous to equation (3), sum beta estimates are then obtained by summing the betas of the contemporaneous and lagged returns for each of the three factors.

In the second stage of the FF3F methodology, we insert either the betas from equation (5) or the corresponding sum beta estimates into equation (4). The risk-premium for systematic market risk, $E(r_m) - r_t$, in the FF3F model is the same estimate used for the CAPM. Also used in this stage are estimates of the long-term average market risk premia for size and financial distress. The averaging period for the size and financial distress premia is 1926–2006.

6.1.3 The Full-Information Industry Beta (FIB) method

The FIB methodology produces cost of capital estimates that reflect the line-of-business composition of the firm. Such estimates can be used to estimate costs of capital by line of business, for divisions or subsidiaries of conglomerate firms. The FIB approach is particularly relevant where, as in this case, firms sell goods in the domestic market, the US and/or EU markets, and in the other non-US and non-EU markets. The underlying premise is that the firm can be envisioned as a portfolio of assets, where the assets represent divisions or individual lines of business. The rationale for the FIB decomposition is the value-additivity property of arbitrage-free capital markets, which holds that the arbitrage-free market value of the firm is the sum of the values of its individual projects. This conceptualisation implies that the firm's overall market beta coefficient is a weighted average of the beta coefficients of the separate divisions or business lines. In theory, the weight on each divisional or line-of-business beta is the market value of the division divided by the market value of the firm as a whole. Because individual business units are not publicly traded, however. market value weights cannot be used. Instead, we follow Kaplan and Peterson (1998) in using sales data to represent business participation.

We seek to decompose the overall market beta coefficient (for the CAPM) or coefficients (for the FF3F model) into separate beta coefficients for each industry in which firms participate. There are two steps in the decomposition: (1) estimate the overall market beta coefficients for a sample of firms using the CAPM or FF3F methods, as discussed above; (2) obtain full information betas (FIBs) for each industry by performing cross-sectional regressions with the overall market betas as dependent variables and a series of weights proxying for the firm's participation in various lines of business as explanatory variables. We also use Dhaliwal et al.'s (1999) beta (adjusted by accounting beta) as a dependent variable in unreported tests.

The regression equation for the CAPM beta, estimated with constant term suppressed, is as follows.

$$\beta_{mi} = \sum_j \beta^f_{mj} w_{ij} + v_{mi} \qquad \textbf{(6)}$$

where

β_{mi} = firm i's overall market systematic risk beta coefficient

β^f_{mj} = the full-information market systematic risk beta for industry, line or division j

w_{ij} = firm i's industry participation weight for industry, line or division j

v_{mi} = random error term for firm i

The w_{ij}, j = 1,2,..., j for firm i, which sum to 1.0, measure the firm's participation in each line of business. Revenues by industry are used to calculate w_{ij}, ie w_{ij} = revenues of firm i in industry j divided by total revenues of firm i. The β^{f}_{mj} which vary by industry but not by firm, capture the impact that any particular line of business is expected to have on the overall riskiness and hence the beta coefficient of the firm. Equation (6) is then used 'out of sample' to estimate the overall beta coefficients β^{f}_{mj} for individual divisions or lines of business by inserting the w_{ij} weights for the division or business line.

A novel approach is to use accounting beta to estimate 'portfolio' weights here; ie regress $\beta_{acc\_i} = \beta_{acc\_j}\, w_{ij}$. That is, use this w_{ij} to replace ratio of sales of firm_i's division_j to total sales of firm_i. The second step can be the same as before, ie decompose aggregated beta to divisional beta based on w_{ij}.

Using equation (6) would not be appropriate to decompose the FF3F size and book-to-market betas because these betas tend to vary systematically with firm size and book-to-market ratio, respectively. Specifically, the size betas are inversely related to firm size, and the BE/ME betas are directly related to firm BE/ME ratios. Accordingly, regressions analogous to (6) for the size and book-to-market betas would be likely to suffer from omitted variables bias. To address this problem, we conduct the following regressions for the size and BE/ME betas to control two additional risk factors (w_{ij} based on accounting beta as above is also used in the following regressions (7) and (8).

$$\beta_{si} = \sum \beta^{f1}_{sj}\, w_{ij} + \beta^{f2}_{s}\, 1n(ME_i) + v_{si} \qquad (7)$$

$$\beta_{bpi} = \sum \beta^{f_1}_{bpj}\, w_{ij} + \beta^{f2}_{bp}\, 1n(BE / ME_i) + v_{bpi} \qquad (8)$$

where

β_{si} , β_{bpi} = overall size and BE/ME beta estimates firm i

β^{f1}_{sj}, $\beta_{bpj}^{f_1}$ = full-information size and BE/ME beta intercept coefficients for industry j

β^{f2}_{s} , β^{f2}_{bp} = full-information size and BE/ME beta slope coefficients

BE_i, ME_i = book value of equity and market value of equity for firm i,

v_{si}, v_{bpi}, = random error terms for firm i, equation j

Equations (7) and (8) allow for different intercept coefficients for each industry and also allow the slope coefficients to vary by the log of market equity and the log of the BE/ME ratio, respectively. The full-information beta estimates for the size factor are obtained using the estimated coefficients β^{f1}_{sj} and β^{f2}_{s} by inserting the industry participation weights (w_{ij}) and 1n(ME_i) for a given firm into equation (7), and the full-information beta for the BE/ME factor is obtained similarly using equation (8).

