THE VALUE RELEVANCE OF DERIVATIVES FOR SOUTH AFRICAN LISTED COMPANIES

by

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"Aut viam inveniam aut faciam." (Hannibal)

ABSTRACT

This study investigates the use of derivatives by firms listed on the Johannesburg Stock Exchange (JSE) during 2005 to 2017, and the disclosure of derivative financial instruments on the financial statements of these entities. The study can be broadly divided into two parts: the first part investigates the determinants of corporate hedging practices by JSE-listed firms, while the second part analyses the value relevance of derivatives disclosures. The first part of the study thus answers the question 'Why do companies use derivatives?' with reference to JSE-listed companies for the period 2005 to 2017. The second part of the study answers the question 'Does the disclosure of derivatives in the financial statements have an impact on firm value?' for the same companies and period.

Binomial logistic regression analyses were done to assess the determinants of the corporate hedging practices employed by JSE-listed firms. Multiple linear regression analyses were used to determine the value relevance of derivatives disclosures.

The results of the study suggest that firm size, growth prospects, leverage and managerial risk aversion are important determinants of JSE-listed firms' hedging decisions. Furthermore, the findings suggest that the disclosure of firms' use of derivatives in the financial statements is value relevant and that companies listed on the JSE are associated with a higher Tobin's Q if they disclose a derivatives amount.

This study also investigates whether the value relevance of derivatives disclosure is influenced differently under different conditions during different economic periods and whether the level of quality of the disclosure influences the value relevance of derivatives disclosure. The data show that the value relevance of risk disclosure companies depend on different economic periods, and that the level of higher quality risk disclosure has a negative impact on the value relevance of derivatives disclosures: firms are valued lower where the level of quality of derivatives disclosures is higher.

KEY WORDS:

Corporate risk management, Derivatives, Firm value, Financial crisis, Hedging, Quality of disclosure, Value relevance

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LIST OF ABBREVIATIONS

Abbreviation	**Meaning**
EME	Emerging Market Economy
FASB	Financial Accounting Standards Board
IAS(s)	International Accounting Standard(s)
IFRS(s)	International Financial Reporting Standard(s)
JSE	Johannesburg Stock Exchange
OTC	Over-the-counter
QDI	Quality of disclosure index
R&D	Research and development
ROA	Return on assets
ROE	Return on equity
SFAS(s)	Statement of Financial Accounting Standard(s)
Tobin's Q	Tobin's Quotient
UK	United Kingdom
US or USA	United States / United States of America

LIST OF DEFINITIONS

Derivative	A financial instrument whose value is linked, based or dependent on an underlying asset or instrument. There are different types of derivatives, including forwards.
Emerging market economy	An emerging market economy has some characteristics of a developed market, but not enough fully to meet the standards of a developed economy. Emerging market economies tend to be characterised by low to middle income per capita income, high market volatility and some economic growth potential.
Firm value	The market value or worth of a firm. Tobin's Q is used to measure firm value.
Hedging	A risk management strategy whereby a position in the financial markets is taken to offset or limit the probability of losses.
Speculating	The trading of financial instruments, usually involving a high level of risk, in the expectation of significant returns.
Tobin's Q	A ratio devised by James Tobin. The ratio is calculated dividing the market value of a company by the replacement value of the firm's assets.

CHAPTER 1:
INTRODUCTION

1.1 BACKGROUND

Every year, the risks faced by business entities become more complex. Hence, firms increasingly resort to sophisticated risk mitigating strategies, including the use of financial instruments such as derivatives, to protect themselves against unforeseen adverse circumstances. The international derivatives market has grown enormously in the last couple of decades, spurred by globalisation, technological advancements and developments in financial theory (Allayannis, Lel & Miller, 2012). This growth has sparked intensive scrutiny of firms' use of derivatives and the effects derivatives use has on the stability of global financial markets. Interest in this topic was fuelled in particular by the role played by the use of derivatives by various entities, especially financial firms, in the 2008/2009 financial crisis.

In the last decade, the focus of research on corporate hedging practices and derivatives use has shifted from developed markets to emerging market economies. South Africa, as an emerging market economy, was already included in a survey by Lien and Zhang (2008) on the use of derivatives in emerging markets. The study reported that at that point, South Africa, Hong Kong and Singapore had the most liquid over-the-counter (OTC) currency derivatives markets in the world. According to Correia, Holman and Jahreskog (2012), derivatives use by South African firms compared favourably with the level of derivatives use in developed economies. South Africa also accounts for the highest use of derivatives by non-financial firms on the African continent – 82% of all firms in Africa that use derivatives are located in South Africa (Holman, Correira, Pitt & Majoni, 2013). Holman *et al.* (2013) found that 54% of non-financial firms in South Africa use derivatives mainly to hedge currency risks with OTC forwards and swaps to hedge interest rate risk.

Despite the recent increase in research on derivatives use in developing countries, thus far, research on South African firms' use of derivatives has not yet produced conclusive evidence on the extent to which firms use derivatives, what determines firms' use of derivatives, or the impact of using derivatives on a firm's value. Studies drawing on South African data have often looked only at selected types of derivatives or specific risk exposures. The research on the derivatives markets in South Africa is thus limited. Hence, the current study attempts to address those limitations and extend the information available.

A study by Toerien and Lambrechts (2016) found that the use of derivatives had no significant impact on firm value where return on equity (ROE), return on assets (ROA), Tobin's Quotient (Tobin's Q), and economic value added (EVA) were used as measures of firm value. They reported that the use of derivatives did have an impact on the market value of a firm's shares, as well as the market value added (MVA).

The research reported in this thesis expands on the previous study by Toerien and Lambrechts (2016). Firstly, a bigger sample of firms and more years are included in the dataset. Secondly, the current study divides the sample years (2005 to 2017) into three different periods to determine the impact of the 2008/2009 financial crisis on the use of derivatives by companies, thus examining a pre-crisis period, a during-the-crisis period and a post-crisis period. Lastly, the study investigates the influence that the quality of disclosure has on the value relevance of derivatives disclosures.

The introduction of the *Statement of Financial Accounting Standards (SFAS) No. 133, Accounting for Derivative Instruments and Hedging Activities* by the Financial Accounting Standards Board (FASB) in the Unites States in 1998, as well as the introduction of *International Accounting Standard 39 (IAS 39)* in 1998 made information on companies' use of derivatives more accessible (Bartram, Brown & Fehle, 2009; Zhang, 2009). It has therefore become easier to analyse companies' financial statements to determine the extent to which derivatives are used. Dunne, Helliar, Power, Mallin, Ow-Yong and Moir (2003) argue that such accounting standards promote proper capturing of exposures, and ensure that hedging policies are aligned with corporate goals. The change in disclosure requirements in terms of *SFAS 133* provides incremental information, and the notional principal amounts are value relevant, suggesting that information can be gained from the expanded requirements by the accounting standards regarding the disclosure of derivatives (Wang, Alam & Makar, 2005).

Much prior research on corporate hedging has focused on identifying the determinants of hedging practices. Various factors have been identified as motives for a corporate hedging strategy, such as company size, company convex tax functions, and company growth options (Nance, Smith & Smithson, 1993), a reduction in earnings volatility (Culp, 2002; Fok, Carroll & Chiou, 1997; Géczy, Minton & Schrand, 1997), tax incentives (Graham & Rogers, 2002), the expected cost of financial distress (Judge, 2002), as well as the existence of market imperfections (Graham & Rogers, 2002). Firm size and leverage were reported to be explanatory variables for Australian firms (Berkman, Bradbury, Hancock & Innes, 2002). Brunzell, Hansson and Liljeblom (2011) argue that the determinants of the use of derivatives are archetypally influenced by motives such as hedging, agency costs or managerial compensation plans. However, they maintain that there is a need to distinguish between firms that use derivatives in order to hedge and those that use derivatives in order to increase profit, because erroneous conclusions may be drawn if they are not separated.

In recent years, the focus of research on corporate hedging has shifted away from exploring the motives that explain firms' decisions to use derivatives, towards the impact of corporate hedging strategies using derivatives on firm value. Various studies have found contradictory evidence on the value relevance of using derivatives. Studies in different parts of the world have also produced conflicting results with regard to the effectiveness of these hedging strategies.

Vivel-Búa, Otero-González, Fernández-López and Durán-Santomil (2013) found a value premium for firms in Spain, while Bielmeier and Hansson Nansing (2013) reported that using derivatives did not add to firm value for German companies. Jankensgård (2015) found that for Swedish firms, derivatives added value to firms that adopted a centralized approach to foreign exchange exposure, while decentralized firms gained no value premium from using derivatives. Studies by Belghitar, Clark and Mefteh (2013) and Ben Khediri and Folus (2010) showed that French firms that used derivatives had a lower firm value than firms that did not.

In the South African context, a study by Walker, Kruger, Migiro and Sulaiman (2014) compared the impact of hedging derivatives on company value in South African companies to that impact on company value in United States (US) companies. Walker *et al.* (2014) considered a sample of 117 non-financial firms for a four-year period between 2006 and 2009 and found no significant value premium for users of derivatives. They argue that their small sample size possibly influenced the outcome of the study, and therefore the current study uses a sample of 200 firms and 13 years to assess the impact of hedging with derivatives on company value.

The current study of the use of derivatives in an emerging market economy such as South Africa can provide valuable insight into what drives the underlying mechanisms of derivatives markets. Derivatives markets in developed economies differ from those in emerging market economies not just in size and value, but also in the different characteristics of these markets, such as legal and other statutory requirements. The current study attempts to provide a basis of comparison for studies comparing developed economies and emerging market economies that can be used to understand the causes of using derivatives better, and what effects using derivatives might have on firm value.

The evidence available thus far on using derivatives as part of a corporate hedging strategy also does not provide definitive answers on the value relevance of such a strategy (Yartey, 2008). The current study thus attempts to offer insight into this problem. The JSE, as the largest stock exchange in Africa, and, since 2020, the 19th biggest in the world, and the 14th largest derivatives market, can offer unique insights into the determinants of using derivatives for corporate hedging, as well as the value relevance of using derivatives (Yartey, 2008).

The derivatives market can also play a vital role in the development of companies in South Africa by managing risk, and promoting cash inflows. The biggest advantage that a developed derivatives market holds is that it gives companies an opportunity to insure themselves against volatile cash flows (Adelegan, 2009).

The contribution of the current study is to promote a better understanding of how derivatives markets work in the South African context. More specifically, the contribution of this study is to elucidate what determines the derivatives disclosure of firms listed on the JSE. Moreover, the study attempts to determine the value relevance of using derivative instruments for firm value. This study also provides insight on how using derivatives during different economic periods, and the quality of derivatives disclosure, affect firm value. A key contribution of the study is that it provides information to shareholders, investors and other stakeholders on the derivatives use behaviour of companies. This topic has thus far received limited attention in research in South Africa; so this study can provide insight into what motivates the use of derivatives by companies and into the effect that such strategies have on firm value, and into whether using derivatives is beneficial to companies.

The literature review focuses on prior studies in respect of the extent of the use of derivatives in other parts of the world and in South Africa. Secondly, it looks at the determinants of using derivatives as part of a hedging strategy. Thirdly, it explores the impact of accounting standards on the disclosure of using derivatives and the effects of the quality of such disclosure. Lastly, the effect of corporate hedging with derivatives on the value of a firm is examined.

1.2 PROBLEM STATEMENT

The term ‘value relevance’ refers to the usefulness of figures and values disclosed in the financial statements of an entity to explain and predict firm value (Barth, Beaver & Landsman, 2001). Barth *et al.* (2001) have shown that studies on value relevance are not important only for accounting standard setting, but also for non-academic parties to assess whether particular accounting amounts reflect information that can be used by investors to value a company’s equity.

Investors value derivative financial instruments differently if derivatives are recognized, rather than only disclosed (Ahmed, Kilic & Lobo, 2006). Prior to *SFAS 133*, companies only needed to disclose derivatives. However, Ahmed *et al.* (2006) found that the increased recognition criteria and expanded accounting practices since the introduction of *SFAS 133* have had a significant impact on investors’ valuation of derivative financial instruments, indicating that recognition and disclosure are not substitutes for each other and also that *SFAS 133* has increased the transparency of the use of derivatives.

The current study investigates the top 200 non-financial firms listed on the JSE to establish the firm characteristics that determine the use of derivatives by these firms. There is not yet any consensus on what exactly drives companies’ decision to use derivative instruments, so this study contributes to the debate by examining whether factors such as the risk of bankruptcy and financial distress costs, the cost of the risk of underinvestment, managerial risk aversion, tax incentives to minimize expected tax liability and other operating characteristics, such as a firm's size, influence a company's decision to use derivative instruments.

Once the firm characteristics that determine derivatives disclosure are established, the study explores the impact that using derivatives has on firm value. The determinants of derivatives disclosure, as well as other known factors that drive firm value, are then used in multiple regression analyses. The current study attempts to determine the value relevance for firm value of the disclosure of derivative instruments in the financial statements of the top 200 non-financial firms listed on the JSE for the period 2005 to 2017.

Though various researchers such as Essers (2013), Griffith-Jones and Ocampo (2009) and Naudé (2009) have sought to assess the impact of the 2008/2009 financial crisis on emerging market economies, few have studied in detail how hedging practices differ during different economic periods. In particular, few previous studies have examined in detail the effects of disclosure during different economic periods have on the value relevance of such disclosures.

South Africa, as an emerging market economy is especially sensitive to shocks in global financial markets. The current study focuses on data collected from South Africa and to enhance understanding of how derivatives can be used as risk management tools to mitigate the effects of international financial problems, it is important to understand first exactly how emerging markets are affected by such international crises. Hence, the study investigates in more detail the effect of global financial shocks on firms' hedging practices by examining in more detail South African corporate hedging during different economic periods. Furthermore, few studies have specifically examined the effects of global financial crises on the value relevance of derivatives disclosures. The current study makes use of a novel statistical approach by comparing the value relevance of derivatives disclosures during various economic periods

To examine in more detail the effects of the 2008/2009 financial crisis, the dataset is divided into three subsets to enable a comparative analysis between different economic periods. The first dataset, referred to as the 'pre-crisis' dataset, includes information for the period from 2005 to 2009. The second dataset, referred to as the 'during-the-crisis' dataset, includes information for the period from 2008 to 2009. The third dataset, referred to as the 'post-crisis' dataset, includes information for the period from 2010 to 2017. By using three data subsets from three different periods, the study is able to compare derivatives use by the companies in the dataset during different economic climates. A second subset of data periods was created in addition to the three data sub-sets. This data period subset split the sample years into a 'before-shock' and 'after-shock' period to more closely examine the effects of a particular shock, in this instance, the 2008/2009 financial crisis, on the value relevance of derivatives. Furthermore, the study can draw conclusions as to whether different economic climates may have influenced the firms' motives to use of derivatives for these companies, and what the impact of different economic climates was on the value-creating abilities of derivatives for firm value during these periods. The methodology is discussed in detail in Chapter 5.

To date, research on the reasons that companies use derivatives have focused on firms in developed markets, notably on firms located in the United States of America (USA), the United Kingdom (UK) and the European Union. More recent research from emerging market economies often offer contradictory evidence. Although the effect that hedging with derivatives has on firm value has received significant attention in recent years, contemporary research has not yet reached consensus as to whether hedging with derivatives is a value-adding strategy for firms or not.

The current study attempts to expand on these concepts and delves into the reasoning behind companies' hedging and whether hedging strategies, specifically hedging with derivatives, do in fact add to firm value.

1.3 PURPOSE STATEMENT

The purpose of the study is to examine in more detail the corporate hedging practices of South African listed firms. Firstly, the study examines whether the top 200 non-financial firms (based on market capitalisation) JSE-listed firms use derivatives according to the rationales for corporate hedging proposed by finance literature. Secondly, the study compares the use of derivatives to firm value, in order to determine whether using derivatives has an impact on firm value. The study goes further to determine whether a specific shock to global financial systems – in the period under review, the 2008/2009 financial crisis – has an effect on the value relevance of derivatives disclosures. Finally, the study investigates the influences the quality of disclosure on the value relevance of derivatives disclosure.

The investigation of corporate hedging motives and practices is important for a number of reasons. The rationales for corporate hedging might differ between emerging market economies and developed countries. As such, a closer investigation from an emerging market perspective could provide better insight as to why companies make use of derivatives. In addition, investigating the value relevance of derivatives disclosures can provide an answer to the question whether the use of derivatives by companies is a value-adding strategy for them. If derivatives disclosures are value relevant, the implication is that companies are valued by the efficacy of their risk management programs. Hence it becomes increasingly important to understand the effects of financial crises on such risk management practices during different economic periods and the disclosure of their risk management practices in the financial statements. Finally, the quality of such disclosure becomes important for stakeholders to correctly assess the exposure of companies risk management practices.

1.4 RESEARCH AIM AND OBJECTIVES

The study explores the value relevance of derivatives disclosure. The value relevance models were expanded upon to examine the value relevance of derivatives disclosure in different economic periods and with varying quality of disclosure. In addition, the study attempts to establish whether firms listed on the JSE use derivatives according to the rationales for corporate hedging identified in the finance literature.

The research objectives of the study can be summarised as follows:

- to examine whether the decision by JSE-listed companies to use derivatives follows the same rationale(s) for corporate hedging as suggested by the finance literature;
- to determine the value relevance of using derivatives for the firm values for the firms listed in the dataset;

- to compare the value relevance in periods when there were different economic cycles; and
- to establish the quality of derivatives disclosure and its impact on the value relevance of derivatives' disclosure for JSE-listed companies.

1.5 IMPORTANCE AND CONTRIBUTIONS OF THE STUDY

The study attempts to identify the firm characteristics that distinguish derivatives users on the JSE. It is important to gain a better understanding of the extent to which derivatives are used on the stock exchange, as well as to understand what distinguishes the type of companies that tend to employ derivative instruments. The study will provide investors, regulators and other interested parties with a better understanding of what type of JSE-listed companies use derivatives. It will provide better insight into how risks are mitigated and controlled by entities and the impact that such risk management strategies have on the value of a firm.

The study provides evidence on the value relevance of the disclosure of derivatives in the financial statements of entities listed on the JSE. This can provide both researchers and decision-makers with valuable insights, not only into the decision of entities to use derivatives, but also into the effectiveness of this strategy.