Equations (6)–(8) are estimated using two techniques – unweighted least squares (UWLS) and weighted least squares (WLS). In the WLS estimations, the weight for each firm in a specified cross-sectional regression is the ratio of its market capitalisation to the total market capitalisation of the firms in the sample. For both the UWLS and WLS cases, we estimate the three FF3F regressions using the seemingly unrelated regressions (SUR) procedure to improve estimation efficiency. The weighted and unweighted FIB regressions for the CAPM are conducted using ordinary least squares.

When UWLS is used to estimate equations (6)–(8), the Bf_{jk} represent market value weighted industry betas (Kaplan and Peterson 1998). The equally weighted results are useful in obtaining an indication of the betas for the average firm in an industry, whereas the market value weighted (WLS) results are a more useful indicator of the overall cost of capital for an industry.

6.2 DATA AND SAMPLE SELECTION

To estimate the CAPM, FF3F and full-information costs of capital, we need data on stock returns and revenues by line of business for a sample of EU and US firms. This section describes the data sources, sample selection procedures, and data screens employed to construct our sample. In this report, we estimate full-information costs of capital for stratified samples of pension-exposed industrial EU and US firms identified in our sample, over the period 2005–08. Stock return data were obtained from Compustat. Data were obtained for the period 2001–08, permitting us to estimate costs of capital for the full study period, because we follow the standard procedure of using 60 monthly observations to estimate our cost of capital models.

6.3 EMPIRICAL RESULTS

This section begins by discussing summary statistics on the industry participation ratios of the firms. The overall beta and cost of capital estimation results are then presented, followed by cost of capital estimates by line.

In all the cost of capital estimates presented in this report, we use as the risk-free rate the average of the 30-day Treasury bill over the years used in this study. Likewise, as the expected risk premia for systematic market risk, size and financial distress, we use the long-run historical (1926–2000) market risk premia on NYSE stocks from French's website.[23] We use the same risk-free rate and risk premia for all cost of capital estimates to focus on the impact of the models and the beta coefficients on the cost of capital, holding constant the risk-free rate and market risk premia.

The various panels of Tables 6.1–6.3 show the CAPM costs of capital based on the beta estimates for both little-exposed and highly-exposed EU firms in terms of:

(a) use of interest rate derivatives

(b) use of foreign exchange derivatives

(c) extent of exposure to hedged FX derivatives

(d) extent of exposure to hedged interest rate derivatives

(e) extent of exposure to hedged and unhedged FX derivatives, and

(f) extent of exposure to hedged and unhedged interest rate derivatives.

The capital asset pricing model (CAPM) cost of capital estimates are shown in Table 6.1. This table shows the average CAPM beta for firms that are identified as insurers on the basis of their having overall financial code 52. Both beta and sum beta regressions are conducted for each firm (equations (2) and (3) above). The beta regression is as shown in equation (9).

$$(r_{it} - r_{ft}) = a_i + B_{mi}(r_{mt} - r_{ft}) + e_{it} \quad (9)$$

where

r_{it} is the return on firm i

r_{ft} is the 30-day Treasury bill (T-bill) rate observed at the beginning of the month

r_{mt} is the value-weighted market return on all NYSE stocks

The 'sum B' model adjusts for non-synchronous trading by adding to the regression the excess market return variable lagged one time period. The reported sum betas equal the sum of the contemporaneous and lagged beta estimates. The data period for each year ends on 30 June. Estimates are calculated using the previous 60 months of returns. The risk-free rate of interest used to estimate the cost of equity capital was the average European Central Bank (ECB) 30-day T-bill rate over the time period for this study, 2005–08, 4.93%. The long-run historical market risk premium as of December 2003 was 8.44% (Ibbotson 2005). Standard deviations are shown in brackets. The t-test shows the significance of the difference between a purely domestic investor and an investor based either in the United States (US Dollars or USD), Eurozone (Euro or EUR), UK (GB pound or GBP) and Switzerland (Swiss Franc or CHF).

Table 6.1 also gives the average beta and sum beta by market capitalisation size quartile for each year of the estimation period. The cost of capital estimate for the period as a whole is 3.6% without the sum beta adjustment and up to 5.5% with the sum beta adjustment, depending on the currency denomination of the investor.

23. http://www.french.com

Table 6.1: CAPM costs of capital for EU and US firms

Panel A: EU Firms						
Type of exposure	**Extent of exposure**	**Domestic**	**EUR**	**USD**	**GBP**	**CHF**
	Small	3.670 (1.778)	4.849 (0.038)	3.041 (0.075)	5.515 (0.033)	3.085 (0.074)
	Large	4.327 (1.140)	4.874 (0.041)	3.109 (0.073)	5.539 (0.034)	3.149 (0.069)
Use derivatives (interest rate)	T-test p-value	0.412	0.034	0.069	0.047	0.064
	Small	3.845 (1.725)	4.849 (0.013)	3.040 (0.027)	5.515 (0.012)	3.085 (0.027)
	Large	4.327 (1.064)	4.874 (0.039)	3.109 (0.071)	5.539 (0.032)	3.149 (0.067)
Use derivatives (FX)	T-test pval	0.628	0.048	0.079	0.063	0.075
	Small	3.861 (1.690)	4.869 (0.068)	3.081 (0.103)	5.532 (0.056)	3.123 (0.102)
	Large	4.336 (1.047)	4.894 (0.064)	3.132 (0.145)	5.554 (0.057)	3.173 (0.137)
Extent of FX hedge exposure	T-test pval	0.661	0.448	0.430	0.442	0.443
	Small	3.798 (0.015)	4.861 (0.019)	3.050 (0.022)	5.523 (0.015)	3.095 (0.022)
	Large	4.311 (1.094)	4.856 (0.040)	3.078 (0.072)	5.524 (0.033)	3.119 (0.069)
Extent of interest hedge exposure	T-test pval	0.905	0.807	0.414	0.672	0.443
	Small	3.907 (1.725)	4.868 (0.013)	3.077 (0.027)	5.532 (0.012)	3.120 (0.027)
	Large	3.304 (1.026)	4.816 (0.063)	3.013 (0.142)	5.489 (0.056)	3.052 (0.134)
Extent of FX H or UH exposure	T-test pval	0.533	0.546	0.560	0.520	0.565
	Small	3.816 (1.725)	4.871 (0.013)	3.087 (0.027)	5.533 (0.012)	3.129 (0.027)
	Large	4.045 (0.005)	4.849 (0.060)	3.043 (0.142)	5.517 (0.054)	3.088 (0.134)
Extent of interest H or UH exposure	T-test pval	4.028	0.332	0.229	0.332	0.240
	Average	3.779 (1.072)	4.863 (0.055)	3.067 (0.121)	5.527 (0.048)	3.111 (0.603)
Total	T-test pval	0.059	0.001	0.001	0.001	0.180

Panel B: US Firms

Type of exposure	Extent of exposure	Domestic	EUR	USD	GBP	CHF
	Small	6.260 (0.001)	6.250 (0.002)	6.260 (0.001)	6.251 (0.002)	6.250 (0.002)
	Large	6.250 (0.002)	6.250 (0.001)	6.250 (0.002)	6.251 (0.001)	6.250 (0.002)
Use derivatives (interest rate)	T-test pval	0.806	0.980	0.964	0.994	0.929
	Small	6.260 (0.002)	6.250 (0.002)	6.260 (0.002)	6.250 (0.002)	6.250 (0.002)
	Large	6.260 (0.001)	6.251 (0.001)	6.260 (0.001)	6.251 (0.001)	6.251 (0.001)
Use derivatives (FX)	T-test pval	0.233	0.215	0.908	0.221	0.206
	Small	6.260 (0.002)	6.251 (0.002)	6.260 (0.002)	6.251 (0.002)	6.250 (0.002)
	Large	6.260 (0.001)	6.250 (0.002)	6.260 (0.001)	6.251 (0.002)	6.250 (0.002)
Extent of FX hedge exposure	T-test pval	0.110	0.799	0.043	0.786	0.827
	Small	6.260 (0.002)	6.251 (0.002)	6.250 (0.002)	6.251 (0.002)	6.251 (0.002)
	Large	6.260 (0.001)	6.250 (0.002)	6.260 (0.002)	6.251 (0.002)	6.250 (0.002)
Extent of interest hedge exposure	T-test pval	0.110	0.410	0.517	0.374	0.433
	Small	6.260 (0.002)	6.251 (0.002)	6.260 (0.002)	6.251 (0.002)	6.251 (0.002)
	Large	6.260 (0.001)	6.250 (0.002)	6.260 (0.001)	6.251 (0.001)	6.250 (0.002)
Extent of FX H or UH exposure	T-test pval	0.622	0.397	0.421	0.374	0.438
	Small	6.260 (0.002)	6.251 (0.002)	6.260 (0.002)	6.251 (0.002)	6.251 (0.002)
	Large	6.260 (0.001)	6.250 (0.001)	6.260 (0.001)	6.251 (0.001)	6.250 (0.001)
Extent of interest H or UH exposure	T-test pval	0.119	0.502	0.183	0.482	0.532
	Average	6.250 (0.002)	6.250 (0.002)	6.250 (0.002)	6.250 (0.002)	6.250 (0.002)
Total	T-test pval Domestic v global	na	0.024	0.836	0.006	0.088

For EU firms (Table 6.1, Panel A), there is a significant difference between the overall use of derivatives (FX and interest rate, hedged) between users and non-users of derivatives. By contrast, for US firms (Panel B), while the overall average CAPM estimate based on EUR, GBP and CHF is significantly different from the domestic-based estimate, there is no overall significant relationship between the size of the exposure and the cost of capital, except for domestic-denominated exposure.