The current study adds to this body of knowledge to provide more insight into the use of derivatives by firms on the JSE, as of 2020 the world's 19th largest stock exchange (JSE, n.d.). Furthermore, the derivatives market on the JSE is characterised by relative big firms with access to economies of scale. The functioning of the derivatives market in South Africa can therefore provide valuable insight into the motivations for listed companies to use derivatives. The study can also enhance understanding of the field of corporate risk management, and the theory of corporate risk management.

The related prior research has focused on the economies of developed countries. Very limited research has been conducted on emerging markets and OTC markets in the past, and few cross-country comparative studies have been done. The current study thus adds to the current debate by investigating the use of derivatives from an emerging market perspective. An exploration of the use of derivatives by companies listed on the JSE in South Africa can offer a unique insight, because the JSE is a well-developed financial market, although South Africa is still ranked as an emerging market economy. The study complements the existing literature by adding the perspective of a developing country and relates the use of derivatives in a developing country to a global perspective.

The study also has various theoretical, empirical and methodological contributions. By investigating the determinants of corporate hedging from an emerging markets perspective, the study contributes to the discussion whether traditional rationales for corporate hedging are sufficient to explain derivatives use in diverse contexts. The study also contributes to the better understanding of the effect that different time periods and quality of disclosure have on the value relevance of derivatives disclosures. The study uses novel data analyses techniques of dividing the dataset into various sub-samples to investigate the effects of the 2008/2009 financial crisis on derivatives disclosure. The study also includes an innovative approach to measure the quality of disclosure, by including a quality of disclosure index. Finally, the study makes use of both a binary and continuous measure of derivatives disclosure in the regression analyses. By making use of two interpretations of the derivatives variable, the study is able to assess two things: if companies are valued differently whether or not they make use of derivatives, and the whether companies are valued differently depending on the extent of their risk management practices.

1.6 DELIMITATIONS AND ASSUMPTIONS

Certain delimitations and assumptions guide this study. The study focuses on 200 non-financial companies listed on the JSE for the period 2005 to 2017. It assumes that all companies listed on the JSE disclose their financial information, including, but not limited to, financial derivatives instruments, in the published financial statements of the entity.

A database of listed companies was created for empirical analysis. The database was limited to companies listed on the JSE that have published financial statements available in the public domain. The database included published financial information from 2005 to 2017.

The values of the derivatives examined in the analyses are captured from Thomson Reuters Datastream and IRESS. The different types of derivative instruments included forwards, futures, options and swaps, and they could be based on commodities, exchange rates, interest rates, bond, shares and indexes.

The study began by identifying the firm characteristics that determined the use of derivatives by firms listed on the JSE. The study assumed that all firms included in the database would disclose the relevant information about derivatives in their financial statements. These derivatives values included exchange rate derivatives, interest rate derivatives and commodity derivatives, as well as other types of derivative instruments that a company chooses to employ. The study assumed that the type of derivatives used by a firm could be classified into one of the aforementioned derivatives classes, and that if a company used derivatives, that strategy would be recognized or disclosed in the financial statements. The study assumed that no derivatives were used by a company without being recognized or disclosed in the financial statements or the accompanying notes.

Only non-financial firms listed by sector on the JSE were included in the database. Financial firms such as banks and investment corporations use derivatives as part of their daily operations. Such firms have an added incentive to use derivatives for purely speculative purposes in an attempt to increase profits of specific trades, and are not typical of companies in general.

The study drew on information made available in the Thompson Reuters Datastream and IRESS databases, which are data repositories of financial information. The study assumed that the data collected from these sources were accurate and of high quality. The researcher also assumed that the information available from these data sources would be sufficient to draw conclusions from in this study. Information was sourced from companies' financial statements. The researcher assumed that information obtained from the financial statements were a just and fair representation of the financial situation of an entity.

The study assumed that all companies included in the dataset subscribed to the appropriate accounting standards and that the values and figures derived from the accounting standards therefore included all the relevant information pertaining to the disclosed amount. The study assumed the integrity of the financial statements, as well as the integrity of the auditing process.

It was assumed in the study that market participants are rational and therefore prefer lower risk investments, given the same level of return, or prefer to receive higher returns given the same level of risk.

1.7 OUTLINE OF THE STUDY

The use of derivatives instruments by companies has received a lot attention in recent years. Although some research has focused on the determinants of using derivatives of corporate hedging and the value relevance of such use, there is not yet consensus as to why companies use derivatives and whether doing so adds value. This is the lacuna in the literature that this study attempt to fill.

The study is structured as set out below.

Chapter 1 has provided the background to the study, the problem statement, purpose, research objectives, a consideration of the intended contribution of the study, as well as outlined its delimitations, assumptions and outline.

Chapters 2, 3 and 4 discuss the financial literature on derivatives, the accounting standards, the determinants of derivatives use, as well as the value relevance of derivatives disclosures in detail. The financial literature reviewed also includes studies on the role that derivative instruments played in the 2008/2009 financial crisis and the growing importance of quality of disclosure in value relevance research.

Chapter 5 sets out the research methodology used in the study.

Chapters 6 to 8 present and discuss the empirical results.

The final chapter, Chapter 9, summarises the conclusions, linking the findings and recommendations. It revisits the limitations of the study and makes recommendations for future research before presenting the concluding remarks.

CHAPTER 2:
DEFINING DERIVATIVES, THEIR CHARACTERISTICS AND DISCLOSURE

2.1 INTRODUCTION

This chapter defines derivatives and discusses their characteristics, how derivatives are used by companies, as well as the firm characteristics that determine companies' use of derivatives. The disclosure of the use of derivatives by companies is also examined, considering the regulation and quality of such disclosure.

The literature review opens the first part of the study (Chapters 2, 3 and 4), which investigates the literature on the history of derivatives instruments and their disclosure in the financial statements of entities, the determinants of corporate hedging practices, and the corporate use of derivatives instruments, focusing on JSE-listed firms before the thesis moves on to the empirical part of the study (Chapters 5, 6, 7 and 8), which analyses the value relevance of derivatives disclosures.

Chapter 2 provides a brief history of financial derivatives instruments and the different derivatives instruments offered on the JSE. This chapter also discusses the different disclosure requirements that companies have to adhere to in order to disclose derivatives instruments in their financial statements. This chapter concludes by discussing the role that the quality of such disclosure plays in finance research and specifically its importance in value relevance research.

The history of derivatives markets is traced below, considering ancient and modern times, and the South African market. This provides a context for understanding the purpose and mechanism of derivatives trading on the JSE, as the focus of this study. This broader historical overview is followed by details of the derivatives products available via the South African Futures Exchange (SAFEX) in Section 2.3. Then, accounting disclosure standards are presented in Section 2.4, and the quality of disclosure is discussed in Section 2.5.

Companies such as those listed on the JSE are required to disclose information on their use of derivatives in their financial statements. Such disclosure is often a requirement for being listed on a stock exchange. Earlier researchers, such as Nance *et al.* (1993) and Smith and Stulz (1985), had to rely on survey data, but more recent researchers have been able to use the financial statements of companies available of reliable databases to assess companies' derivatives positions. However, accounting standards constantly change as new updates are made to disclosure requirements. The quality with which information is disclosed can also vary between individual companies. This chapter provides a summary of the various accounting standards that prescribe the disclosure of derivatives in the financial statements of entities and demonstrates the importance of quality of disclosure for finance and value relevance research.

2.2 A BRIEF HISTORY OF DERIVATIVES AND DERIVATIVES MARKETS

Instruments with characteristics similar to those of modern-day derivatives have been in evidence for millennia. As far back as ancient Mesopotamia and ancient Rome, contracts were created to facilitate trading and enhance food security. Today's financial markets can trace their roots to the Chicago Board of Trade (CBOT), the world's oldest organised futures market that still operates today. The history of derivatives markets is traced below from ancient times to modern developments, and then the focus hones in on the South African market.

2.2.1 Derivatives markets from ancient times to the mid-1800s

Evidence of the use of derivatives goes as far back as the Mesopotamia civilization. Around 1750 BC, the sixth king of Babylon instituted the Hammurabi code, which facilitated the application of derivatives by allowing goods and services to be purchased and sold at an agreed-upon price at a date in the future (Kummer & Pauletto, 2012).

In ancient Greece, derivative-type instruments are recorded in the writings of Aristotle, around 330 BC. He writes about a man called Thales, who was certain that he would have an excellent olive crop, and who deposited money for the exclusive use of olive presses once the olives had been harvested and if the harvest was plentiful (Kummer & Pauletto, 2012). This is an early example of an option contract.

Various European cities and countries claim the distinction of having the world's first organized stock exchange and derivatives market. Several Italian city states, such as Venice, developed debt instruments and bonds to trade with (Kummer & Pauletto, 2012). However, it was the Dutch, and in particular the incorporation of the Dutch East-India Company (the Vereenigde Oost-Indiesche Compagnie or VOC) in the early 1600s, that formalized the trading of shares and bonds on a formal exchange in Amsterdam (Kummer & Pauletto, 2012). The London stock exchange followed soon after, starting from humble origins, when trading was conducted in coffee houses (Kummer & Pauletto, 2012).

In Asia, the Dojima rice exchange was founded in the late 1600s to formalize the trade of rice brokers and moneychangers in Japan (Kummer & Pauletto, 2012).

2.2.2 Modern developments

Modern derivatives markets can be said to have started in 1848 in the American city of Chicago, which is located close to the agricultural heartland of the US in the Midwest, and is a transport hub with access to the Great Lakes. This meant that Chicago was ideally situated for the development of commodity markets (Kummer & Pauletto, 2012). However, price fluctuations and price uncertainty led both buyers and sellers of commodities to develop forward contracts to hedge against counter-party risk. The CBOT brought together these buyers and sellers to facilitate trading between the different parties. The CBOT later developed futures contracts, which are standardized forward contracts, to make it easier for anybody to participate in trading on the exchange. It later merged with the Chicago Mercantile Exchange and is today the largest futures exchange in the world.

Derivatives markets have grown substantially over the last few decades and this growth has not been limited to developed economies (Mihaljek & Packer, 2010). Trading volume first peaked before the global financial crisis of 2008/2009, marked by increases in trading volumes for all groups of derivatives products. The collapse of Lehman Brothers in 2008 and the ensuing global tsunami of financial problems resulted in a contraction of exchanges in general, and OTC markets in particular. Since then, however, derivatives trading activity has rebounded spectacularly, and today not only advanced economies but also emerging market economies contribute to the growth in the global derivatives exchange and OTC markets.

2.2.3 The South African derivatives market

The Johannesburg Stock Exchange (JSE) was founded in 1887, when gold was discovered on the Witwatersrand in South Africa. The purpose of the exchange was to facilitate trade and financing arrangements between mining companies and financial companies. Today, the JSE is the largest stock exchange in Africa and the 19th largest in the world, with a market capitalization just under $1 trillion (JSE, n.d.).

In 1990, SAFEX was founded as a futures exchange subsidiary of the JSE. It consists of two divisions: the financial markets division for trading equity derivatives, and the agricultural markets division for trading agricultural derivative instruments.

The South African derivatives exchange initially started as an initiative by Rand Merchant Bank to enhance liquidity in local financial markets and to hedge against volatile capital flows. Rand Merchant Bank thus originally acted as the exchange, clearing house and market-maker for the futures market. In early 1990, SAFEX and the SAFEX Clearing Company (SAFCOM) took over the management of the derivatives exchange from Rand Merchant Bank. The derivatives exchange was officially opened on 10 August 1990, and the JSE acquired SAFEX in 2001 to became its sole owner (Adelegan, 2009; Bekale, Botha & Vermeulen, 2015).

A division for agricultural commodity futures to trade agricultural products such as maize, sunflower seeds and wheat was added to SAFEX in 1995. The agricultural futures division has now grown to the point that the cash market relies on it for price discovery and transparency, and the prices generated on the agricultural derivatives market serve as a benchmark and reference point for markets throughout southern Africa Adelegan, 2009; Bekale *et al.,* (2015).

2.3 DERIVATIVES PRODUCTS OFFERED BY SAFEX

SAFEX offers a variety of derivatives instruments that can be traded, based on different asset classes, including commodities, equities, fixed income and foreign exchange. The most important derivative instruments traded on SAFEX are discussed briefly below, listed by asset class. These are the derivative instruments that companies listed on the JSE can use, either as part of their risk management strategy for hedging and mitigating risk, or to speculate on price movements.

2.3.1 Commodity derivatives

SAFEX offers a variety of derivative contracts on underlying local commodities, including agricultural products, local grains and oilseeds. It also offers foreign-referenced contracts on commodities such as agricultural products, oil, precious metals and copper. Companies listed on the JSE are not very likely to use commodity derivatives as part of their risk management strategy, but some large companies in specific sectors such as mining and industrial manufacturing may choose to hedge the prices of some of the commodities they use, or import/export.

SAFEX's Agricultural Markets Division offers the following derivative contracts (JSE, n.d.):

- Grain futures and options:
  Investors can hedge or speculate on the price movement of several different types of agricultural produce and mining products. These derivative contracts are based on a number of underlying commodities, including white and yellow maize, wheat, soy beans and sorghum.
- Options on commodity futures:
  There are various options for contracts that enable farmers and millers to hedge against price movements.
- International commodity derivatives:
  Derivatives contracts on various international commodities such as corn (maize), soy, wheat and copper, oil, gold, platinum and silver can be traded on SAFEX.
- South African Volatility Index (SAVI) white maize:
  This is an index that allows various market participants to determine the volatility and sentiment relating to the local white maize market. It is merely an indicator and not a tradable contract.
- Quanto futures and options:
  These are cash-settled derivatives in which the underlying traded product is denominated in a foreign currency but is settled in a domestic currency at a fixed

exchange rate. These futures and option contracts reference energy products, metals and soft commodities.

2.3.2 Equity derivatives

Derivative contracts on company shares and other equity instruments are traded by various types of investors, including institutional investors and commercial banks. The following derivatives contracts are offered by SAFEX's Financial Derivatives Division (JSE, n.d.):

- Warrants:
  Warrants are normally classified as conventional securities rather than as derivative instruments, but warrants are in fact long-dated put or call options issued on an individual basket of listed companies' securities trading with a maturity longer than 10 years.
- Can-do futures and options:
  These products refer to derivative instruments or contracts that can be specifically tailored to individual clients' specifications.
- Exchange-traded contracts for difference (CFDs):
  A contract for difference is listed and traded on the exchange and an appointed clearinghouse of the JSE then clears the contract for difference. A contract for difference can be defined as an agreement to exchange the difference between the value of a specific asset at the beginning of the contract and the asset value at the end of the contract; unlike with single stock futures (SSFs), dividends are taken into account.
- Single stock futures (SSFs):
  Investors gain exposure to the price movements of the underlying shares.
- Dividend-neutral stock futures:
  Investors can gain exposure to the price movements of underlying shares, but the risk inherent in dividend assumptions and futures pricing is removed.
- Equity index futures:
  Market participants can gain exposure to the price movements of an underlying basket of equities, without having to trade the individual assets making up the index.
- South African Volatility Index (SAVI) Squared:
  Exposure is offered to investors through exposure to market volatility through

future variance that is realised daily. These are in essence forward contracts on realized annual variance. The holder of the contract agrees to buy or sell variance at a pre-determined strike price at a future date. On expiry, the holder receives the difference between the stock's realized variance and the specified variance strike price.

- Dividend futures:
  This is a contract that is sold alongside a future with the purpose of paying out the difference between the implied dividend and the actual dividend. An investor can also trade speculative dividend futures or dividend-neutral futures.
- International equity derivatives:
  Investors can gain exposure to the price movements of international blue chip shares through SSFs.
- MSCI South Africa Index: The MSCI South Africa Index measures the performance of large and mid-cap segments of the South African market. Investors can use futures or options to gain up to 85% exposure of the free float-adjusted market capitalisation in South Africa.
- Equity options: These give the investor the right, but not the obligation, to buy shares (a long option) or sell shares (a put option) at a fixed price at a future date. Equity options are available for most of South Africa's largest and most liquid companies, as well as for FTSE/JSE indices.

2.3.3 Interest rate derivatives

Debt plays a pivotal part in a company's capital structure and changes in interest rates can have severe consequences for a company's finances. The ability to protect themselves against adverse movements in interest rates is an important factor that motivates large companies listed on the JSE to use interest rate (credit) derivatives. The following interest rate derivative products are offered by SAFEX (JSE, n.d.):

- Bond futures:
  The contract holder has a contractual obligation to buy or sell a bond at a predetermined price on a specified date. The JSE offers bond futures with underlying government or corporate bonds.
- Options on bond futures:
  Unlike bond futures, bond options give the investor the right, but not the obligation, to buy or sell a bond future contract at a specified price.

- Johannesburg Interbank Agreed Rate (JIBAR) futures:

  The Johannesburg Interbank Agreed Rate is used as a barometer for short-term interest movements in the South African financial markets. It is an average rate calculated from borrowing and lending rates that are independently derived from quotes obtained from different banks for different periods. Johannesburg Interbank Agreed Rate futures are futures contracts that have the Johannesburg Interbank Agreed Rate as an underlying instrument.
- Bond Index futures:

  These futures give investors exposure to an underlying basket of government bonds listed on the JSE. Bond index futures are derivative contracts that track the JSE Bond Indices.

2.3.4 Currency derivatives

Currency derivative instruments allow investors to hedge against fluctuations in exchange rates. Many large, international companies face increasing exposure to volatility between different currency exchange rates. The JSE currency derivatives market started by offering currency futures on US$/Rand, GBP/Rand and EUR/Rand, but many other products are now available (JSE, n.d.):

- Currency futures:

  The underlying instrument for a currency future contract is the rate of exchange between one unit of foreign currency and the South African rand. Currency futures contracts give investors the right to buy or sell an underlying currency at a specified exchange rate.
- Currency options:

  These contracts are similar to currency futures; however, the investor has the right, but not the obligation, to buy or sell an underlying currency at a specified exchange rate. Investors are required to pay a premium for the choice of exercising the option or not.
- Maxi currency futures:

  This is a normal currency future that is abnormally large – US$100 000 per contract rather than the usual US$1 000. These contracts help meet market demand for larger contract sizes and help encourage larger trading contracts on the JSE.

- Currency Quanto futures and options:
  These are based on the world's most actively traded currency pair, namely the EUR/US$ exchange. They can be traded on the JSE.