Table 6.2 provides the equivalent overall cost of capital estimates based on the FF3F method. This table shows the average regression coefficients from the Fama–French three-Factor Model for firms which are identified as EU firms. Both beta and sum beta regressions (equations (5) and (6) on page 40) are estimated for each firm. The beta regression is shown in equation (10).

$$(r_{it} - r_{ft}) = a_i + B_m(r_{mt} - r_{it}) + B_{sipst} + B_{hipht} + e_{it} \qquad (10)$$

where

r_{it} is the return on firm i

r_{ft} is the 30-day Treasury bill rate observed at the beginning of the month

r_{mt} is the value-weighted market return on all NYSE stocks

The firm size and BE/ME factors, pst and pht, respectively, are determined as follows. At the end of June of each year all NYSE stocks are allocated to two groups (small, S or big, B) based upon whether their market capitalisation is less than or greater than median market capitalisation of NYSE stocks. Stocks are also sorted into three book-to-market groups (low, medium, high) based upon the breakpoints for the bottom 30% (L), middle 40% (M) and top 30% (H) values of book equity-to-market capitalisations for NYSE stocks. Six size-BE/ME portfolios (SL, SM, SH, BL, BH, BM) are then formed using the intersections of the breakpoints defined above. Value-weighted monthly returns on the six portfolios are calculated from July to the following June. The size factor, pst, is the difference, each month, between the average returns on the three small-stock portfolios (SL, SM, SH) and the three big-stock portfolios (BL, BM, BH). The BE/ME factor, p_{rt}, is the difference each month between the average returns on the two high BE/ME portfolios (SH and BH) and the two low BE/ME portfolios (SL and BL). The 'Sum B' model adjusts for non-synchronous trading by including each factor and each factor lagged by one time period. The reported sum betas equal the sum of the contemporaneous and lagged regression coefficients. Estimates are calculated using the previous 60 months of returns. More detail on the construction of the firm size and BE/ME factors can be found in Fama and French (1995). The factors are available on French's website. The risk-free rate of interest used to estimate the cost of equity capital was the average ECB 30-day T-bill rate over the time period for this study 2005–08, 4.93%. The long-run historical market risk premium as of December 2003 was 8.44% (Ibbotson 2005). Standard deviations are shown in brackets. The t-test shows the significance of the difference between a purely domestic investor / investor based in the US, Eurozone (EUR), UK (GBP) or Switzerland (CHF).

Table 6.2: Fama–French Three-Factor cost of capital estimates for EU firms

Panel A: EU Firms						
Type of exposure	**Extent of exposure**	**Domestic**	**EUR**	**USD**	**GBP**	**CHF**
Use derivatives (interest rate)	Small	3.804 (1.886)	4.983 (0.145)	3.175 (0.184)	5.649 (0.140)	3.219 (0.182)
	Large	4.535 (1.126)	5.082 (0.287)	3.317 (0.313)	5.747 (0.282)	3.356 (0.311)
	T-test pval	0.324	0.281	0.179	0.305	0.185
Use derivatives (FX)	Small	3.998 (1.789)	5.002 (0.051)	3.193 (0.037)	5.669 (0.052)	3.238 (0.037)
	Large	4.535 (1.090)	5.082 (0.294)	3.317 (0.320)	5.747 (0.289)	3.356 (0.318)
	T-test pval	0.699	0.566	0.387	0.602	0.401
Extent of FX hedge exposure	Small	3.925 (1.686)	4.934 (0.072)	3.145 (0.107)	5.597 (0.060)	3.188 (0.106)
	Large	4.611 (1.138)	5.170 (0.369)	3.407 (0.380)	5.830 (0.365)	3.448 (0.378)
	T-test pval	0.931	0.051	0.088	0.046	0.082
Extent of interest hedge exposure	Small	3.930 (0.127)	4.993 (0.123)	3.182 (0.120)	5.655 (0.127)	3.227 (0.120)
	Large	4.538 (1.134)	5.083 (0.336)	3.306 (0.356)	5.751 (0.333)	3.347 (0.354)
	T-test pval	0.946	0.499	0.336	0.478	0.355
Extent of FX H or UH exposure	Small	3.946 (1.789)	4.907 (0.051)	3.117 (0.037)	5.571 (0.052)	3.160 (0.037)
	Large	3.252 (1.130)	4.765 (0.364)	2.961 (0.375)	5.437 (0.360)	3.001 (0.374)
	T-test pval	0.985	0.014	0.026	0.012	0.024
Extent of interest H or UH exposure	Small	4.011 (1.789)	5.065 (0.051)	3.282 (0.037)	5.728 (0.052)	3.324 (0.037)
	Large	4.292 (1.099)	4.853 (0.292)	3.047 (0.295)	5.521 (0.288)	3.092 (0.294)
	T-test pval	0.679	0.425	0.315	0.432	0.327
Total	Average	3.942 (1.135)	5.026 (0.328)	3.231 (0.340)	5.690 (0.324)	3.274 (0.338)
	T-test pval	na	0.001	0.006	0.001	0.001

Panel B: US Firms

Type of exposure	Extent of exposure	Domestic	EUR	USD	GBP	CHF
		6.922	6.853	6.842	6.853	6.853
	Small	(1.220)	(0.669)	(0.625)	(0.669)	(0.669)
		6.901	6.971	6.955	6.971	6.970
Use derivatives	Large	(0.887)	(1.342)	(1.262)	(1.342)	(1.342)
(interest rate)	T-test pval	0.920	0.562	0.536	0.562	0.562
		6.833	6.979	6.837	6.979	6.979
	Small	(0.662)	(1.167)	(0.612)	(1.167)	(1.167)
		7.038	6.806	6.968	6.806	6.806
	Large	(1.493)	(0.865)	(1.304)	(0.865)	(0.864)
Use derivatives (FX)	T-test pval	0.405	0.379	0.486	0.379	0.379
		6.731	6.837	6.829	6.843	6.837
	Small	(0.737)	(0.612)	(0.602)	(0.625)	(0.612)
		7.049	6.969	6.927	6.956	6.969
	Large	(1.239)	(1.304)	(1.126)	(1.262)	(1.304)
Extent of FX hedge exposure	T-test pval	0.098	0.486	0.489	0.536	0.486
		6.826	6.843	6.851	6.837	6.843
	Small	(0.601)	(0.625)	(0.663)	(0.612)	(0.625)
		6.965	6.956	6.938	6.969	6.956
	Large	(1.268)	(1.262)	(1.193)	(1.304)	(1.262)
Extent of interest hedge exposure	T-test pval	0.444	0.536	0.625	0.486	0.536
		7.014	6.830	6.852	6.830	6.830
	Small	(1.120)	(0.602)	(0.669)	(0.602)	(0.602)
		6.893	6.927	6.970	6.927	6.927
Extent of FX H or UH	Large	(1.054)	(1.126)	(1.342)	(1.126)	(1.126)
exposure	T-test pval	0.735	0.489	0.562	0.489	0.489
		6.776	6.852	6.978	6.852	6.852
	Small	(0.620)	(0.663)	(1.167)	(0.663)	(0.663)
		6.971	6.938	6.806	6.938	6.938
Extent of interest H or UH	Large	(1.199)	(1.193)	(0.865)	(1.193)	(1.193)
exposure	T-test pval	0.262	0.626	0.379	0.626	0.626
		6.918	6.918	6.918	6.918	6.918
	Average	(1.063)	(1.063)	(1.063)	(1.063)	(1.063)
Total	T-test pval	na	1.000	0.997	0.998	0.997

The FF3F costs of capital average shown in Table 6.2 is approximately 0.5% higher than the comparable CAPM costs of capital for both EU and US firms (Table 6.1). The higher FF3F estimates reflect the risk-premia for firm size and the BE/ME factor. Hence, it is likely to be important for firms to utilise a multiple-factor model when estimating the cost of capital.

The FF3F cost of capital estimates for US firms are consistent with the FF3F estimates for all industries, which average about 3.5% (after adjusting for the risk-free rate, which was about 2.5% lower in Ibbotson's analysis (2005) than in ours). The FF3F cost of capital estimates for US firms should be somewhat higher than average CAPM estimates for EU firms, as they tend to have more sensitivity to the BE/ME factor. There are no statistically significant relationships, however, between the extent of exposure to various types of derivatives use and FF3F cost of capital estimates of either US or EU firms (see Table 6.2, Panels A and B).

6.3.1 Full-information costs of capital

The full-information CAPM beta coefficients for EU sample firms are shown in Table 6.3. The beta estimates shown in the table are the industry-participation intercept coefficients (β^{f}_{mj}) from the CAPM FIB regression (equation (6) on page 40) on all EU sample firms that met our sample selection criteria. The dependent variable in the regression is the vector of sum beta estimates obtained from equation (3) (see page 39). Table 6.3 displays full-information CAPM beta estimates for EU firms. The full-information beta is estimated from the cross-sectional regression shown in equation (11).

$$B_{mi} = S\, B_{fmj}(w_i) + v_{mj} \qquad (11)$$

where

B_{mi} is the equity beta estimated using equation (3) for firm i

B_{fmj} is the estimated full-information beta for industry j

wj is the per cent of firm i's net sales in industry j

The regression is estimated by OLS (equally weighted) and via weighted least squares (market weighted). The latter is used so we can obtain market-capitalisation weighted industry full-information betas. The weight is equal to the market capitalisation of firm i relative to the market capitalisation of all NYSE stocks. Any firm with an estimated beta greater than 5 or less than –5 is removed from the sample. The full-information regression was estimated separately for each calendar year and as a pooled regression across all four years. The risk-free rate of interest used to estimate the cost of equity capital was the average ECB 30 day T-bill rate over the time period for this study 2005–08, 4.93%. The long-run historical market -risk premium as of December 2003 was 8.44% (Ibbotson 2005). Standard deviations are shown in brackets. The t-test shows the significance of the difference between a purely domestic investor and an investor based in the US, Eurozone (EUR), UK (GBP) or Switzerland (CHF).