The derivatives listed above represent the different types of derivative instruments that can be traded on the JSE. The derivatives market in South Africa has experienced enormous growth since its inception, and today, this market is considered to function well and efficiently. The number of contracts traded and the underlying asset classes that derivative contracts are based on have also increased in recent years. These improvements offer companies many different products, often tailor-made, to choose from, to help companies to facilitate, manage and individualize their hedging strategies.

2.4 DISCLOSURE OF DERIVATIVES: ACCOUNTING STANDARDS, THEIR INFLUENCE AND INTERPRETATION

Understanding how derivatives are disclosed in financial statements is important for a couple of reasons. Firstly, international and local accounting standards *require* companies to disclose information on the corporate use of derivatives. Without such disclosure requirements, investors, researchers and the general public have no way of knowing the extent to which companies use derivatives. Secondly, accounting standards change over years, and different countries have adopted different standards to disclose information on the use of derivatives. The manner in which derivatives are disclosed can therefore also have an impact on *investors' perceptions*.

The revision of accounting standards is an attempt to force companies to disclose more accurate information on how they use derivatives. Such disclosure requirements are often complex and difficult to understand, so users of financial statements must be careful when they interpret information provided in the statements.

Thus we can see companies have a large selection of derivatives instruments at their disposal, written on any number of risk exposures. Any use of these derivative instruments should be disclosed in the financial statements. Researchers concerned with the determinants of derivatives use, and the effects of companies' derivatives use on the value of these companies, can thus investigate and analyse companies' financial statements to evaluate their derivatives exposure. The sections below discuss the importance of accounting information (information contained in the financial accounts of firms) and the value derived from such information. Disclosure requirements do not remain stagnant, and therefore the sections below offer an overview of the disclosure requirements for derivatives through the years.

2.4.1 Importance and benefits of value relevance research

The value relevance literature describes accounting information as value relevant if there is a prescribed association between accounting numbers and equity market values. Hence, research on value relevance attempts to establish the usefulness of accounting information to predict firm value (Barth *et al.*, 2001).

A number of researchers have studied the value relevance of derivatives disclosure. For instance, Venkatachalam (1996) found that fair value disclosures for derivatives helped explain cross-sectional differences between banks' stock prices. He reported a positive coefficient for the disclosed fair values of off-balance sheet derivative financial instruments for banks. The notional amounts of disclosed derivative instruments also contained incremental information to the fair values, so this information can be used to assess banks' risk management strategies and whether the use of derivatives decreases or increases, or whether banks are valued differently by investors if they use financial derivative instruments.

Ahmed *et al.* (2006) argue that investors value financial derivative instruments differently, depending on whether the derivative instruments are disclosed or recognized. They found the valuation coefficients for recognised financial derivatives for banks to be significant, whereas derivatives instruments that were merely disclosed had no significant valuation coefficients. The findings of Ahmed *et al.* (2006) have two important implications. Firstly, recognition and disclosure of information, specifically pertaining to financial derivatives, are not substitutes for each other. Secondly, differences in how financial derivatives appear in the financial statements affect investors' perceptions. An increase in the transparency of accounting information can theoretically make such information more value relevant (Ahmed *et al.,* 2006).

The ability of users of accounting financial statements to derive useful information from the financial statements strongly determines the significance of value relevance studies. Wong (2000) argues that users of financial statements would be interested in information regarding derivatives contained in the financial statements, such as the notional amounts of both long and short positions, the disaggregated notional amount of information by class of instrument, time to maturity, leverage, and complexity of the instruments. Other information on non-derivatives related to underlying exposures, information on notional amounts and fair values by currency can also influence the value relevance from financial statements (Wong, 2000). Finally, information on the currency gains and losses of both derivatives and non-derivatives, information on value changes in the underlying currency and more frequent disclosures of fair value would be useful in helping the users of financial statements to assess firms' currency exposures (Wong, 2000).

It is important to note that value relevance research in itself is not used as a valuation process, but rather refers to the study of how accounting information is incorporated into the valuation process (Badenhorst, 2015; Barth *et al.*, 2001). Therefore, the primary focus of the current study is not price formation in capital markets, but rather whether using derivatives (and the recognition and disclosure of such a strategy) is value-relevant. In other words, the study assesses whether the recognition and disclosure of derivatives in a firm's financial statements provide incremental information in the valuation process to determine the firm's value.

Different factors can influence the price informativeness of accounting information, and the difference between recognition and disclosure of accounting information can have different effects on price informativeness (Barth, Clinch & Shibano, 2003). Price information has been found to be determined by a complex interaction of the recognized amount, disclosed information, the information revealed by prices and how they interact with expertise acquisition (Barth, *et al.*, 2003). In other words, the usefulness of information from accounting statements depends not only on the amounts that are recognised, but also on the quality of such information. The implication of this for the current study is that a measure of the *quality* of disclosure should be included when assessing the effect of derivatives disclosures on firm value.

Value relevance research is important for several reasons. The main goal of financial reporting is to provide investors and users of financial statements with adequate information so that they are able to calculate company value. Value relevance studies investigate statistical relations between the market value of company shares and accounting information, to see whether this goal of financial reporting has been met.

Value relevance research has also played a role in facilitating discussion when new accounting standards have been introduced. For instance, value relevance studies investigating whether assets should be recognized at fair value or at historical cost can contribute to how standard setters develop and apply future standards, and can also help companies decide whether and how to implement new standards (Beisland, 2009). Value relevance studies on using derivatives can help standard setters to understand the adequacy and informativeness of current standards and disclosure requirements better.

The accounting standards dealing with derivatives are notoriously difficult and therefore value relevance research can contribute to the better understanding of the problems companies face in recognizing and disclosing derivatives. Furthermore, research of this type can also benefit analysts, investors and other users of financial statements who have to rely on information in the financial statements to make informed decisions. The type of value relevance research in the current study, on the use of derivatives, can benefit users of financial statements by demonstrating how much value users of financial statements in fact place on the amounts disclosed in the financial statements.

2.4.2 Requirements of the Financial Accounting Standards Board (FASB) and International Accounting Standards Board (IASB)

The requirements governing the recognition and disclosure of companies’ use of derivatives have changed numerous times over the years. These changes were introduced to cope with increased use of these instruments, as well as the growing complexity of these instruments. Furthermore, situations such as the 2008/2009 financial crisis have led to a greater demand for transparency around the use of derivatives. Accounting standards attempt to address these concerns in the form of the various Statements of Financial Accounting Standards (SFAS) and the International Financial Reporting Standards (IFRS).

Various countries' recognition and disclosure requirements in respect of financial statements are determined by different accounting standards set by various accounting bodies. Some countries accept the SFAS requirements set by the FASB while other countries follow IFRS, set by the International Accounting Standards Board (IASB). Discrepancies and conflicts can arise when companies subscribe to different accounting rules. It is therefore important to understand which countries' companies subscribe to which accounting bodies' standards.

The changes in the accounting standards that prescribe the disclosure of derivative instruments in the financial statements has had the effect of making more information available on corporate hedging (Abhayawansa & Abeysekera, 2005). The introduction of the first requirement set by the FASB, namely *SFAS No. 119*: *Disclosure about Derivative Financial Instruments and Fair Value of Financial Instruments* in 1994 in the US (FASB, 1994), and of *International Accounting Standard (IAS) 32* (IASC, 1996) and *AC 125: Financial Instruments: Disclosure and Presentation* (IASC, 1998), and then later *IAS 39: Financial Instruments: Recognition and Measurement* (IASC, 1998) and *SFAS No. 133: Accounting for Derivative Instruments and Hedging Activities* (FASB, 2001), has made it possible to determine more accurately both the extent to which a company uses derivative instruments and its motivation for that use. It has also made it possible to analyse company financial statements to gain a better understanding of the firm characteristics that drive the decision to use derivatives.

The continuous revision and update of accounting standards is important. Prior to the introduction of *IAS 39* and *SFAS No. 133*, companies' use of derivatives was often relegated to the notes to the financial statements, if it was disclosed at all. The values recognized in the financial statements were also limited to historical cost. However, many financial derivatives do not have an initial cost, so that limiting their representation to the notes failed to reflect the extent of a company's real risk exposure. The introduction and maintenance of these accounting standards has increased the transparency with which derivatives use in companies is disclosed.

IAS 39 (*IFRS*), and *SFAS No. 133* (which is the American standard) stipulate standards for recognising and measuring financial assets, financial liabilities and contracts for non-financial instruments, including financial derivatives and derivatives embedded in non-derivative contracts. Accordingly, these instruments are recognised in the statement of financial position, at fair value. Any deviation from fair value, for example, marking-to-market, should be reflected in the statement of profit or loss and other comprehensive income (FASB, 2018; IASB, 2018).

The FASB regulates the accounting rules for the disclosure, measurement and regulation of derivatives in the United States. *SFAS No 133: Accounting for Derivative Instruments and Hedging Activities* requires an entity to recognize all derivative instruments in the financial statements, either as an asset or as a liability. Financial derivatives should be measured at fair value, and accounting for changes in fair value should be reflected in the earnings statement (statement of profit or loss). There are also special rules for hedging activities. These special rules stipulate that formal documentation must exist at the inception of a hedge indicating how the hedge will work and how its effectiveness will be calculated. Hedges that fail this effectiveness test, or that are not properly designated as a hedge at their inception must be marked to market regularly, and gains or losses from these instruments must be reflected immediately in an earnings statement (Dunne *et al.*, 2003).

The FASB has changed and amended the disclosure requirements regarding derivatives several times to account for various problems as they have arisen. These changes in derivatives accounting and disclosure practices include *SFAS No. 133: Accounting for Derivative Instruments and Hedging Activities* (FASB, 1998), and *SFAS No. 138: Accounting for Certain Derivative Instruments and Certain Hedging Activities* (FASB, 2000).

The standard requires all derivatives to be valued at fair value and recognized either as an asset or a liability in the statement of financial position. A company can decide, under this statement, whether to apply hedge accounting (if a hedge is classified as effective, it can minimize volatility in the statement of profit or loss). The standard was an update of several existing accounting standards, including *SFAS No. 52: Foreign Currency Translation* (FASB, 1981), *SFAS No. 80: Accounting for Futures Contracts* (FASB, 1984), and *SFAS No. 119: Disclosure about Derivative Financial Instruments* *and Fair Value of Financial Instruments* (FASB, 1994). *SFAS No. 133* combined these standards into one integrated standard and became effective from 2000. *SFAS No. 133* has in turn been amended several times. *SFAS No. 138*, effective June 2000, revised numerous aspects of *SFAS No. 133*. As indicated above, *SFAS No. 133* replaced *SFAS No. 52*, which stated that gains or losses made on a hedged foreign currency denominated underlying instrument should be reported in earnings. *SFAS No. 133* then required that the gains or losses be disclosed as other comprehensive income (OCI). However, *SFAS No. 133* states that an amount equal to the gain or loss must be deducted from other comprehensive income and included as part of income to lessen the exposure of income as a result of the hedge.

SFAS No. 149: Amendment of Statement 133 on Derivative Instruments and Hedging Activities (FASB, 2003, effective June 2003) amended and clarified the accounting and reporting for derivative instruments specified by *SFAS No. 133*. This standard aims to standardize the reporting of derivative contracts either as derivatives or as hybrid instruments, and requires derivative contracts with comparable characteristics to be accounted for in a similar manner. *SFAS No. 155: Accounting for Certain Hybrid Financial Instruments* (an amendment of *SFAS No. 133* and *SFAS No. 140*) (FASB, 2006) introduced in September 2006 removed the exemption of applying *SFAS No. 133* to interest in securitized financial assets, the purpose of this standard is to have similar instruments reported in the same way, regardless of the form of the instrument. *SFAS 155* also adjusted the time at which an entity is allowed to determine the fair value of an instrument, so that the entity can choose fair value at acquisition, at issuance or as a re-measurement. Lastly, *SFAS No. 161: Disclosures about Derivatives Instruments and Hedging Activities* (FASB, 2008) also amended and expanded the disclosure requirements of *SFAS No. 133*. This standard requires entities to disclose qualitative information about their objectives in and strategies for using derivative instruments. They must also disclose additional quantitative information about fair value amounts and gains and losses to provide investors with additional information on the purpose for which a firm uses derivatives, as well as how the firm accounts for and discloses these instruments (Chang, Donohoe & Sougiannis, 2016).

A change in disclosure requirements can have several unanticipated consequences. For instance, a change in accounting method was found to have an effect on the behaviour of management (Hughen, 2010). Changes in disclosure requirements allowed firms the option to restate previously issued financial statements, because of the improper use of hedge accounting. Managers of firms are more likely to focus on accounting earnings rather than economic earnings, given firms' historical abilities to meet earnings targets. However, an entity's ability to meet earnings forecasts and to beat analysts' predictions was found to be negatively correlated with the likelihood of continuing an economic hedge after changes in the accounting treatment of hedge accounting (Hughen, 2010).

Changes to the mandatory disclosure of derivatives can also influence other factors. Chiorean (2016) found that after the introduction of *SFAS 161* the extent to which firms used derivatives decreased significantly, and the use of derivatives for speculation also decreased significantly. Chiorean's (2016) research confirmed the findings reported by Hughen (2010) that a change in disclosure requirements has an effect on firms' risk management strategies. Furthermore, after the introduction of *SFAS 161*, companies were found to use hedge accounting less, and rather to use non-designated derivatives (Chiorean, 2016). The introduction of the standard did provide information on the economic use of a derivative (whether it was used to hedge or to speculate), but it was found that the companies provided less information than prior to the introduction of the standard (Chiorean, 2016). Research thus suggests that analysts and investors already struggle to interpret information in derivatives disclosures (Campbell, 2013; Chang *et al.*, 2016; Koonce, Lipe & McAnally, 2008) and that changes in these disclosures led to changes in the how firms used these instruments.

How derivatives are treated in the financial statements has an impact on how investors and other users of financial statements interpret and value derivative financial instruments. Ahmed *et al.* (2006) investigated mandatory recognition of derivatives instruments at fair value after *SFAS No. 133*, compared to the disclosure of derivatives prior to *SFAS No. 133* in the notes to the financial statements. The study compared the recognized amounts to the disclosed amounts for a sample of banks that used of both. Recognized derivative instruments were found to have a positive value coefficient significantly higher than zero, while derivative instruments that were only disclosed had value coefficients that were not significantly higher than zero (Ahmed *et al.,* 2006). Value coefficients were also significantly higher than zero for derivative instruments that were recognized after the introduction of *SFAS No. 133*, while disclosed derivative instruments prior to the introduction of *SFAS No. 133* were found not to have value coefficients significantly different from zero (Ahmed *et al.,* 2006). Investors (and other users of financial statements) do not value recognized instruments the same way as disclosed instruments, and the users of financial instruments do not pay the same amount of attention to disclosed amounts as to recognized amounts. Furthermore, the introduction of *SFAS No. 133* and *IFRS 7* and *IAS 39* has influenced the transparency of derivative financial instruments and how investors value these derivative instruments (Ahmed *et al.*, 2006).

Siregar, Anandarajan and Hasan (2013) studied whether the objectives of *SFAS No. 133* were met and whether the additional information disclosed under this accounting standard is value relevant. *SFAS No. 133* requires companies to recognize the fair value of derivative instruments on the face of the statement of financial position and to report gains and losses from derivatives in the statement of profit or loss. This is a departure from previous standards, which allowed companies to disclose the information on derivatives only in the notes to the financial statements. Siregar *et al.* (2013) found the additional recognition of derivatives to be value relevant, but to have a negative effect. They ascribed their findings to the possibility that users of financial statements perceived derivative instruments to be risky. They also found the recognition of gains and losses of derivatives in the statement of profit or loss to be value relevant.

Wang *et al.* (2005) attempted to determine the value relevance of banks' derivatives disclosure two years after the introduction of *SFAS No.133*. Their study also included the years in which *SFAS No.119* (prior to the expanded fair value recognition criteria of *SFAS No.133*) guided derivatives disclosure. They found that the increase in disclosure requirements under *SFAS No.119* was economically significant and value relevant, and could provide incremental information beyond earnings and book value. A limitation that they noted was that they only included two years' worth of data under *SFAS No.133*, which could have reduced the statistical significance of the study. The current study therefore attempts to provide statistically significant answers on whether the disclosure of derivative instruments under *SFAS No.133* and *IAS 39* is value relevant – this study can include more years' worth of data in the database than the study by Wang *et al.* (2005), and can include the data covering the anomalous period of the 2008/2009 global financial crisis, which post-dates Wang *et al.*'s (2005) study.

2.4.3 International Financial Reporting Standards

Most research on the disclosure, recognition and measurement of derivatives and their impact focuses on US-based companies, which are regulated by the FASB. Hence, the accounting standards *SFAS No. 119* and *SFAS No. 133* set the requirements for the disclosure, recognition and measurement of derivatives. By contrast, South African companies subscribe to the IFRS, issued by the IASB. In countries subscribing to the IFRS, the disclosure and recognition of derivative instruments during the period under review were prescribed by *IAS 32*: *Presentation and description of financial instruments*, *IFRS 9: Financial instruments*, *IAS 39: Recognition and measurement* and *IFRS 7: Disclosure.* South Africa subscribes to the accounting standards set out by IFRS. *IAS 39* in its current form was reissued in December 2003 and came into effect 1 January 2005, although *IAS 39* is considered to be complex and full of exceptions and inconsistencies (Campbell, 2013; Chang *et al.*, 2016; Kawaller, 2004). *IFRS 9: Financial instruments* was introduced to replace all previous standards to address the shortcomings of *IAS 39* in particular, in the period following the period under review (IASB, 2018).

IFRS 9 had an effective date of 1 January 2018, since which all companies under that disclosure regime have to disclose derivative instruments according to *IFRS 9*. Companies are also required to disclose comparative figures, meaning that previous years' financial statements need to be adjusted according to *IFRS 9* (IASB, 2018).

The current study determined the value relevance of *IAS 39* by considering a sample of firms disclosing derivative instruments for the years 2005 to 2017. Future research can include years after 2018 to determine and compare the value relevance of disclosure under *IFRS 9* versus that under *IAS 39*.