We conducted the FIB estimation separately by year and also conducted a panel data regression including the data from all four years of the sample period in a single regression. Only market-value weighted averages, based on the distribution of sales between domestic, EU or US and non-EU and non-US markets, are shown in the Table 6.3. Whereas the equally weighted averages provide an indication of the beta for the average firm, the market-value weighted averages provide an indication of the systematic risk sensitivity for the industry as a whole. We focus most of the discussion on the panel data results, but the annual averages are generally quite similar.

Table 6.3: Full information CAPM beta and cost of capital estimates with sum beta for EU firms adjustment for financial services industries

Panel A: EU Firms						
Type of exposure	**Extent of exposure**	**Domestic**	**USD**	**EUR**	**GBP**	**CHF**
Use derivatives (interest rate)	Small	4.223 (1.860)	3.044 (3.601)	4.853 (3.563)	2.378 (3.606)	4.808 (3.564)
	Large	4.279 (0.948)	3.731 (2.022)	5.497 (2.023)	3.067 (2.022)	5.457 (2.023)
	T-test pval	0.172	0.003	0.001	0.001	0.001
Use derivatives (FX)	Small	4.343 (0.488)	3.400 (0.472)	5.208 (0.468)	2.734 (0.478)	5.163 (0.466)
	Large	4.165 (0.893)	3.604 (1.850)	5.410 (1.849)	2.936 (1.851)	5.365 (1.849)
	T-test pval	0.172	0.003	0.001	0.001	0.001
Extent of FX hedge exposure	Small	4.399 (1.255)	3.489 (2.937)	5.291 (2.994)	2.826 (2.929)	5.247 (2.988)
	Large	3.750 (0.820)	1.964 (1.725)	3.734 (1.734)	1.297 (1.724)	3.694 (1.733)
	T-test pval	0.175	0.003	0.001	0.001	0.001
Extent of interest hedge exposure	Small	4.510 (0.109)	3.744 (0.121)	5.550 (0.108)	3.080 (0.118)	5.506 (0.011)
	Large	3.416 (0.815)	1.682 (1.574)	3.418 (1.584)	1.019 (1.572)	3.381 (1.587)
	T-test pval	0.173	0.003	0.001	0.003	0.002
Extent of FX H or UH exposure	Small	4.368 (1.235)	3.460 (2.971)	5.261 (2.961)	2.796 (2.981)	5.217 (2.959)
	Large	4.251 (0.840)	2.447 (1.725)	4.234 (1.734)	1.787 (1.724)	4.189 (1.733)
	T-test pval	0.172	0.003	0.001	0.001	0.002
Extent of interest H or UH exposure	Small	4.425 (0.684)	3.425 (0.962)	5.227 (0.604)	2.763 (0.978)	5.183 (0.640)
	Large	4.583 (0.895)	4.034 (1.896)	5.798 (1.899)	3.370 (1.895)	5.758 (1.899)
	T-test pval	0.172	0.003	0.001	0.003	0.001
Total	Average	4.194 (0.953)	3.110 (1.903)	4.906 (1.913)	2.446 (1.902)	4.862 (1.912)
	T-test pval diff FF3F v FIB	0.172	0.003	0.001	0.003	0.001

Panel B: US Firms

Type of exposure	Extent of exposure	Domestic	EUR	USD	GBP	CHF
	Small	7.250 (0.002)	7.250 (0.002)	7.250 (0.002)	7.251 (0.002)	7.250 (0.002)
Use derivatives (interest rate)	Large	7.250 (0.002)	7.250 (0.001)	7.250 (0.001)	7.251 (0.001)	7.250 (0.002)
	T-test pval	0.880	0.980	0.882	0.994	0.929
	Small	7.250 (0.002)	7.250 (0.002)	7.250 (0.002)	7.250 (0.002)	7.250 (0.002)
Use derivatives (FX)	Large	7.250 (0.001)	7.251 (0.001)	7.250 (0.001)	7.251 (0.001)	7.251 (0.001)
	T-test pval	0.804	0.215	0.238	0.221	0.206
	Small	7.250 (0.002)	7.251 (0.002)	7.250 (0.002)	7.251 (0.002)	7.251 (0.002)
Extent of FX H exposure	Large	7.250 (0.001)	7.250 (0.002)	7.250 (0.001)	7.251 (0.002)	7.250 (0.002)
	T-test pval	0.233	0.799	0.926	0.786	0.927
	Small	7.250 (0.001)	7.251 (0.002)	7.250 (0.002)	7.251 (0.002)	7.251 (0.002)
Extent of interest hedge exposure	Large	7.250 (0.002)	7.250 (0.002)	7.250 (0.001)	7.250 (0.001)	7.250 (0.001)
	T-test pval	0.806	0.410	0.518	0.404	0.532
	Small	7.250 (0.002)	7.251 (0.002)	7.250 (0.002)	7.251 (0.002)	7.251 (0.002)
Extent of FX H or UH exposure	Large	7.250 (0.001)	7.250 (0.002)	7.250 (0.002)	7.251 (0.002)	7.250 (0.002)
	T-test pval	0.622	0.397	0.430	0.374	0.438
	Small	7.250 (0.001)	7.251 (0.002)	7.250 (0.002)	7.251 (0.002)	7.251 (0.002)
Extent of int H or UH exposure	Large	7.250 (0.002)	7.250 (0.001)	7.250 (0.001)	7.251 (0.001)	7.250 (0.001)
	T-test pval	0.100	0.502	0.629	0.482	0.532
	Average	7.250 (0.002)	7.250 (0.002)	7.250 (0.002)	7.251 (0.002)	7.250 (0.002)
Total	T-test pval FIB v CAPM	0.001	0.001	0.001	0.001	0.001