2.4.4 Disclosure requirements

The disclosure requirements relating to derivatives are onerous and complex. Financial accounting standards compel companies to disclose derivative instruments at fair value, and any gains and losses from these instruments must be recognized immediately as part of earnings. On the other hand, if certain criteria are met, then derivatives can be disclosed as part of hedge accounting in the financial statements, and then a different accounting treatment applies. The recognition timing of these gains and losses of derivatives can be altered to decrease reported earnings volatility. Pierce (2015) found that using hedge accounting decreases earnings volatility, but that investors' perceptions of firm risk did not decrease significantly due to the decrease in earnings volatility as a result of hedge accounting. He did, however, find that using hedge accounting increased firm value. In other words, using derivatives, and specifically the disclosure of derivatives as hedge accounting, does add to firm value, but it does not have an effect on the perceived riskiness of firms. This finding also implies that investors do not differentiate between the perceived riskiness of derivatives that are disclosed and derivatives that receive hedge accounting treatment.

Several researchers have noted the complexity of derivatives disclosure requirements (Campbell, 2015; Chang *et al*., 2016; Kawaller, 2004; Ryan, 2012). Even expert analysts struggle to interpret derivatives activity, or the impact such activity has on earnings forecasts, correctly. Chang *et al.* (2016) showed that analysts' earnings forecasts of companies that are new derivatives users are less accurate and more dispersed after derivatives use has been initiated, and that despite their expertise analysts routinely misjudge the earnings implications of the companies' derivatives activities. The study by Chang *et al.* (2016) found specifically that the complexity of disclosure requirements and the financial reporting of derivatives is difficult for even expert analysts to interpret correctly. They claim that a series of derivatives standards have improved analysts' abilities to forecast earnings correctly. This strengthens the argument that changes to the accounting standards that prescribe derivatives disclosure are needed to reflect more accurately the purpose and use of these instruments by companies.

Cash flow hedges are specific derivative instruments that illustrate the complexity of the disclosure requirements. A cash flow hedge is used to hedge companies' exposure to volatility in expected future cash flows, arising from changes in the prices of the underlying commodities, interest rates and exchange rates. The fair values of these hedges are reported on specific dates in the financial statements, and any unrealized gains or losses are reported under the equity section of the company's statement of financial position. Firms can, however, reclassify these unrealized gains or losses into earnings when the hedge expires. There are concerns shared by analysts and the Securities Exchange Commission (SEC) and FASB that investors may not adequately price the information provided by the disclosure requirements of derivatives. Campbell (2015) investigated the information content of unrealized gains and losses from cash flow hedges for future profitability and stock returns. He reported that unrealized gains or losses were negatively associated with future gross profit, but this only happened after a firm reclassified its existing hedges into earnings. His findings suggest that unrealized gains and losses from cash flow hedges serve as a firm-specific summary measure that predicts cross-sectional differences in profitability in the future, and that investors do not price the implications of unrealized gains and losses immediately (Campbell, 2015).

SFAS 133 requires pairing the gains and losses with the gains and losses of the designated hedge item, rather than with overall market exposure. Companies can selectively decide on which exposures qualify for hedge accounting, and to what extent. Kawaller (2004) argues this is challenging for analysts when they have to interpret the disclosure of derivatives in the financial statements. Hedge accounting may not be applied to all the exposures; hence, the extent of exposure could be underrepresented in the financial statements. Furthermore, Kawaller (2004) posits that analysts should also take into account the quality of a company's predictions of future price movements when they evaluate a company. Analysts should therefore be aware of the shortcomings of the disclosure requirements, because financial statements do not necessarily provide full detail on the extent of exposure or the quality of a company's investment forecasts.

The question then arises whether companies should use derivatives? Koonce *et al.* (2008) found that investors reward firms that use derivatives, and especially firms that use derivatives to address firm risk. Furthermore, investors assign a higher value premium to firms that use derivatives. Koonce *et al.* (2008) ascribe this higher value premium to investors' valuing high levels of decision-making care. Furthermore, they argue that managers do not need to fear negative investor perceptions relating to using derivatives and can therefore use derivatives to improve firms' financial results.

2.4.5 Key differences between US GAAP, IFRS and the different accounting standards for derivatives

There are some key differences between the IFRS, which are used internationally in more than 100 countries, and US GAAP. At a conceptual level, the IFRS are considered to be a principles-based approach to accounting standards, whereas US GAAP is considered to be more rule-based. It has been argued that the IFRS, being more principle-based, are better able to capture the underlying economics of transactions than US GAAP can.

Rule-based accounting standards follow a prescribed list of rules that need to be followed in compiling financial statements. One advantage of a rule-based accounting system is that the threat of lawsuits is diminished, as accounting practitioners can be legally challenged if their judgments on financial statements are incorrect. Rule-based accounting also has a set of rules that can increase the accuracy of the financial statements. However, rule-based accounting standards can become overly complicated, with many exceptions to the prescribed rules.

The main advantage of principles-based accounting standards, such as IFRS, is therefore that the broad guidelines set out by the standards can be employed in a variety of circumstances, unlike US GAAP, in which the guidelines and rules cannot necessarily be used in every situation (Ernst & Young, 2011). The disadvantage is that the principles set out by IFRS are open to interpretation and manipulation and can lack reliability and comparability. IFRS requires much less detail than US GAAP and the financial statements prepared under IFRS are therefore significantly shorter (Ernst & Young, 2011).

There are some similarities between US GAAP and IFRS in terms of the requirements they prescribe for recognizing and disclosing derivatives (Ernst & Young, 2011). Both US GAAP and IFRS require financial instruments to be classified into specific categories to ascertain the measurement of those instruments, and to clarify when financial instruments should be recognized or de-recognized in the financial statements. Both US GAAP and IFRS also require that all derivatives be recognized in the statement of financial position, and that further details on those instruments reported in the statement of financial position be disclosed in the notes to the financial statements (Ernst & Young, 2011).

There are also some differences in how the different accounting standards account for recognizing and disclosing derivatives. Section 2.4.6 below explains the main differences of recognizing and disclosing derivatives between US GAAP and IFRS according to the definition of a derivative, hedging a risk component of a financial instrument and hedge effectiveness. According to US GAAP, an instrument is considered a derivative if it has one (or more) underlying asset(s), one (or more) notional amount(s), or payment provision(s), or both, requires no initial net investment as defined, and must be settled net, as defined. Certain scope exception exists for instruments that would otherwise meet these criteria (Ernst & Young, 2011). In terms of the definition requirements, IFRS differs from US GAAP in that the definition of a derivative does not include the requirement for a notional amount to be indicated, nor is net settlement required. Furthermore, some of the scope requirements are excluded by IFRS, or are different from those under US GAAP (Ernst & Young, 2011). These differences are explained in more detail in Section 2.4.6.

Regarding hedging a risk component, US GAAP does not allow for any additional flexibility, and only risk components that are specifically identified by the literature may be hedged (Ernst & Young, 2011). On the other hand, IFRS allows risks associated with only a portion of the instruments' cash flows, or fair values to be hedged, provided that the effectiveness of the hedge can be measured (in other words, the portion can be separately identified and reliably measured) (Ernst & Young, 2011).

In respect of hedge effectiveness, US GAAP allows for the 'short-cut method' for interest rate swaps hedging recognized debt instruments, whilst IFRS does not (Ernst & Young, 2011). Under IFRS, the assessment and measurement of hedge effectiveness considers only the change in fair value of the designated hedge portion of the cash flows of the instrument, but that portion must be separately identifiable and measured reliably. On the other hand, US GAAP requires that all contractual cash flows have to be considered in calculating the change in fair value of a hedged instrument, even if only a component of the contractual coupon payment is the designated hedged item (Ernst & Young, 2011). This is referred to as the long-haul method of assessing hedge effectiveness for a fair value hedge of the benchmark interest rate component of a fixed rate debt instrument.

Finally, US GAAP allows for the inclusion of options' time value in hedge effectiveness, whereas IFRS does not permit the time value to be included (Ernst & Young, 2011).

2.4.6 Differences between *IAS 39* and *IFRS 9*

As of 1 January 2018, companies subscribing to IFRS will no longer be permitted to recognize and disclose derivatives according to *IAS 39*, which has been replaced by *IFRS 9*. The replacement of *IAS 39* by *IFRS 9* is an attempt to simplify the often complex recognition and disclosure requirements of *IAS 39*, many of which came under scrutiny during and after the 2008/2009 financial crisis.

In terms of scope, *IFRS 9* encompasses the same financial instruments as those included under the scope of *IAS 39*, with the exception that some instruments can be subjected to the own-use exception at fair value through profit or loss (FVTPL) under *IFRS 9*. Also, the scope of impairment requirements under *IFRS 9* applies to all loan commitments and contract assets under the scope of *IFRS 15: Revenue from contracts with clients.*

IFRS 9 replaces the classification of categories for financial assets under *IAS 39*. It is considered a more principle-based approach than the previous accounting standard. In the past, *IAS 39* relied on specific definitions to classify financial assets. The classification of financial assets under *IFRS 9* is based on contractual cash flows characteristics and the entity's business model for managing financial assets. Furthermore, under *IFRS 9*, embedded derivatives are not separated or bifurcated if the host contract is an asset under the scope of the accounting standard. The entire hybrid contract must be assessed for classification and measurement and removes the difficult bifurcation assessment for financial host contracts that prevailed under *IAS 39*. Furthermore, *IFRS 9* removes the exceptions that some instruments whose fair value cannot be reliably measured, or that some financial assets/liabilities which are linked to or settled by the delivery of unquoted equity, may be valued at cost. Under *IFRS 9*, all derivatives liabilities are measured as fair value through profit and loss

(FVTPL). *IFRS 9* also removes the exception that some equity investments in private companies can be measured at cost, so henceforth all equity investments must be measured at fair value.

In terms of impairment, *IFRS 9* applies a single impairment model to all financial instruments that are subject to impairment testing, replacing the different models used for different instruments under *IAS 39*. Impairment losses should be recognized on initial recognition and subsequent reporting dates, regardless of whether the loss has been incurred or not. Finally, the rules for hedge accounting under *IFRS 9* were simplified to reflect risk management and treasury operations better.

It is important to note that the current study collected South African data from companies listed on the JSE. These companies are required to disclose financial information and – specifically relevant for this study – information pertaining to the derivatives they used, according to the IFRS standards, set out by the IASB. The data were collected for the period from 2005 to 2017. During this time, companies listed on the JSE were required to recognize and disclose information on their use of derivatives according to *IAS 39*, although some companies (as indicated) adopted *IFRS 9* early.

The purpose of the current study is not to assess differences between the usefulness and value relevance of two different accounting standards (*IAS 39* and *IFRS 9*) that pertain to the same underlying subject (derivatives). Rather, the aim of the current study is to investigate the value relevance of derivatives *information* contained in the financial statements of companies listed on the JSE during a specific period, recognized or disclosed by one specific accounting standard (*IAS 39*). Although there could be differences in how information is interpreted (depending on the manner in which it was recognized or disclosed in the financial statement and whether it was done in accordance with *US GAAP*, *IAS 39* or *IFRS 9*), it falls beyond the scope of the current study to ascertain those differences.

Various researchers have previously examined whether there are significant differences between the information recognized and disclosed under IFRS versus information disclosed under US GAAP. Mandatory adoption of IFRS can increase both the quality of information and accounting comparability between firms (Horton, Serafeim & Serafeim, 2013). The mandatory introduction of standardized accounting rules has been found to decrease forecast errors and improve forecast accuracy. This improvement was found to be larger where the differences between IFRS and non-US domestic standards (local GAAP) were larger, indicating that the introduction of IFRS has a significant impact on improving the quality of companies' information environment (Horton *et al.*, 2013).

The accounting values for firms that have adopted IFRS because it is mandatory for them to do so (as in South Africa) are more comparable to the accounting values for companies that apply US GAAP (Barth, Landsman, Lang & Williams, 2012). This comparability is higher for firms whose adoption of IFRS was mandatory than for those who adopted IFRS voluntarily. The comparability is also higher for firms in countries where IFRS is mandatory, common law countries, and for in countries with high enforcement than for firms that apply local GAAP (Barth *et al.*, 2012).

Gordon, Jorgensen and Linthicum (2008) examined the differences between US GAAP and IFRS. The aim of their study was to determine whether earnings reported was of a higher quality for firms reporting according to IFRS than for firms reporting to US GAAP. They wanted to establish whether IFRS earnings reporting were more or less informative than US GAAP earnings reporting and to determine whether home country incentives, institutions and regulations influence comparison between the two different accounting formats. Earnings under IFRS and US GAAP were in fact comparable in quality, although US GAAP-reconciled earnings displayed evidence of being incrementally more value relevant and informative. The implication of this is that financial statements are less useful for valuation if companies stop reconciling US GAAP to IFRS. However, differences between reporting standards were found in few specific earnings attributes in code law countries, where auditors are strong analysts, adherence to the standards was high and investor protection was low (Gordon *et al.*, 2008).

An important insight for the current study is the fact that the accounting amounts that are recognized and disclosed under US GAAP have higher value relevance than information recognized and disclosed under IFRS (Barth *et al.*, 2012). The accounting values for common law firms (firms that adopt IFRS through common law practices) have a value relevance comparable to that of the accounting amounts under US

GAAP (Barth *et al.*, 2012). Furthermore, research suggests that accounting quality was higher for US firms, as measured in terms of earnings smoothing, accrual quality and timeliness, and the comparability of accounting information was found to increase after the adoption of IFRS (Barth *et al.*, 2012).

There are costs that arise from differences between accounting practices in different countries, particularly costs to analysts who need to use information that is recognized or disclosed differently under different accounting standards (Bae, Tan & Welker, 2008). This implies that the costs and benefits of harmonizing international accounting practices need to be weighed against each other. As it stands, differences between accounting practices have a negative impact for financial analysts, notably analysts who collect, analyse and disseminate accounting information (Bae *et al.*, 2008). Potential economic costs are thus associated with the variation in accounting standards (Bae *et al.*, 2008).

So far, more than 100 countries have adopted IFRS, including the UK, countries in the European Union (EU), Australia, Canada and South Africa. Several notable countries that are considering adopting IFRS, but that have not yet done so, include the US, Russia, Japan and India. Although the world as a whole is moving towards uniform accounting standards, this is not without its problems, as local economic and political dynamics make complete convergence between accounting practices unlikely.

The advantages of uniform financial reporting standards are arguably a decrease in cost of capital and transaction costs to investors, an increase in market liquidity, and better facilitation of international capital flows and the formation of capital (Daske, Hail, Leuz & Verdi, 2008; Epstein, 2009). However, there is not complete consensus on the advantages of uniform accounting practices (such as comparability or having defined standards): the theory is sometimes at odds with the realities when the costs have to be weighed against the benefits of implementing uniform standards. Moreover, despite attempts to align local GAAP, particularly US GAAP, to IFRS, some important differences remain (Ball, 2006). Such differences between local GAAP and IFRS can influence decision-makers who seek information from accounting sources, as well as researchers.

Although a considerable body of research has been conducted on the comparability of IFRS and GAAP, the purpose of the current study is not to explore the differences between IFRS and US GAAP, specifically relating to the recognition and disclosure of the (ZAR) amounts of derivatives. It is sufficient to acknowledge that such differences exist (as summarised in Table 2.1). The adoption of IFRS, whether compulsory or voluntary, improves the comparability of accounting amounts to US GAAP and their value relevance, as well as the quality of the information environment of firms (as the summary of key differences between *IAS 39* and *IFRS 9* in Table 2.2 shows).

Table 2.1: Differences between US GAAP and IFRS

	US GAAP	**IFRS**
Conceptual framework	Rule-based	Principle-based
Guidelines set by standards	Many exceptions	Can be used in most circumstances
Recognition of financial instruments	• Should be classified into specific categories • Should be recognized in statement of financial position	• Should be classified into specific categories • Should be recognized in statement of financial position
Definition requirements of derivatives instruments		• Does not include a notional amount to be indicated • Net settlement is not required

US GAAP: US generally accepted accounting principles,
IFRS International financial reporting standards

Source: Own compilation

Table 2.2: Key differences between *IAS 39* and *IFRS 9*

	IAS 39	*IFRS 9*
Date in use	1 January 2005 – 31 December 2017	1 January 2018 - current
Scope		Certain exceptions with regard to own-use FVTPL
Classification	Specific definitions	Contractual cash flow characteristics and entity's business mode for managing financial assets
Embedded derivatives	Bifurcation assessment	Not separated or bifurcated
Impairment	Different models	Single impairment model

IAS International accounting standards,
IFRS International financial reporting standards,
FVTPL fair value through profit or loss
Source: Own compilation

2.4.7 Accounting standards and the regulation of derivatives disclosure

Forcing companies to disclose information about their use of derivatives effectively and accurately is of the utmost importance. Given the impact and influence that derivatives had on the American sub-prime lending crisis and subsequent global financial crisis of 2008/2009, there have been calls for stricter regulation of the derivatives market (Ayadi & Behr, 2009).

Fang, Chen and Fu (2013) argue that accounting information is only value relevant when economies are stable. Their study on the effects of the value relevance of financial instruments in Taiwan before and after the financial crisis of 2008/2009 demonstrated that accounting information was value relevant in stable economic periods, but that this information's value relevance declined and became less important to investors when the economic or financial environments changed drastically.

Since the financial crisis in 2008/2009, there have been calls for further and stricter regulation of the derivatives market. Ayadi and Behr (2009) point out that at present the derivatives market is mostly self-regulatory and that regulations do not adequately induce market participants to use derivatives in the most desirable ways. They cite the weakness of derivatives pricing methods and financial institutions' risk management frameworks, inability to control aggressive investor behaviour, and regulatory actions that are outmoded as sources of the market disruptions and decrease in liquidity during the American sub-prime lending crisis (Ayadi & Behr, 2009). They also argue that a hybrid regulatory system that relies on market discipline and oversight is not enough and call for further market and regulatory measures to be taken to ensure a more viable and stable financial system. The absence of effective derivatives regulations can lead to disruption in the global financial system, as happened during the 2008/2009 financial crisis, and the use of derivatives by companies worldwide can exacerbate the consequences of such disruptions.

Clark and Judge (2009) have made a plea for regulators, such as the accounting standards bodies that set the rules and regulations for the accounting policy for the use of derivatives, not to implement rules that are so stringent that they would influence companies' derivatives use. Both the types of derivatives that can be used and the extent to which derivatives are used can be influenced by the accounting policy – regulations that are too severe and inflexible could lead to firms' not hedging with those types of instruments, or not hedging at all, which could have a negative impact on shareholder value.

Corporate governance can also influence the hedging decision-making process. Strongly governed firms tend to use derivatives to hedge currency exposure in order to overcome costly financial exposure, while weakly governed firms tend to use derivatives for managerial reasons (Lel, 2012). Strongly governed firms are thus more likely to use derivatives to overcome financial market friction and currency risk than firms with looser governing structures.

The current study incorporates findings from previous studies with regard to the impact of accounting standards on both the reporting and disclosure of derivatives in the financial statements of a company, as well as the impact of such reporting and disclosure on derivatives use by companies. The study draws on these findings to gather empirical evidence on the use of derivatives from the notes to companies' financial statements.

The study addresses some of the gaps in the research on the use of derivatives by companies in South Africa for corporate hedging and the impact that such derivatives use has on the share price of a firm, as well as the influence of different accounting standards requirements on derivatives usage. This study will therefore be useful to decision-makers who need that information.

2.5 THE QUALITY OF DISCLOSURE OF ACCOUNTING INFORMATION

The information quality and the transparency of companies' disclosure of both voluntary and non-voluntary information in the financial statements is becoming an increasingly important component of value relevance studies: the quality of disclosure can greatly influence the outcome of value relevance studies. This raises two important questions: from an academic perspective, whether the quality of disclosure should not form an integral part of any value relevance study; and from a practical perspective, whether the quality of disclosure does not have a significant impact on the value effect assigned to companies from the value relevance studies point of view. These aspects are explored briefly below.

2.5.1 Quality of derivatives disclosure

Some studies have sought to establish a link between the quality of derivatives disclosure and the value relevance of such disclosure. High quality derivatives information was found to be value relevant by Hassan (2004), in respect of both hedge information and risk information. Furthermore, Hassan (2004) investigated the quality of derivatives information disclosure for firms with specific firm characteristics, including firms' size, profitability, price-earnings ratio, market-to-book ratio, the level of research and development (R&D) activity, debt-to-equity ratio, the type of industry and auditor. The research showed that a firm's size, price-earnings ratio and debt-to-equity ratio was most closely associated with higher disclosure quality (Hassan, 2004). A study by Hassan, Percy and Stewart (2006) with Australian data employed a self-developed disclosure index based on *AASB 1033: Presentation and Disclosure of Financial Instruments* to measure the transparency of derivatives disclosure. The transparency of disclosures for firms in the extractive industry in Australia has increased over the period, although firms still use their own discretion in disclosing information on derivatives. The regression results showed that companies that were larger, had higher price-earnings ratios and higher debt-to-equity ratios practised more transparent derivatives disclosure (Hassan *et al.*, 2006).

Previous studies have also explored the link between different firm characteristics and the quality of disclosure of financial instruments. In a Malaysian study, Hassan and Mohd-Saleh (2010) found that overall disclosure quality was low for firms listed on the Bursa Malaysia, but noted that quality had improved, especially after the introduction of *Malaysia Accounting Standards Board (MASB) 24: Financial Instruments: Disclosure and Presentation*. Importantly, this implies that the implementation of accounting standards (specifically in respect of financial instruments) does provide companies with an incentive to provide high quality reporting in their financial statements. Furthermore, Hassan and Mohd-Saleh (2010) showed that firm size, debt-to-total assets and the existence of a risk management committee were associated with quality of disclosure.

Huang and Huang (2012) investigated the usefulness of derivatives-related disclosure in China. They considered a sample of 53 Chinese listed firms to determine the degree of derivatives-related disclosure. They conducted content analysis to compare derivatives-related disclosures and information contained in the financial statements of companies' annual reports to a quality of disclosure index based on the provisions of IFRS and IAS. Huang and Huang (2012) found that the level of compliance of their sample with IFRS and IAS derivatives disclosure requirements was generally low.

It should be noted that the usefulness of information disclosed in the financial statements of entities is limited to the utility, or value, that a user of a set of financial statements derives from such use. In other words, if a user is unable to gain significant insight from the information contained in the financial statements of an entity, the usefulness of the financial statements should be questioned, or at the very least the inclusion of any information that is not useful should be questioned. This has an important implication for value relevance studies: if the usefulness of the information in the financial statements is questioned, the value relevance of that information for firm value is also in question.

The usefulness and quality of derivatives disclosure has come under scrutiny in recent years, not least due to several financial scandals and the 2008/2009 global financial crisis. Studies on the Australian banking sector found that the disclosure of principal amounts and credit disclosure had an insignificant impact on stock returns, but that the disclosure of fair value gains and losses for both trading and non-trading derivatives did have a significant impact on stock returns (Li & Gao, 2007).

A distinction should be made at this point between the focuses of different studies. Some researchers examining the quality or transparency of disclosures in the financial statements have based their studies on whether or not particular information is disclosed in the financial statements. In other words, they were concerned with whether or not firms have mentioned certain information in the financial statements, and whether this is in line with what is prescribed by the particular accounting standards that apply to these firms. However, other researchers argue that it is not enough simply to mention everything that is required by the accounting standards concerned: one also has to look at the manner in which it is said. In other words, it is not just a question of *what* is being said, but *how* it is said. Hence, the *quality* of information on derivatives disclosed also matters, and not just simply the quantity. Quality refers to how information is disclosed, and not simply whether information is included or not.

For example, Chung, Kim, Kim and Yoo (2012) investigated how the quality of information might affect the manner in which newly disclosed information on derivatives-related loss announcements is recorded into share prices. They found that investors were likely to misprice derivatives-related losses in some firms if information on underlying foreign currency positions was unavailable around the timing of the announcements. This implies that an increase in the *quantity* of disclosure of information does not necessarily lead to better equity valuation, and therefore the *quality* of information being disclosed should be considered. From here on, the current study refers to the quality of disclosure. Quality refers to and includes the transparency, usefulness or value of disclosure.

The call for more (quantity) and better (quality) disclosure cannot be ignored. The levels of numerical and textual disclosure information have been shown to be significantly related to the efficiency with which stock prices are able to absorb new information (Chung, Hrazdil, Novak & Suwanyangyuan, 2019). Chung *et al.*'s (2019) study suggests that the amount of numerical and narrative information available can act as an important determinant of market efficiency. Chung *et al.* (2019) provide empirical evidence of the importance of expanded numerical and narrative disclosure of information. Their results indicate that longer and more detailed financial statements provide more value relevant information against which new information can be measured and incorporated into stock prices.

In South Africa, Van Zyl (2017) investigated a perception of a decline in the usefulness of accounting financial statements in the decision-making processes of the users of financial statements. Often the financial statements included generic and superfluous information on accounting policies with no purpose other than to increase the volume of financial statement disclosures. This increase in volume of disclosure can in fact decrease the usefulness (and value relevance) of financial statements. This has an important implication for value relevance studies: the inclusion of generic and non-specific accounting policies in the financial statements can unnecessarily increase the volume of the financial statements to the point where it detracts from the usefulness (value relevance) of those financial statements. On the other hand, a lack of proper disclosure is often blamed for real world implications.

A lack of disclosure and the complexity of disclosure, specifically of financial instruments and financial derivative instruments, are often blamed for causing financial scandals (Li & Gao, 2007) and even for the financial crisis in 2008/2009. It is therefore important from an accounting policy perspective to formulate the necessary limits of information that should be included in financial statements to achieve the aim of 'usefulness' of accounting records. On the other hand, users of financial statements also have a responsibility to understand that not all information contained in financial statements is relevant and, conversely, that not all relevant information is contained in the financial statements.

Coetsee (2006) argues that material amendments need to be made in the disclosure of financial instruments in line with the requirements set out by the IASB. The IASB framework has been criticized for failing to provide adequate disclosure requirements for financial instruments in two important respects: firstly, for failing to cater specifically for the accounting of risks (in the form of accounting for contracts) and, secondly, for not dealing specifically with accounting for fair value. IFRS and US GAAP do deal with certain aspects of these shortcomings, but a more complete and redrafted accounting framework is needed to resolve pertinent accounting issues. In other words, the usefulness of information contained in the financial statements of companies should be guided by the standards that prescribe the treatment of a particular accounting framework, but these standards should also be underpinned by a sound accounting framework.

Value relevance studies therefore become an important guide and source of information for the setters of accounting standards. Value relevance studies are concerned with the value effect of the information contained in the financial statements; therefore, the setters of accounting standards should draw on the results of value relevance studies to determine what information is useful and what must be included in the financial statements.

2.5.2 How to measure disclosure quality

The information quality of disclosure is not easily quantifiable. It is often associated with the level of information disclosed by firms (Scaltrito, 2015). Different researchers have used different methods to measure information quality. Broadly speaking, one can distinguish between objective tools to measure information quality (such as direct study of the information source through a content analysis, event frequencies or disclosure indexes), and subjective instruments (such as questionnaires, surveys and analysts' opinions, which do not rely on analysis of the original source of information) (Scaltrito, 2015).

Several researchers have employed subjective instruments to measure the information quality of disclosures. These instruments include using questionnaires and surveys to gain the opinions of industry experts on different categories of documents, published annual reports and other requested information and quarterly reports, as well as other information that is published but not requested, and other aspects of disclosure. The Chartered Financial Analyst (CFA) Institute, an amalgamation of the Financial Analysts Federation (FAF) and Institute of Chartered Financial Analysts (ICFA), which merged to become the Association for Investment Management and Research (AIMR), is one institution that carries out such surveys. A score on the quality of disclosure is calculated using the weighted evaluation, based on objective criteria used by the analysts on the different categories of documents mentioned above, namely published annual and quarterly reports and other requested information.

Scaltrito (2015) reviewed prior studies that used these surveys to determine levels of disclosure of financial information, citing (listed chronologically) Imhoff (1992), Welker (1995), Lang and Lundholm (1996), Sengupta (1998), Healy, Hutton, and Palepu (1999), Bushee and Noe (2000), Botosan and Plumlee (2002), Gelb and Zarowin (2002), and Byard and Shaw (2003). Criticisms against this approach include subjectivity in the rating process, an unclear understanding of the criteria for definitions of rating, and problems with the clarity of the questionnaires used.

Objective instruments to measure quality of information, such as the transparency of disclosure of financial information in the accounting statements, are based on a direct analysis of the original documents in which the information is made available. This includes content analysis (a qualitative study of the vocabulary in a company's financial statements and notes) to understand and standardize the content. Such textual analysis can be carried out in respect of three main elements, namely thematic, syntactical and/or linguistic analysis. Problems with this approach include the fact that an analysis of syntax and linguistics does not necessarily take into account the overall meaning of the concepts, that the readability of the documents might not be universal, and that a substantial number of resources may be needed to manually explore the documents. According to Scaltrito (2015) studies that conducted content analysis included those by Hussainey, Schleicher and Walker (2003), Beattie and Thomson (2007), and Jo and Kim (2007).

Event analysis studies the frequency with which particular information is disclosed, and the impact of good or bad news on the level of disclosure. This approach is less popular than disclosure indexes and content analysis, but Scaltrito (2015) lists the following researchers as having adopted this method: Lang and Lundholm (2000), Brown, Hillegeist and Lo (2004), and Verrecchia (2004).

The creation of a disclosure index is one of the most widely used methods to measure the level (quality) of disclosure of information. Specific elements of voluntary and/or mandatory items that are observed from particular sources of information are calculated to create a disclosure index. Cerf (1961) was the first to use a disclosure index in research on the disclosure of financial information. Most researchers since then have created *ad hoc* indexes on the different aspects of information under study, for example, Hassan *et al.* (2006) and Scaltrito (2015) list the following authors that created their own disclosure indexes: Cooke (1989, 1991, 1992), Malone *et al.* (1993), Wallace (1988), Wallace *et al.* (1994), Botosan (1997), Tower, Hancock and Taplin (1999), Chalmers (2001), Taplin, Tower and Hancock (2002), and Ali *et al.* (2003). A number of researchers have employed indexes created by external organizations such as the Centre for International Financial Analysis and Research (CIFAR) – examples listed by Hassan *et al.* (2006) and Scaltrito (2015) are Patel, Balic and Bwakira (2002), Ali *et al.* (2007), Barron, Kile and O'Keefe (1999), Salter (1998) and Hope (2003a, 2003b).

A weighted or unweighted disclosure index can be created based on the presence of the elements indicated in the assigned source of information. The following weightings can be used:

- dichotomous, with 1 indicating the presence of information and 0 indicating its absence;
- dichotomous and quantitative, with 2 indicating that information is available both in a quantitative and qualitative manner, 1 indicating that information is only available as qualitative information, and 0 showing its absence; and
- a score range, where a score is given depending on a pre-determined range of detail in the information given.

Indexes of disclosure are not free of bias, and have been criticised because some subjectivity can influence the elements and degree of relevance of the items under review.

It is thus clear that different researchers have made use of different methods in the past to assess the quality of accounting information included in the financial statements of companies, and they have considered different disclosure regimes. Each different approach has its own merits and shortcomings. It is important in terms of the current study that an element of the quality of disclosure is included in the analysis of the value relevance of derivatives disclosure for JSE-listed firms.

The annual reports of companies included in the sample were investigated using either a weighted or an unweighted index, and a dichotomous and quantitative procedure was followed. A weighting of 2 was given for pertinent disclosed information of excellent quality, 1 was given for pertinent disclosed information and a 0 otherwise.

The unweighted index was considered less subjective than an index with a quantitative weighting, or with a score system that indicates the level of quality of derivatives disclosure. A weighted index can then also be created to test the robustness of an unweighted index in the analyses.

The hypothesis that is developed from this section is that the value relevance of derivatives disclosure differs between companies that have a different quality of derivatives disclosure, as measured by a quality of disclosure index.

2.6 SUMMARY AND CONCLUSION

This chapter has investigated how the quality of disclosure in financial statements can influence the outcome of value relevance studies. It seems that the quality of disclosure should form an integral part of any value relevance study, because the quality of disclosure can significantly impact the value effect assigned to companies based on value relevance studies. The next chapter discusses the determinants of derivatives use as part of corporate hedging practices in more detail.

CHAPTER 3:
THE DETERMINANTS OF CORPORATE HEDGING

3.1 INTRODUCTION

This chapter discusses firm specific characteristics and factors that have an impact on the use of derivatives by firms.

Early research on using derivatives focused on establishing the reasoning underlying firms' hedging practices. Smith and Stulz (1985) identified three main reasons for value-maximizing firms to hedge, namely tax management, the cost of financial distress and managerial risk aversion. Another study by Nance *et al.* (1993), drawing on limited data, indicated that firms make the decision to hedge in much the same manner as other financial decisions, and that companies hedge themselves in response to tax incentives, to lower expected transaction costs and to limit agency costs. The determinants of derivatives use as a way to hedge are discussed in more detail below.

3.2 DETERMINANTS OF DERIVATIVES USE

The introduction of *SFAS No. 105: Disclosure of Information about Financial Instruments with Off-Balance-Sheet Risk and Financial Instruments with Concentrations of Credit Risk* changed the manner in which any data on how firms used derivatives could be captured. Prior to *SFAS No. 105*, researchers had to rely on survey data (Nance *et al.*, 1993; Smith & Stulz, 1985). However, for the first time, *SFAS No. 105* required firms to disclose off-balance sheet financial instruments in the financial statements. This has made it possible for researchers to draw on publicly available data to determine and explain the hedging practices of publicly listed firms.

Initial studies using data represented in the financial statements, rather than survey data, confirmed that companies could increase their value by using derivatives to decrease the probability of financial distress, to reduce the agency costs of debt and some equity agency costs, although it was found that firms' value did not necessarily increase when the expected tax liability decreased (Fok *et al.*, 1997).

Firms with greater growth opportunities and tighter financial constraints are more likely to use derivatives. Firms also use derivatives to smooth earnings volatility – this use of derivatives may be of benefit to firms that use them prudently (Géczy *et al.*, 1997). Companies with significant foreign exchange exposure are also both more likely to hedge with derivatives, and to receive the greatest benefits. Géczy *et al.* (1997) attempted to differentiate between firms that used derivatives to hedge and those that used derivatives to speculate. They reported that the firm characteristics in their sample firms were not indicative of optimal speculating motives, and that therefore firms mainly used derivatives to hedge.

Goldberg, Godwin, Kim and Tritschler (1998) confirmed the existing theories of hedging practices. They conducted meta-analysis to identify the firm characteristics of companies that used derivatives. They found that firms used derivatives to safeguard internal funds for future investment, to reduce managers' employment risk, to reduce the costs of financial distress, to adjust capital structure, and to reduce conflict between debt- and shareholders. Furthermore, using derivatives was found to be positively correlated to multi-nationality, accounting returns on assets, growth prospects, and firm size (Goldberg *et al.*, 1998). Interest rate derivative instruments were positively correlated with debt levels. Also, liquidity (as measured by the current ratio) had a negative correlation with using derivatives (whether or not companies use them) and had no effect on the level to which (how much) companies use derivatives. Lastly, companies in regulated sectors were found to use fewer derivatives (Goldberg *et al.*, 1998).

Looking at two different samples, Howton and Perfect (1998) ascertained that the determinants of the use of derivatives for a non-random sample of large US firms were strongly related to the theoretical determinants of derivatives use: they were directly related to financial distress and external financing costs, tax considerations and currency risk exposure, but inversely related to hedging substitutes. However, the use of derivatives in a random sample of firms was unrelated to these variables (Howton & Perfect, 1998). An important aspect of Howton and Perfect's (1998) work for the current study was that they analysed the annual reports of the firms in the sample to determine the level of derivatives use, and applied a continuous measure of derivatives contract value to document the dollar value of different types of hedging instruments to identify the determinants of the use of derivatives. In their sample of

451 Fortune 500/S&P 500 (FSP) firms, 61% of firms used derivatives, but only 36% of the sample of 461 randomly selected firms used derivatives. Howton and Perfect (1998) found that interest rate swaps, currency forwards, and futures were the most frequently used derivative instruments. Their study showed that the application of a continuous measure of derivatives use to data captured from the annual reports of companies in the sample was robust and supported the findings from previous studies relying on data from surveys.

Judge (2002) found strong evidence of a relationship between proxies for expected financial distress costs and the decision to hedge foreign currency exposure. His study focused on data from non-financial firms in the UK. Judge (2002) found a significant relationship for both financial distress and size. He ascribed these findings to the higher expected costs of financial distress in the UK, compared to the US. He also suggested that there might have been some bias in prior US studies, such as those of Nance *et al.* (1993) and Smith and Stulz (1985), which may have included companies that also hedge interest risk. The inclusion of such firms could bias the findings of financial distress as a reason to hedge foreign exchange currency.