The value-weighted estimates suggest that the FIB CAPM cost of equity capital for US and EU firms is approximately 0.5–1%. The estimates are based on regressions (6)–(8) (see pages 40–41) with the sum beta estimates as dependent variables. For EU firms (Table 6.3, Panel A), all coefficients are highly statistically significant. Although standard errors for other industries are not shown, nearly all the industry participation coefficients are also statistically significant.

Panel estimates in Table 6.3 show that EU firms have higher market systematic risk beta estimates than US firms (see Panel B), which do not provide any evidence of statistically different cost of capital estimates for low versus high derivatives users. This provides further evidence that US firms' stock returns are much more sensitive to financial distress than stocks in general and that financial distress significantly increases the cost of capital for EU firms.

Based on value-weighted estimates, the cost of equity capital for EU firms is 4.0%. Because FIB estimates focus only on the financial industry components of financial guarantee betas, the numbers differ from those in Tables 6.1–6.3, which present betas for the entire firm rather than specific business lines. Nonetheless, the full-information costs of capital for EU firms in Tables 6.1–6.2 are consistent with the results shown in Table 6.3.

Based on the equally weighted results shown in Table 6.3, the average US firm has a significantly higher cost of capital than the average EU firm. Based on the value-weighted results, the average US firm has a significantly higher cost of capital than for all other equivalent non-financial firms in the EU.

The most important implication of Tables 6.1 and 6.2 is that the FF3F costs of capital appear to be substantially larger than the CAPM costs of capital. The FIB FF3F cost of capital for EU firms is approximately 4%, whereas the CAPM cost of capital is about 3.5%. The FF3F model leads to higher cost of capital estimates for EU firms than the CAPM for two primary reasons: (1) the FF3F systematic market risk betas in Table 6.2 are larger than the comparable CAPM betas in Table 6.1; and (2) the FF3F model imposes positive cost of capital premia for small size and financial distress which are not present under the CAPM. The risk premium component of the CAPM cost of capital for EU firms for the equally weighted case in Table 6.1 is 2.7%. For the equally weighted case in Table 6.2, the risk premium from the CAPM beta factor is 2.6%, the risk premium for the size factor is 0.51%, and the risk premium for the BE/ME factor is 0.5%, for a total risk premium of 4%, approximately 0.5% higher than under CAPM. Clearly, controlling for factors other than systematic market risk makes a significant difference, with the financial distress premium playing a pivotal role.

7. Conclusion

This study exploits newly available accounting disclosures concerning derivatives exposures to examine the association between derivatives use, type of derivatives use and measurement type and amount of derivatives use, and the quality of earnings and cash flows, for a sample of US and EU multinational firms from the FTSE Global 500. Further evidence on this issue is relevant given the size and concentration of resources in large corporations, the increasing trend towards globalisation in capital markets and service and good provision, and increasing public policy concerns about the opacity of reporting by multinationals in complex and changing and uncertain regulatory environments.

In contrast to previous research, the present research is the first to identify incentive problems as a specific alternative justification for the use of derivatives by multinational firms. It is also the first to show a direct comparison of the determinants and nature of derivatives use by US and EU-based multinationals. Our analysis focuses attention on the use of derivatives by EU firms in the three years immediately surrounding the harmonisation of IFRS, where standardised currency and interest rate environments make comparison with their US competitors plausible and interesting. In undertaking our research, we also identify new variables associated with derivatives use, such as idiosyncratic risk, discretionary accruals and pension-related sources of firm-specific underfunding and risk. We are the first to identify corruption, regulatory quality and accounting as being an integral part of these choices, and extend our analysis to include the speculative trading of derivatives. Thus, our study provides a number of new insights into old issues concerning the determinants of derivatives use and their broader risk management implications.

We predict, and find, that there is a relatively strong and robust association between both the propensity to use derivatives and the level of use of derivatives with a range of firm-specific idiosyncratic and financial risk factors. We also predict that these relationships hold for interest rate and foreign currency derivatives and that these relationships help explain changes in the use level of derivatives. These results are robust across both US and European firms. The findings both clarify and condition the results on the overall use of derivatives.

We estimate the cost of capital for EU firms under various assumptions about the methodology of estimation as well as different currency denominators of the investor in these firms. Our cost of capital estimates are robust to alternative methodologies. Using the full-information beta (FIB) approach overcomes the limitations of the CAPM and FF3F methodologies in not recognising the differential costs associated with sales when segmented into domestic, EU/US and other markets. We find that the cost of capital for heavy derivatives users of various types is in many cases significantly higher than for low derivatives users. These results are robust to different methodologies and currency denominations.