Firms can use derivatives to hedge future investment expenditure (Adam, 2002). A strong relationship between the minimum revenue guaranteed by hedging and investment expenditure was reported in Adam's (2002) study. He inferred that hedging increases the probability that firms will use derivatives to increase internal financing. He found that firms that do not hedge are financed 100% externally, whereas firms that do hedge are only financed 86% externally. This provides empirical evidence that firms employ derivatives to lessen their dependence on costly external sources of finance, and that a well-developed derivatives market can provide a valuable source of financing to firms that might be constrained in the capital market (Adam, 2002).

The findings of empirical studies on derivatives use are not conclusive. Studies have reported contradictory evidence on firms' use of derivatives, as well as their motivation to do so. There could be several reasons for this. Studies tend to be sample-specific, so studies in different countries may produce conflicting results. Country-specific or sector-specific factors may not be adequately captured by the models used in the different studies (Bartram *et al.*, 2009). Although risk management theory may explain corporate behaviour, it is still developing, and has to keep on developing as new risks emerge that threaten the welfare of a company, and as new methods emerge to protect firm welfare.

Corporate governance may also shape companies' derivatives activities. The degree to which shareholders are able to monitor managers' activities has a significant influence on a company's decision to use derivatives (Lel, 2012). In Lel's (2012) study, strongly governed firms (those that had policies in place to monitor managerial actions) tended to use derivatives to reduce exposure to currency fluctuations and to overcome market friction associated with the cost of external financing, while companies that were weakly governed tended to use derivatives mainly for managerial reasons. Lel's (2012) sample included firms from 30 countries over a period of ten years.

The strength of corporate governance can affect the use of derivatives by firms in several ways. Firstly, it can affect a firm's decision to use derivatives for hedging or speculating (Lel, 2012). Exposure to costly movements in exchange rates is less likely in firms with higher transparency and better monitoring of managerial actions. Secondly, shareholders can use corporate governance mechanisms to affect firm value (Lel, 2012). Thirdly, enhanced corporate governance and monitoring of managers can reduce agency conflict between shareholders and managers, resulting in firms being able to use derivatives to a greater extent (Lel, 2012).

Evidence on corporate hedging incentives remains ambiguous. Recent research has tried to find confirmatory evidence, but results remain contradictory. This shows that there are not yet definitive answers on motivations for derivatives use, and that patterns in corporate structure continue to shift. New accounting standards and changing economic outlooks could alter the motivations for hedging policy that applied in the 30 years for which derivatives have been in use, and also our understanding of derivatives use.

Despite the questions that remain, recent studies have confirmed some of the factors that serve as an impetus for derivatives use. Financial distress costs are a powerful motivator, and there is weak evidence that underinvestment and dependence on costly external finance also play a role, but taxes and agency conflict do not display explanatory power (Arnold, Rathgeber & Stöckl, 2014). Arnold *et al.* (2014) applied meta-analysis to combine results from previous studies to find evidence for these determinants of derivatives use. Meta-analysis using a combination of the qualitative and quantitative data of selected previous studies can provide greater statistical power to support some conclusions with regard to the determinants of using derivatives. Using meta-analysis does not necessarily address underlying problems with identifying the determinants, nor is it able to address fundamental empirical modelling issues from the selected studies. Hence, there is still conflicting evidence on whether or not some specific firm characteristics influence the use of derivatives by firms (Arnold *et al.*, 2014).

Most of the early research on the corporate use of derivatives focused on the US market. However, in recent years, research on derivatives use in risk management practices has also included research in other parts of the world.

Berkman and Bradbury (1996) used the fair value of derivatives disclosure and the notional contract amount, scaled by the market value of firms, to establish the level of derivatives use by companies in New Zealand. They were able to examine audited financial statements. In New Zealand, firms are required to include both the fair value and the notional contract value of on-balance sheet and off-balance sheet financial instruments. Berkman and Bradbury (1996) found that for 116 firms listed on the New Zealand Stock Exchange the use of derivatives increased with leverage, size, the existence of tax losses, the proportion of shares held by directors, and the pay-out ratio. Derivatives use decreased with interest cover and liquidity. Considering data from financial statements enables researchers to develop a continuous measure of hedging activity, unlike survey data, which are usually limited by low response rates.

Berkman *et al.* (2002) tested a sample of 106 industrial and 52 mining firms on the Australian stock market to determine the relationship between the use of derivatives by these firms and market imperfections such as financial distress and tax losses. They also considered the relationship with internal financial requirements, including growth options, operating cash flows and liquidity. Size and leverage were found to be the main explanatory motives for using these instruments, but the Australian data provided weak evidence overall for the main determinants of derivatives use (Berkman *et al.*, 2002). This may possibly be ascribed to the voluntary disclosure requirements in Australia, or the fact that derivatives use could be understated in the financial statements (Berkman *et al.*, 2002).

Heaney and Winata (2005) used a much larger sample of 374 large Australian firms to explain derivatives use by companies. They noted scale, financial distress, taxes, management compensation, agency costs, optimal investment arguments and the existence of foreign assets and foreign sales as the main motivations for using derivatives. Specifically, size, leverage, R&D, ROA, the existence of tax losses and foreign sales had a positive impact on derivatives use. However, liquidity, director shareholding and market-to-book/leverage interaction had an inhibiting effect on derivatives use (Heaney & Winata, 2005).

By contrast, Anand and Kaushik (2007) reported that management motivations for using foreign currency derivatives in firms in India included hedging to increase firm value, management utility and compensation, complying with accounting and disclosure requirements, strengthening control systems, and exploiting tax benefits to reduce the cost of capital. A high debt ratio as well as a high number of employee stock ownership plans' usage influenced the use of derivatives by Indian firms.

Charumathi and Kota (2012) show that firms use derivatives to hedge and to protect themselves against volatility in interest rates, exchange rates, commodity prices and equity prices. Their sample of large, non-financial Indian firms revealed that firm size was the most important determinant of the likelihood that a company would use derivatives. Their findings imply that only large firms in India are able to afford to use derivatives. Furthermore, for Indian firms, the underinvestment hypothesis, financial distress hypothesis, managerial risk aversion and rationale for using alternate methods of hedging were not reliable predictors of a firms using derivatives.

According to Bodnar, Consolandi, Gabbi and Jaiswal-Dale (2013), the decision to use derivatives contracts by firms in Italy, where the market is characterized by family-run firms, was influenced by size, geographical location, rating, industry, access to capital markets, involvement in international trade and the educational level of management. The study drew on survey data and logit regressions to determine that Italian non-financial firms were strongly influenced by these firm characteristics in their decision to use currency and interest rate derivatives. The most important characteristics were found to be international trade, access to capital markets and managerial educational levels (Bodnar *et al.*, 2013).

It is possible – indeed likely – that firms in different countries have different reasons to hedge. For example, Ameer (2010) argues that the lower percentage of derivatives use by Malaysian firms (112 of 427 companies listed on the Malaysian stock exchange) might be because of these firms' preference for the customization and flexibility of forward foreign exchange contracts over standardized contracts.

Afza and Alam (2011) conducted research on firms in Pakistan. They found that non-financial firms use hedging techniques to minimize financial distress costs, financial constraints and foreign exchange exposure. Companies in their sample with higher growth and managerial ownership and higher foreign exposure were more likely to hedge. Companies with lower tangible assets and higher leverage ratios were more likely to use derivatives to hedge unpredictability in net income (Afza & Alam, 2011).

Chaudhry, Iqbal, Mehmood and Mehmood (2014) also explored the factors and motivators of hedging practices amongst Pakistani firms. A strong relationship between using derivatives and companies' foreign purchases, growth options, liquidity and size was reported. Derivatives users were characterized by large size, growth opportunities, cash flow volatility, and both foreign exchange and interest rate exposure. Derivatives users had a competitive edge over non-users, due to being better able to manage risk and benefit from the economies of scale that derivatives provide (Chaudhry *et al.*, 2014).

In Canada, one third of publicly listed non-financial firms were found to use derivative instruments, and this increased during periods of uncertainty (Paligorova & Staskow, 2014). According to their study, the firm characteristics of hedgers in Canada were the same as those of hedgers in other jurisdictions: larger Canadian non-financial firms were more likely to use derivatives, as were more profitable firms and firms with lower earnings volatility. Paligorova and Staskow's (2014) findings also suggest that using derivatives was value enhancing for firms, since the firms that hedged with derivatives were more profitable and experienced lower volatility in earnings than non-hedgers. Finally, Canadian hedgers seemed to manage their statements of financial position actively, holding less cash and accessing external sources of financing in capital markets, implying effective use of derivative contracts.

It is thus important to establish the determinants of companies' derivatives use. The purpose of this study is to identify the firm characteristics that influence the adoption and level of use of derivatives by firms. Once the determinants of derivatives use has been established, one is better able to understand what type of JSE-listed firms are more likely to make use of derivatives. These measures and proxies that explain companies' derivatives use can then also be viewed in relation to other drivers of firm value in the value relevance statistical models.

3.3 THE EXTENT OF DERIVATIVES USE

Once researchers had begun to establish *why* companies use derivatives, they also started to investigate the *extent* to which companies use derivatives. Many researchers have investigated both the extent of companies' derivatives use and whether or not it is economically significant for companies to use them. Research often examines these two aspects together, but whereas the studies discussed above focus mainly on the *determinants* of hedging, the studies discussed in this section focus mainly on the *extent* of hedging, although some studies do mention how and why firms used derivatives. The studies investigating the extent of derivatives use illustrate the growth of international derivatives use and of their relative importance as part of companies' risk management strategies. The growth in the extent of derivatives use also drives research in derivatives, to enhance understanding of the use of derivatives by companies and the effect that such use has on firm value.

3.3.1 International evidence

Guay and Kothari (2003) found, for a sample drawing on US data, that the magnitude of derivatives holdings was economically small in relation to the entity-level risk exposure. They posit that even though the effect of using derivatives was economically insignificant for entity-level risk, firms do use derivatives to fine-tune their overall risk management strategy, which includes other types of activities, such as operational hedging. They argue that companies use derivatives in a decentralized approach for internal budgeting or performance evaluation purposes, or for purposes other than those traditionally predicted by risk management theory. They may use derivatives to speculate on asset prices and to mitigate the probability that changes in asset prices will influence analyst forecast errors.

A study by Nelson, Moffitt and Affleck-Graves (2005) contradicted the findings of earlier studies such as that by Hentschel and Kothari (2001), who found evidence of hedging activities in 62% of a sample of 425 large firms in the US. Nelson *et al.* (2005) examined 5 700 unique firms and found evidence of derivatives usage in only 21.6% of firms in the sample. Most of the sample firms used foreign exchange currency derivatives and interest rate derivatives, while only a few firms in the sample used commodity derivatives. Larger firms were more likely to use derivatives (Nelson *et al.*, 2005). The study also explored the effect of using these derivatives on stock return performance during the sample period and found that firms that hedged outperformed those who did not by 4.3% on average per year. However, interestingly, this outperformance was limited to companies that chose currency derivatives (Nelson *et al.*, 2005).

Bartram *et al.* (2009) examined the use of derivatives in a global survey compromising 7 319 firms from 50 countries. The aim of the study was to elucidate the motivation for using derivatives. Drawing on data for a very large sample of firms, Bartram *et al.* (2009) were able to include 80% of global market capitalization of non-financial firms in their study. The study also included foreign exchange rate, interest rate and commodity derivatives to provide greater cross-sectional variability in each variable and greater statistical power to their analyses. They reported that the determinants of using derivatives included those suggested in the literature (size, the need to lower financial distress costs or resolve agency conflicts between managers and shareholders), but also that using derivatives was endogenously determined with other financial and operating decisions that might be more intuitive in nature (such as dividend policy, holding liquid assets and international operating hedging) (Bartram *et al.*, 2009).

Previous research on the use of derivatives focused on establishing the determinants and the extent of such use, primarily in the developed economies of the US, UK and Europe. More recently, researchers have begun to study the use of derivatives in developing countries, and whether using derivatives is influenced by the same factors as those that apply to companies in developed economies. However, the findings from these studies in developed and developing countries are often contradictory and still inconclusive. Furthermore, the extent and motivations for using derivatives by companies in South Africa have not yet been investigated in detail and the current study therefore attempts to provide insight into the motivation and extent of derivatives use from the context of a developing country.

3.3.2 Emerging market economies

The role that derivatives can play in exacerbating the effect of international financial events has been the subject of much research in recent years. The use of derivatives in small, open economies leaves them vulnerable to the effects of global financial problems, such as the financial crisis experienced in 2008 and 2009. The extent to which using derivatives, and their effect, on the economies of emerging market economies have therefore received more scrutiny in recent years – researchers have analysed not only the impact of using derivatives on returns, but also the increase in risk that arises from using derivatives.

The growth of derivatives markets turnover in emerging market economies is more rapid than that in advanced economies (Mihaljek & Packer, 2010). The speedy growth in these markets is attributed to strong growth in international trade, the expansion of financial globalisation and regulatory reforms in individual countries which have made it easier to trade internationally. Mihaljek and Packer's (2010) study was one of the first to attempt to comprehensively review using derivatives markets in emerging market economies, including China, Hong Kong, India and Korea in Asia, Brazil and Mexico in Latin America, Poland, Russia and Turkey from central and eastern Europe, as well as South Africa. They found that derivatives are more likely to be traded OTC in emerging markets than in advanced economies, and that the growth in turnover of derivatives markets, particularly foreign exchange derivatives, can largely be attributed to trade, financial activity and GDP per capita.

Mihaljek and Packer (2010) show that, although the South African market lagged behind in terms of the total size and worth of the four major centres mentioned in the study, the maturity and sophistication of the South African banking and financial system contributed to the total notional amount outstanding on interest rate derivatives.

Using derivatives in emerging markets has for the most part been to the benefit of the firms operating in these markets. Aysun and Guldi (2011) showed a negative correlation between foreign rate exposure and derivatives usage for firms in more than 20 countries considered as emerging markets, including Brazil, India, Russia and South Africa. Such firms in emerging markets were successful in limiting foreign exchange rate exposure by successfully using derivative instruments. The fact that emerging economies are exposed to foreign exchange rate fluctuations and the need to find ways in which to mitigate the risks associated with such exposure are important reasons for research on emerging market economies (Aysun & Guldi, 2011). Emerging market economies pursue more active monetary policies; many have more flexible exchange rate regimes and experience large capital inflows (Aysun & Guldi, 2011). Hence, there is a greater need to identify underlying risks that are not necessarily captured in the financial statements. This need to identify and manage the risks introduced by increased exposure and the consequences of the 2008/2009 financial crisis drives the urgency for further research on this topic.

The daily volume of derivatives transactions between 2004 and 2007 increased by 115.6% in emerging markets, but increased only by 29.9% in advanced economies (Aysun & Guldi, 2011). The South African market was included in Aysun and Guldi's (2011) study, which revealed that the daily derivatives market volume more than doubled in South Africa between 1998 and 2007, from $5 206 million in 1998 to $10 568 million in 2007. The main advantage of a developed foreign exchange derivatives market is the ability for both domestic and foreign investors to hedge themselves against currency risk. They can also increase their speculative positions and reduce the commensurate risk in the absence of strict foreign exchange regulations. Overall, the probable positive impact of a developed derivatives market outweighs its negative aspects (Aysun & Guldi, 2011).

It is important to understand the effect of using derivatives for firms in emerging market economies such as the South African one. Using derivatives can be detrimental to corporations, and negative effects can be intensified in firms located in countries considered as emerging market economies (such as South Africa) and have more volatile currency markets (Farhi & Borghi, 2009). The increased financialization of the global economy has resulted in an increase of financial assets in non-financial companies; the commensurate financial income promised by these instruments has also become more important to companies. The drive to obtain short-term results at the expense of long-term value-creation has led to an increase in speculative behaviour in these types of financial instruments. Companies in emerging markets also joined the global market to enjoy the sophisticated financial systems of developed economies, not just to seek more operational profits from new markets, but also non-operational profit from financial instruments (Farhi & Borghi, 2009).

Although some companies in emerging markets may historically have used international financial instruments to hedge foreign operations, such as exchange rate derivatives to hedge currency fluctuations, they have also sought to profit from these financial markets by seeking capital gains by engaging in speculative transactions (Farhi & Borghi, 2009). All this has increased companies' exposure, not just to the risks and fluctuations inherent from foreign operations, but also in the financial markets they used as protection against underlying risks. Thus, companies from emerging markets face an increase in exposure to risk in global financial markets due to their exposure arising from hedging activities, and to their active pursuit of capital gains and profits from speculative trading in financial markets (Farhi & Borghi, 2009).

The foreign exchange market in emerging market economies is mainly driven by growth in the derivatives markets, and by demand from international investors to expand or hedge exposure to currency risk (Ehlers & Packer, 2013). Growth in the derivatives market relies on growth in OTC markets, indicating a need for tailored instruments, but could also reflect the fact that the financial systems in emerging market economies are less sophisticated. The trading of the currencies of emerging market economies is positively correlated to cross-border financial flows; hence, offshore trading in emerging market economy currencies has increased at a greater pace than growth in the total foreign exchange turnover in emerging market economy currencies (Ehlers & Packer, 2013).

An important finding from Ehlers and Packer's (2013) research for the current study is the differences pointed out between the derivatives markets of advanced economies and those in emerging market economies. South Africa is included in their study as an emerging market economy. Growth of derivatives markets in emerging market economies has outpaced that of advanced economies, although growth has slowed to 13% since 2010 for emerging markets Ehlers and Packer (2013) (Ehlers and Packer

(2013). The average daily turnover for derivatives markets in emerging market economies, accounting for both local and cross-border inter-dealer double-counting, amounted to $1.1 trillion, which represented about 4% of emerging market economies' GDP, compared to a $10.3 trillion turnover in advanced economies, or 24% of advanced economies' GDP (Ehlers & Packer, 2013). Foreign exchange derivatives play a more important role in emerging market economies than in advanced economies, with more than half of total turnover accounted for in this segment. By contrast, about of 66% of total turnover in advanced economies is due to trading in interest rate (credit risk) derivatives (Ehlers & Packer, 2013). The size and growth of the international derivatives markets signifies both the importance and vulnerability to exchange rate risk of emerging market economies' exchange rates, and the lower depth and liquidity in the bond and money markets of emerging market economies.

Derivative markets are less developed in terms of size and value in emerging market economies than those in advanced economies. Therefore, one should take care when interpreting results from studies on derivatives markets, since findings in a particular economic jurisdiction might not necessarily be comparable to those for another jurisdiction – studies on economies from emerging markets may not be comparable to studies from advanced economies. Since those distinctions exist, it is important to undertake studies on derivatives markets in different economies to help explain how derivatives markets function. It can also help to enhance understanding of how derivatives contribute to financial markets and whether differences between the findings of different studies are due to different markets or geographic locations, or to how international investors view derivatives. Finally, studies in different markets can compare and contrast how using derivatives influences firm value in different markets.

South Africa is classified as an emerging market economy by the Financial Times Stock Exchange (FTSE) and the Morgan Stanley Capital International Index (MSCI). The current study of derivatives in South Africa (as an emerging market) is therefore important for several reasons. Firstly, the growth of derivatives markets in emerging market economies has outpaced the growth of derivatives markets in developed economies (Ehlers & Packer, 2013). Secondly, by studying the effects of using derivatives in different economies in different situations, researchers can gain a better understanding of the working of derivatives markets. The current study can be used in future studies as a basis for comparative studies that will be better able to establish endogenous and exogenous reasons for firms' use of derivatives, and the effects of that use on firm value.

Keffala and De Peretti (2013) explored the effect of using derivatives on the risk faced by banks in emerging and recently developed countries including five banks from South Africa. They studied the use of four different types of derivative instruments (forwards, futures, options and swaps) on five different measures of accounting risk (leverage risk, liquidity risk, two types of credit risk and total risk). They reported that using swaps and forwards decreased risk, whereas using options and futures had a slight positive effect on bank risks. Keffala and De Peretti (2013) inferred that banks mainly used swaps and forwards as part of hedging activities, but an element of speculation comes into play when banks employ options. Their findings suggest that banks are able to decrease risk by using derivatives. Hence, they recommend that the role that derivatives play and their effect on emerging market economies should be revisited.

Tóth (2014), who focused on banks in Hungary, found that using derivative instruments had the effect of slightly increasing bank risks, as measured by liquidity, leverage, credit and overall risk for Hungarian firms. Conducting panel data analysis and using a random effects model, Tóth (2014) set out to clarify the effects of changes in accounting standards on banks' use of derivatives, and how derivatives such as forwards, futures, options and swaps affected the risks that banks faced. Tóth (2014) argues that, given an insignificant relationship between derivatives use and overall risk for banks, the fair valuations of these types of instruments are sufficient to provide substantive financial information. In other words, disclosure requirements were sufficient to provide adequate information on derivatives use and the use of derivatives did not significantly impact overall risk for banks. The current study excludes financial companies from the dataset, but an important finding from Tóth's (2014) research is the suggestion that the fair value representations of derivatives instruments in financial statements of companies offer sufficient information on the use of derivatives by such companies. The current study therefore assumes that the fair values disclosed in the financial statements are a fair representation of derivatives use by companies.

Atilgan, Demirtas and Simsek (2016) reviewed the literature on using derivatives and derivatives markets in emerging market economies. They reviewed 152 articles from 11 leading international journals. The most important findings from their review were that research current at that time focused on the markets in Korea, Taiwan and China, that the most popular topics investigated were market structure and price discovery, and that equity index futures were the instruments most studied. There was a dearth of cross-country comparative studies, as well as research on the OTC markets. These findings are important for the current study, which attempts to add to this body of knowledge and fill the gap identified by Atilgan *et al.* (2016) by conducting research on the derivatives market in South Africa, which was included as an emerging market economy in studies mentioned in Atilgan *et al.*'s (2016) review. The current study attempts to provide a basis of research on derivatives markets in South Africa for future comparative studies in respect of emerging market economies compared to developed economies.

Research into emerging markets has increased in importance in recent years, not least due to the impact of the 2008/2009 financial crisis on the economies of both developed and developing nations. At the time, some investors experienced large losses when the US equity index on the S&P 500 declined by as much as 32% and large cap stocks on the Dow Jones decreased by 28% during the financial crisis. However, equity market indices in emerging economies increased by as much as 85% in Sri Lanka, 54% in Colombia, and 7% in Argentina and South Africa, and volume in trade also increased significantly (Atilgan *et al.*, 2016). The growth in these markets and economies reinforces the need for further research on derivatives markets in emerging economies.

3.3.3 Studies on South African data

Although only limited research has been conducted on the effect of derivatives use on firm value for firms listed on the JSE in the past, several studies in South Africa have focused on the pricing of derivative instruments.

The use of derivatives by South African companies was found to compare favourably with that of companies in developed economies (Correia *et al.*, 2012). Correia *et al.* (2012) gathered data by means of a comparative questionnaire survey to determine the extent and motivations for derivatives use by South African companies. South Africa as a small, emerging market economy is exposed to volatile exchange rates and interest rates. Close to 90% of companies in the study used derivatives – exchange rates were mostly hedged by OTC forward contracts, while interest rates were mostly hedged by swaps (Correia *et al.*, 2012). South African companies, in contrast to firms in most developed economies, are subject to exchange controls and are only allowed to hedge actual contractual exposures and not anticipated exposures. Furthermore – an important finding with implications for the current study – Correia *et al.* (2012) pointed out that South African companies did not use derivatives for speculation. Correia *et al.* (2012) called for future research to investigate the relationship between using derivatives and factors such as leverage, firm size, liquidity and dividend policy. The current study answers this call by investigating the determinants of derivatives use by South African firms.

Firms in South Africa represent the vast bulk of derivatives users on the African continent. Only some 5% of firms in Africa use derivatives for hedging purposes, of which South African firms contribute 82% (Holman *et al.,* 2013). From a sample of 692 firms in 20 countries in Africa, only 29% used derivatives. A total of 54% of South African firms used derivatives (Holman *et al.*, 2013). The findings by Holman *et al.* (2013) are indicative of the underdeveloped nature of financial markets in Africa in comparison to markets in developed economies, but South Africa seems to follow other emerging market economies in the world more closely than other countries in Africa.

The development of the derivatives markets of emerging economies (such as those in Africa in general and South Africa in particular) is much less prominent than that of such markets in developed economies. As indicated above, Holman *et al.* (2013) showed the limited extent of the use of derivatives by African firms. Their findings are supported by Upper and Valli (2016), who found that only 10% of derivatives contracts were denominated in the currency of an emerging market economy. The portion of the global derivatives market contributed by emerging market economies is much smaller than their comparative share in world GDP and world trade. South Africa is lauded by Upper and Valli (2016) for significant market activity in its currency trading and for coming closest of the emerging market economies to both the total turnover (relative to GDP), and the foreign exchange derivatives turnover (relative to trade) of the developed economies. However, these ratios are still far below the average of developed economies.

Furthermore, fewer types of instruments are traded in emerging markets and these instruments are also more likely to be traded OTC. It is possible that market participants in emerging market economies have little access to formal financial institutions and find using derivatives too costly. The small extent of derivatives trading in emerging markets can be another reason for the lack of research on derivatives markets from emerging market economies (such as South Africa). Since South Africa has well-functioning financial infrastructure and easily available information on financial markets, studies on South African data can be used as a proxy for other similar emerging market economies.

Other studies on derivatives using South African data focus more on the valuation and volatility of these instruments. Kotzé, Labuschagne, Nair and Padayachi (2013) aimed to construct a market-related arbitrage-free implied volatility surface for two stock indices and ten single stock futures (SSFs), using a quadratic deterministic function. Kotzé *et al.* (2013) investigated actual traded data to show how all no-arbitrage conditions are implemented and tested. Implied volatilities are often employed to quote the prices of options; for instance, the implied volatility of a European option on a particular asset as a function of the strike price and the option's time to maturity is known as the asset's volatility surface. Traders monitor these volatility surfaces closely. Kotzé *et al.* (2013) found that the implied volatility and moneyness of two indices and 10 SSFs on the JSE can be explained by a linear model. They used a quadratic deterministic volatility function for three years of traded data. Furthermore, they found that the volatility surfaces have different shapes for different SSFs listed on the JSE and suggested that their model can assist the South African clearing house in generating volatility surfaces. Although theory on pricing derivatives instruments diverges from the focus of the current study, an important aspect of Kotzé *et al.*'s (2013) work for the current study is that their findings are consistent with observations from mature markets, indicating the level of maturity of the derivatives market on the JSE. That said, the South African economy as a whole is still considered an emerging market economy, despite the country's advanced financial systems. South Africa is listed together with Brazil, Russia, India and China, as one of the BRICS countries, which are deemed to be at a similar stage of advancing economic development.

Other research on South African data has attempted to determine whether the institutionalisation of derivatives trading could enhance growth prospects for countries in Sub-Saharan Africa. Bekale *et al.* (2015) examined the impact of derivatives trading on output and growth volatility, using the South African economy. Bekale *et al.* (2015) failed to find statistically significant changes in pre- to post-derivatives output growth and little causality between SAFEX trading volumes and the real economy growth of South Africa. However, enough evidence exists from other studies to suggest that the institutionalisation of derivatives trading can have a positive effect on economic development, and that countries with a well-functioning derivatives market can experience higher economic growth. Bekale *et al.* (2015) looked at the derivatives markets from a macro-economic perspective, while the current study adopts a more micro-economic perspective to determine from an individual firm's point of view what effect derivatives trading have on firm success.

There is limited research on the value relevance of derivatives disclosure on South African data, although previous research by Toerien and Lambrechts (2016) found that there was a limited positive influence from using derivatives on firm value for 40 non-financial firms listed on the JSE. It is this gap in value relevance research that the current study addresses.

3.4 SUMMARY AND CONCLUSION

This chapter discussed the literature on the determinants of derivatives use and such use as part of broader corporate financial risk management. Evidence from studies in different parts of the world often provided contradictory results on why companies use derivatives. The gaps in the literature and the lack of consensus provided the impetus for the current study to contribute to this discussion. The next chapter discusses the different uses of derivatives by companies in more detail.

CHAPTER 4:
CORPORATE USE OF DERIVATIVES

4.1 INTRODUCTION

Research on firms' use of derivatives has diverged in recent years: a significant portion of research focuses on the relationship between derivatives and the financial characteristics of firms, but there is also research on whether investors reward firms that use derivatives with a higher firm value.

This chapter discusses the use of derivatives as part of firms' corporate risk management strategy and the effect that such use of derivatives has on firms' value.

4.2 DERIVATIVES AND THE 2008/2009 FINANCIAL CRISIS

The 2008/2009 financial crisis, and the causes of the crisis have been the subject of much debate since the first effects of the US subprime mortgage crisis began to ripple through global financial markets. Many reasons for the crisis have been postulated, and one of these is the role played by sophisticated financial instruments, such as derivatives, in causing and magnifying the effects of the crisis.

There are several reasons why it is important to understand the role of derivatives in exacerbating the financial crisis. The internationalization of financial markets across the globe has had the effect that very few domestic markets can isolate themselves from the impact of a global crisis. The interconnectedness of financial markets means that problems in overseas markets affect domestic markets as well. Derivative instruments trade internationally and are often a way in which smaller investors gain access to larger international markets. These derivatives instruments can thus contaminate domestic markets with problems from abroad. Finally, the sheer size of derivatives markets globally, compared to traditional financial markets, implies that any crisis experienced in these markets strongly influences almost every aspect of global financial markets. The role derivatives played in the 2008/2009 financial crisis and the impact of the financial crisis are discussed in more detail in Section 4.2.1.

4.2.1 The role of derivatives in the financial crisis period

Following the 2008/2009 financial crisis, derivatives were strongly blamed for both causing the crisis and exacerbating the effects of the global financial meltdown. Hence, several researchers have studied the role that derivatives played in the financial crisis and the impact derivatives had on firm risk, firm value and security prices.

Petrova (2009) argues that, even though derivatives – especially complex derivative products such as credit default swaps and collateralized debt obligations – have been blamed for creating the US subprime mortgage crisis that led to the global financial crisis, they are not necessarily to blame. Petrova (2009) suggests that it is rather a combination of several factors that caused the initial problems and led the crisis to escalate to global proportions. These factors include how the US derivatives market is structured, the creation of low-quality mortgages with sub-prime securitisation and the ensuing regulatory arbitrage of those mortgages (Petrova, 2009). Other factors are the long-term increase in US housing prices, corporate greed in chasing short-term profits over shareholder wealth creation, a lack of regulation, specifically in the OTC market and for credit default swaps, and collateralized debt obligations as off-balance sheet instruments (Petrova, 2009). Credit ratings agencies are also implicated, as they failed to take responsibility and applied inappropriate methodologies to identify risk. Moreover, toxic financial statements by financial institutions harbouring toxic assets, and large exposure to these instruments contributed to the crisis (Petrova, 2009). When the housing market crashed, all these potential factors contributed to magnify the ensuing financial crisis (Petrova, 2009). Markets worldwide were contaminated due to the extent to which global financial markets are integrated, the excessive and uncontrolled use of complex derivative instruments, and the exposure of international banks to toxic assets in their financial statements, as well as to dangerous levels of leverage.

Petrova (2009) points out that bankruptcy is a potential condition in a free market. The fact that the US government needed to bail out institutions such as Merril Lynch and Bear Sterns by using taxpayers' money indicates the fundamental danger of improper use of derivatives: the lack of understanding of complex derivative instruments and the misuse of these derivative instruments caused corporate failure to the extent that flagship financial institutions went bankrupt, and this had massive repercussions for global financial well-being.

Jickling (2009) provides a helpful summary of the most important theories on the causes of the financial crisis proposed by various authors. The creation of hybrid derivative instruments including mortgage-backed securities became widespread in the years leading up to the 2008/2009 financial crisis. Mortgage-backed securities were dispersed widely within the financial network, so the subprime crisis affected not only those mortgage loans that were securitized, but also non-securitized mortgage loans (Jickling, 2009). Several of the factors thought to have caused the financial crisis are relevant to the current study, including securitization, mark-to-market accounting, off-balance sheet financing, the complexity of financial instruments, credit default swaps and OTC derivatives.

In the US, the FASB requires companies to disclose the value of the financial instruments they hold at fair or current market value. During difficult financial periods, this regulation can force certain companies, for instance, financial institutions, to recognize losses at prices that could theoretically be far below the long-term fundamental value of the instruments, exacerbating the effects of economic downturns and reducing market confidence. It can be argued that this uncertainty about the true financial health of financial institutions, especially during turbulent economic periods, can in itself both cause and exacerbate a financial crisis. Although accounting standards attempt to provide a true and fair reflection of a company, those standards are not perfect, so they are both fallible and open to abuse. Tinkering with those standards can also have an unintentional negative impact on the reliability of published financial information.

The complexity of financial instruments can cause a financial crisis when investors and regulators are unable to accurately assess the risks associated with the instruments involved. Logically, rational investors should not invest in instruments that they do not fully understand or are not fully able to value, but such investments are in fact commonly made. Furthermore, instruments such as credit default swaps and credit derivatives seem to have increased credit risk, rather than to have mitigated risk, as originally intended. The lack of clarity on risk exposure when investors assess derivatives' risk is compounded when those derivatives are traded on OTC markets, which are often not regulated, and where little information is available (Jickling, 2009).

Barth and Landsman (2010) argue that fair value accounting played only a small role in causing the financial crisis. Financial reporting on fair value, asset securitization, derivatives and loan loss provisioning are unlikely to have played a role in the financial crisis – rather, there was insufficient transparency regarding information on asset securitization and derivatives for investors to assess the level of riskiness properly. Barth and Landsman (2010) rightly mention that the stability of the financial system is the responsibility of the banking sector and not the responsibility of accounting standard setters; the objectives of banking regulators and accounting standard setters are different. Therefore it is unlikely that changes to financial reporting requirements would correspond exactly to the changes that the banking regulators need to make to strengthen the banking sector. They note, however, that it is important that enhanced disclosure about derivatives and the recognition of assets or liabilities left over after securitization improve transparency and reflect the risk associated within banks assets and liabilities better (Barth & Landsman, 2010).

Stunda (2014) explored the information content of earnings on security prices for firms that used derivatives and for firms that did not use derivatives during three periods: the pre-crisis, during-the-crisis, and post-crisis periods. The dataset used in his study was expanded to differentiate between (a) firms that received Troubled Asset Relief Program (TARP) funding and used derivatives, (b) firms that did not receive TARP funding and used derivatives, and (c) firms that neither received TARP funding nor used derivatives. TARP refers to the almost $1 trillion of taxpayer money that the US government allocated to bail out 'troubled assets' such as mortgages, securities, obligations and instruments that were used as speculative derivatives.

The accounting earnings of firms that used derivatives and received TARP funding showed positive information-enhancing signals in the pre-crisis period, but in the during-the-crisis and post-crisis periods they displayed negative information-enhancing signals (Stunda, 2014). This finding suggests that investors discounted accounting earnings releases when they made investment decisions in these periods. The accounting earnings displayed positive information-enhancing signals on security prices for firms that used derivatives but did not receive TARP funds, and for firms that neither used derivatives, nor received TARP funds for all three periods (Stunda, 2014). These findings suggest that investors relied on earnings releases for these firms when the investors made investment decisions. Stunda's (2014) results indicate that derivatives are both useful and risky for companies to use, but that well-informed investors, such as institutional investors, are capable of discerning which companies are using derivatives correctly, versus which ones are not.

A large amount of research has been dedicated to exploring the causes and effects of the global financial crisis of 2008/2009, identifying many possible reasons. Subsequent research has also investigated the contribution made by these factors to both causing and exacerbating the financial crisis, not least the impact of derivatives. It is beyond the scope of the current study to investigate in detail the effect that using derivatives had in causing the financial crisis. Most researchers agree that it was a combination of factors that caused the financial crisis, and derivatives played some role in the crisis, whether it was direct or indirect.

4.2.2 The impact of the financial crisis on emerging market economies and the use of derivatives to hedge risk

South Africa is considered a developing country and an emerging market economy. Developing countries and emerging market economies are vulnerable to external shocks, for instance, the 2008/2009 global financial crisis. This vulnerability arises for several reasons, including the relatively small weight of such economies in terms of international trade, their being subject to exchange rate fluctuations, and their high dependence on the agriculture and mining sectors.

Several researchers have attempted to determine the impact of the financial crisis on developing countries and emerging market economies (Essers, 2013; Griffith-Jones & Ocampo, 2009; Naudé, 2009; Salman, Chivakul & Llaudes, 2010). For the purposes of the current study, is it helpful to understand both the causes of the 2008/2009 financial crisis, and the effect of such crises on emerging market economies. Because the current study focuses on data collected from South Africa as an emerging market economy, to enhance understanding of how derivatives can be used as risk management tools to mitigate the effects of international financial problems, it is important to understand first exactly how emerging markets are affected by such international crises.