Overall, we find strong traces of support for the view that derivatives use by complex multinationals performs a risk management role in mitigating sources of idiosyncratic risk and incentive problems. Many of the factors associated with derivatives use also imply that the capital structure policy of large conglomerates can be best viewed from an integrated and dynamic corporate financial perspective. In addition, our hypotheses predict and uncover interesting new dimensions in the relationship between the total amount of derivatives use and firm-risk characteristics. Even so, our results are also conditioned by broader institutional, regulatory and accounting quality issues that affect the location and reporting environment of US and EU firms. In particular, our findings support the hypothesis that the enforceability of strict hedge accounting rules may vary from a strict registration rule-based approach (US) to disclosure enforcement (EU). Overall, we find a fairly robust relationship between both the propensity to use derivatives and the amount of use, and various financial characteristics of firms, although both the statistical strength and direction of these relationships vary considerably across the regions in which these firms are based. In particular, our finding that EU firms tend to view derivatives use much more liberally than that implied by the relatively narrow and specific focus of whether they are qualified for hedging treatment raises important questions concerning the corporate governance and accountability of these organisations to their shareholders and other stakeholders.

Extreme caution must be given to these findings, however, given the relatively short time-frame between the initial adoption of IAS by large European firms, and the implementation of costly and complex associated derivatives reporting requirements. Our sample period was not sufficiently long to undertake robustness tests on the effects of changes in fundamental economics affecting the provision of and demand for derivatives use, and various accounting and regulatory factors that control and mitigate the overall predicted relationships. Further research is needed to update and validate the overall results reported, particularly in the light of more recent changes to derivatives reporting after the latest financial crisis.

While we have paid much attention to understanding the sources and nature of derivatives use by multinationals, and their broader linkages to corporate financial policy, our results and analysis can be further extended in a number of dimensions. Further research is needed to identify better measures for foreign currency and interest rate exposure of multinationals, which have complex and interacting exposure to both types of instrument. More research is also needed to identify sources and the nature of idiosyncratic risk and discretionary accruals, both of which contribute to the opaqueness of reporting by these large entities. Finally, more work is needed to tease out the implications and interrelationships between overall corporate financial policy, including risk management related to derivatives, and other sources of retained capital, such as pension funds and other post-retirement benefits.

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Appendix: Derivatives disclosures from sample

FROM THE 2006 ANNUAL REPORT OF GLAXOSMITHKLINE

Financial risk management
A number of derivative financial instruments are used to manage the market risks from Treasury operations. Derivative instruments, principally comprising forward foreign currency contracts and interest rate and currency swaps, are used to swap borrowings and liquid assets into the currencies required for Group purposes and to manage exposure to funding risks from changes in foreign currency rates and interest rates (p. 127).

39 Financial instruments and related disclosures continued (p. 134)

The following table sets out the principal amount and fair values of derivatives contract which qualify for hedge accounting treatment.

	2006		2005	
	Contract or underlying principal amount	Fair value of derivatives contract	Contract or underlying principal amount	Fair value of derivatives contract
	£m	£m	£m	£m
Cash flow hedges				
Cross currency swaps	338	44	342	10
Fair value hedges				
Foreign currency contracts	–	–	2,151	74
Interest rate swaps	1,696	(40)	1,848	(42)
Cross currency swaps	500	(5)	500	3

Derivative instruments
SFAS 133, 'Accounting for Derivative Instruments and Hedging Activities', as amended by SFAS 137 and SFAS 138 and as interpreted by the Derivatives Implementation Group, was adopted by the Group with effect from 1st January 2001....[sentences omitted] SFAS 133 prescribes requirements for designation and documentation of hedging relationships and ongoing assessments of effectiveness in order to qualify for hedge accounting (p. 140).

FROM THE 2005 ANNUAL REPORT OF ANHEUSER-BUSCH COMPANIES

Financial derivatives
Anheuser-Busch uses financial derivatives to mitigate the company's exposure to volatility in commodity prices, interest rates, and foreign currency exchange rates. The company hedges only exposures in the ordinary course of business and company policy prohibits holding or trading derivatives for profit.

The company accounts for its derivatives in accordance with FAS No. 133, 'Accounting for Derivative Instruments and Hedging Activity,' which requires all derivatives to be carried on the balance sheet at fair value and meet certain documentary and analytical requirements to qualify for hedge accounting treatment (p. 46).

Derivatives and other financial instruments
Following are the notional transaction amounts and fair values for the company's outstanding derivatives, summarized by risk category and instrument type, at December 31 (in millions, with brackets indicating a deferred loss position) (p. 51).

	2005		2004	
	Notional amount	Fair value	Notional amount	Fair value
Foreign currency:				
Forwards	$115.2	$(2.1)	$114.7	$ 0.7
Options	277.2	7.6	151.0	3.8
Total foreign currency	392.4	5.5	265.7	4.5
Interest rate:				
Swaps	250.0	0.2	150.0	5.6

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