There are several reasons for developing countries' susceptibility to the adverse impact of global financial crises. Naudé (2009) argues that, firstly, financial contagion affects emerging market economies. This happens when financial institutions in emerging market economies hold assets in advanced economies: they are then exposed to negative consequences from adverse circumstances in those developed countries. A decrease in stock prices and house prices in developed markets indirectly reduces the capital available to financial institutions in emerging market economies, and this can have a knock-on effect on investment, growth and employment. Secondly, a recession in developed economies can reduce earnings from exports from emerging countries, most of which (for example, China and India) depend on growth in their export market or depend on exporting commodities (for example, South Africa). Thirdly, financial flows from official development assistance, foreign direct investment, trade credit and financial remittances are all negatively affected by a recession in advanced economies, and can have a severe impact on the growth rate of developing countries, because then less investment flows to those countries (Naudé, 2009).

Although many developing countries were indeed constrained by the crippling effects of the credit crunch, some countries showed remarkable resilience in the face of these extraneous shocks. Naudé (2009) highlights six possible reasons for some countries' ability to buffer the effects of the international crisis. These reasons include the fact that the epicentre of the crisis was a developed economy, not an emerging market, as in some previous crises. Another was that the financial sectors in developing countries were not necessarily directly affected. A measure of decoupling of the growth rates of developed and developing countries in recent years, good growth and better policies in developing countries, as well as taking note of lessons from the 1998 Asian crisis, has helped some developing countries' economies to become more resilient to global shocks. The largest developing countries, namely China and India, continued to grow during the crisis, albeit at a slower pace, thereby mitigating the effects of the crisis on their trading partners. Finally, various fiscal expansion programmes undertaken by developing countries helped to mitigate the extent of the damage caused by the crisis. That said, the financial crisis and the ensuing credit crunch has highlighted the dependence of developing countries on advanced economies for trade, and the continued vulnerability of these countries to external elements. They also highlighted the need for reform in international financial regulation.

Griffith-Jones and Ocampo (2009) also identified three determinants that play a significant role in how developing countries are affected by international financial crises, namely remittances, capital flows and international trade. Exceptional financing, high remittances, high commodity prices and the growth of China as an alternative financing and trading destination spurred growth in many developing countries prior to the financial crisis, so it was the reversal of these factors, combined with the emerging recession in the US and other developed countries, that drove the financial crisis in developing countries.

The extent to which individual emerging market economies were affected by the global financial crisis also depended on their level of trade and financial linkages to advanced economies, as well as by economic fundamentals (Salman *et al.*, 2010). The impact of the financial crisis was more pronounced in emerging market economies with weaker economic fundamentals and with higher trade and financial linkages, such as demand in advanced economies and foreign bank claims. Some emerging market economies were able to weather the impact to some degree. Higher reserves and better policy fundamentals and vulnerability indicators during the pre-crisis period helped buffer emerging market economies against the crisis.

In view of the impact of the financial crisis on developing countries (both emerging market economies and low-income countries), some researchers have investigated how vulnerable these countries are to exogenous shocks, and have sought ways in which these countries could address their vulnerability to such shocks. Developing countries were affected because the crisis originated in the US and Europe, resulting in a decrease in trade and private investment flows, but also in the slow-down of remittances and bilateral aid. Such external shocks are detrimental to developing countries, since output volatility hampers both growth and the reduction of poverty (Essers, 2013).

Essers (2013) identified both the advantages and drawbacks of four key ways in which emerging market economies can deal with their vulnerability. First, only trying to cope with the aftermath is backward-looking and can be painful. Second, the prevention of such shocks by lowering exposure is a long-term process. Third, self-insurance has big opportunity cost implications. Lastly, market insurance and hedging might be unavailable, and may be politically sensitive (Essers, 2013). Most importantly for the current study, Essers (2013) stresses the importance of market insurance and the development of financial markets to assist developing countries in hedging themselves against external shocks to protect themselves. Essers (2013) looked at three possible interventions, namely local currency lending, currency derivatives and contingent credit facilities.

Regarding local currency lending restrictions on the International Bank of Reconstruction and Development (IBRD), it is important that the Inter-American Development Bank, the Asian Development Bank and African Development Bank prohibit the International Bank of Reconstruction and Development from holding open currency positions (but not necessarily from retaining non-credit risks), which means that local currency risk from these institutions needs to be backed by borrowings in the same currency or must be hedged using currency risks (Essers, 2013). These interventions have the effect of excluding precisely those countries that are most in need of loans and that do not have deep local currency markets, nor access to advanced currency derivative instruments to hedge themselves. The International Bank of Reconstruction and Development offers countries the ability to hedge with derivatives through its Flexible Loan products to tailor repayments terms, time to maturity and the amortization schedule (Essers, 2013). It also offers access to risk management instruments such as currency and interest rate conversion options and currency and interest rate swaps. However, again, these instruments are largely only available to countries that already have sufficient development of their financial markets to allow for such instruments to be used (Essers, 2013).

Currency risk can also be managed through a Dutch initiative, the Currency Exchange Fund, launched by the Netherlands Development Finance Company. It uses a hedge fund to offer medium-term and long-term swap agreements to convert hard currency into local currency for their stockholders (Essers, 2013). The Currency Exchange Fund offers an avenue for, amongst others, the African Development Bank and Inter-America Development Bank to offset some currency risk. International financing institutions have, however, been reluctant to expand contingent financing facilities such as credits or grants to developing countries without additional contingencies attached (Essers, 2013).

In terms of the current study, Essers' (2013) findings point to the need for developing countries to apply financial risk management strategies and exploit advanced financial instruments for hedging purposes to protect themselves against volatility in global markets. Furthermore, the study calls attention to the lack of research on the use of derivatives by emerging market economies in view of the potential impact of international financial crises on developing countries (Essers, 2013). The current study responds to this lacuna in the discourse, specifically assessing the use of derivatives in an emerging market economy, South Africa, and the impact of that strategy in different economic and financial climates, by comparing the value relevance of derivatives use during three different periods, namely prior to the 2008/2009 financial crisis, during the financial crisis and in the post-crisis period. The current study thus also attempts to provide a basis from which future research can be conducted.

Aizenman, Jinjarak, Lee and Park (2016) also explored the vulnerability of developing countries to global shocks such as the 2008/2009 global financial crisis and the Eurozone sovereign debt crisis. Developing countries suffered a consistently negative effect on returns on equity and bond markets during the financial crisis, but the effects from the Eurozone sovereign debt crisis were more mixed and limited. Developing countries are clearly still vulnerable to external shocks originating from advanced economies, due to the interdependence of financial markets (there are spill-overs in equity and bond investments), the exposure of banks through cross-border lending, and the various trade links (Aizenman *et al.*, 2016).

The Eurozone sovereign debt crisis arose from the unsustainably high public debt of periphery countries in the Eurozone (Aizenman *et al.*, 2016). Heavy exposure of Eurozone banks to such debt can hurt developing countries for two reasons. Firstly, the Eurozone is a large (often the largest) trading partner of many developing countries, so Eurozone economic trouble can be contagious to countries that depend on trade with the Eurozone (Aizenman *et al.*, 2016). Secondly, due to the interdependence of financial systems, if there is financial instability in the Eurozone, it can spill over to developing countries. Aizenman *et al.* (2016) found that the global financial crisis had a larger impact on the returns of equity and bond markets than the

Eurozone crisis did, probably due to the larger impact of the global financial crisis overall, and the fact that the Eurozone crisis was more limited, namely to countries in the European Union (EU). However, they highlight the dependence of developing countries on advanced economies and the likelihood of contagion to developing countries of financial instability and economic problems originating from advanced economies (Aizenman *et al.*, 2016).

To build on the prior studies discussed above, the current study divided the data collected from the JSE into data from different economic periods, namely the pre-crisis, during-the-crisis and post-crisis periods, to determine whether companies' use of derivatives during this time was effectual in protecting firm value (which is the purpose of implementing a risk management strategy and using derivatives). Once it has been established whether or not using derivatives in an emerging market economy is able to influence firm value, that information can be used as a platform for future research that can more specifically ascertain the specific value-creating (value-protecting) abilities of derivative instruments.

4.3 DERIVATIVES, RISK MANAGEMENT AND FIRM VALUE

4.3.1 Risk management and firm value

Early research on corporate risk management established the benefits of hedging. These studies posit that if external finance is more costly than internally generated funds, corporations benefit from risk management practices such as hedging, by ensuring that sufficient funds are available to take advantage of potential investment opportunities (Froot, Scharfstein & Stein, 1993). However, even an optimal hedging strategy does not insulate firm value against market risk, so the more closely a firm's cash flows are correlated to future investment opportunities, the less likely the firm is to hedge. Conversely, the more closely a firm's cash flows are correlated to a firm's collateral values, the more likely the firm is to hedge. Multinational firms' hedging strategies depend on several additional factors, such as exchange rate considerations, so some multinational firms aim for a fixed quantity of foreign investment in the countries they operate. It seems that firms are better to able to align investment and financing strategies if they use non-linear instruments such as options. Importantly, there are meaningful distinctions between forwards and futures as hedging tools. Moreover, it seems that the optimal hedging strategy for a firm is also dependent on the hedging strategies of its competitors (Froot, 1993; Froot *et al.*, 1993).

These early findings by Froot *et al.* (1993) have important implications for the current study. Froot *et al.* (1993) suggest possible reasons for firms' adoption of corporate risk strategies, and they implicitly assume that such strategies include using derivative instruments. Furthermore, they suggest a direct link between corporate risk management (and using derivatives) and firm value, implying that the implementation of a corporate risk management strategy is directly linked to firm value. The current study focuses only on firms' use of derivatives as part of an overall corporate risk management strategy, and therefore excludes other strategies that firms may implement as part of risk management.

4.3.2 Derivatives and firm value

Allayannis and Weston (2001) were some of the first researchers to investigate whether firms' use of derivatives affects firm value. They used a sample of 720 large non-financial firms in the US to test the impact of using foreign currency derivatives on Tobin's Q. They found that using foreign currency derivatives is positively associated with firm value, given their control variables: size, profitability, leverage, growth opportunities, the ability to access financial markets, geographic and industrial diversification, credit quality, industry effects (depending in which sector they operate) and time effects.

Continuing the exploration of the impact of hedging strategies in specific industries, Jin and Jorion (2006) used a sample of 119 US oil and gas producers to evaluate the effect of hedging activities on firm value. Their findings contradicted those of Allayannis and Weston (2001), as they found no difference between the firm values of firms that used derivatives and those of firms that did not. They argue that firms in the oil and gas industry approach Mogdiliani and Miller's (1958) irrelevance conditions, according to which any hedging of financial risks by firms in this industry does not confer much of an advantage, since investors can hedge these (easily identifiable) risks on their own. The hedging premium found for a large sample of multinationals could arise from other factors, such as informational asymmetries, or operational hedges that add value. So it is not necessarily the use of derivatives that drives the hedging premium – the hedging premium may in fact be dependent on the risks the given firm is exposed to (Jin & Jorion, 2006).

Allayannis, Lel and Miller (2011) considered a sample of firms from 39 countries to examine the influence of corporate governance in the decision of firms to use foreign currency derivatives, and the impact of such use on firm value. They found a value premium for firms that exhibited strong internal or external corporate governance. This value premium was found to be most pronounced for firms that had both strong internal firm governance and strong external country level governance (Allayannis *et al.*, 2011). Their findings imply that investors assess the quality of corporate governance with regard to derivatives use, and that quality corporate governance leads to sound economic reasons for hedging with foreign currency derivatives. This is then in turn reflected in the value premium.

4.3.3 International evidence on derivatives and firm value

Several studies in recent years have focused on derivatives use in different countries, to establish whether using derivatives adds to firm value, given the difference in setting, situation and level of development of the various financial markets. These studies report conflicting and often contradictory evidence on the influence of the use of derivatives on firm value. Studies from different countries with different characteristics, development and maturity of their financial markets can broaden our understanding of how derivatives markets function. Furthermore, comparative studies between derivatives markets in different countries can help to establish whether differences arise from country-specific reasons, or whether derivatives markets function in the same way, regardless of their geographic locations.

Previous studies have focused on companies' use of derivatives as a hedging tool. The current study compares the value creation (or value destruction) abilities of using derivatives in different economic cycles. The purpose of using derivatives as a hedge is to protect firms against loss of value during difficult economic cycles, so the current study attempts to determine whether the use of derivatives by companies listed on the JSE was successful in adding to firm value, or protecting firm value during downward cycles.

4.3.3.1 Derivatives and firm value in developed countries

Early research into the relationship between using derivatives and firm value focused mainly on companies listed in the US. Allayannis *et al.* (2011) found a positive relationship between using foreign currency derivatives and firm value, proxied by Tobin's Q, for large financial firms in the US. They argue that firms hedge to address the frictions that contradict Modigliani and Miller's (1958) model of perfect markets, such as the existence of taxes, transactions costs, or the cost associated with financial distress. Previously, Allayannis and Weston (2001) used different univariate and multivariate tests to control for other known drivers of firm value, including firm size, profitability, leverage, growth opportunities, the ability to access financial markets, both geographic and industrial diversification, credit quality, industry effects, firm fixed effects, and time effects. Moreover, they used alternative measures of Tobin's Q and firm value, and alternative specifications to account for the effect of potential outliers. Firms that started a hedging programme were able to increase firm value, while firms that remained unhedged or did not initiate a hedging policy experienced a decrease in firm value relative to hedged firms.

Different researchers have focused on specific sectors of the US economy. Jin and Jorion (2006) found then although hedging with derivatives enabled firms to decrease stock price sensitivity to oil and gas prices, hedging with derivatives did not affect the market value for 119 oil and gas producers. Jin and Jorion (2006) used a homogeneous sample of firms in a single US sector to eliminate some spurious and confounding factors that could influence their findings, as would have happened if they had included multinationals as Allayannis and Weston (2001) did. The hypothesis that risk management is always a value adding strategy for firms suggests that there are crucial differences in the type of risk hedged, and this in turn implies that the hedging premium depends on the type of risk that is being hedged. Commodity risk, such as the risk hedged against by oil and gas producers, is easy to identify and is also easy for individual investors to hedge against, which means that this particular sector comes closer to Modigliani and Miller's (1958) irrelevance proposition. The risk associated with foreign currency exposure is harder to identify, and hence more difficult for individual investors to diversify away. Moreover, foreign exchange hedges could reflect other factors that add to firm value, such as informational asymmetries or operational hedges that can be positively correlated with the presence of derivatives (Allayannis & Weston, 2001).

Shares of airlines that hedge jet fuel prices trade at a premium (Carter, Rogers & Simkins, 2006). They found that investors valued airlines that used jet fuel hedging at a premium, and indeed valued hedging more where they expected the hedge to protect the airline’s ability to invest in adverse times. The reduction in risk exposure to jet fuel price increases is economically significant, so hedging jet fuel prices is a value adding strategy for airlines. Furthermore, investment opportunities in the airline industry correlated positively with jet fuel costs, as higher jet fuel costs are consistent with lower cash flow. Therefore, most of the hedging premium is due to the interaction of hedging with investments, and hence it is attributable to a decrease in underinvestment costs (Carter *et al.*, 2006).

More recently, Pérez-González and Yun (2013) used the introduction of new weather derivatives and the use of these innovations by energy firms to show that risk management has an impact on firm outcomes, and that implementing active risk management strategies can lead to an increase in firm value. They used the introduction of new innovative tools targeted at specific economic risks as an exogenous shock to a subset of utility firms and the cost of hedging weather-related risks. They looked at the introduction of these instruments to compare the relative valuation of firms exposed to weather risk and found a positive effect on firm value. Firms that used these instruments were able to increase debt capacity, investments and smooth earnings, indicating that using financial derivatives had a positive impact on firm value and that firms can influence their market value by active risk management (Pérez-González & Yun, 2013).

Adam and Fernando (2006) studied quarterly observations on cash flows from 92 gold mining firms in North America, and observed economically significant increases in cash flows from derivative transactions. Adam and Fernando (2006) found a positive realized risk premium, stemming mostly from positive cash flow gains between the contracted forward prices and realized spot prices. Concurrently, they found no evidence of an increase in systematic risk for firms in the sample, implying that these derivative transactions increased shareholder value. Their study shows that transactions with derivatives do not have a zero net present value (Adam & Fernando, 2006). This is important, because studies prior to theirs did not consider the increase in risk premiums that gives rise to positive cash flows as an important motive for firms to use derivatives. They proposed that the increases in shareholder value could stem either from the mitigation of market imperfections, or from risk premiums in the forward markets, but they admitted that it is difficult to pinpoint exactly which of the two applies (Adam & Fernando, 2006). In other words, positive cash flows from derivatives transactions can lead to increases in shareholder value, and this could be a motive for firms to use derivatives (Adam & Fernando, 2006). In addition Adam and Fernando (2006) also found that expected positive cash flows from selective hedging (timing derivatives transactions, or incorporating market views into hedging strategies) were small.

Selective hedging can skew results regarding the value adding abilities that arise from using derivatives. In other words, selective hedging can negate the positive impact the use of derivatives has on firm value. Incorporating managerial market views and timing derivatives transactions directly influences corporate financial risk management strategy, which could skew findings from studies attempting to isolate the value creation opportunities that arise from using derivatives. Thus, if managerial market views and the timing of hedging transactions (in other words, selective hedging) are included in corporate hedging decisions, this implies that an element of speculation is introduced into corporate hedging strategy. Brown, Crabb and Haushalter (2006) investigated whether selective hedging had a significant bearing on operational or financial performance. Examining the time variations in the hedge ratios of a sample of 44 gold producers, they found that the incorporation of managerial views into corporate hedging can lead to limited success, but that shareholders did not benefit significantly from such selective hedging. Brown *et al.* (2006) suggest that selective hedging is widespread for a number of reasons, including using selective hedging to defend derivative positions, or to insulate the value added. The success of some selective hedging strategies could also convince senior management that those strategies are successful in adding value. Finally, the lack of an optimal hedging ratio may allow for firms to justify any hedging ratio (Brown *et al.*, 2006).

MacKay and Moeller (2007) found a positive relationship between firm value and corporate risk management strategies for a sample of oil refineries in the US. Their findings seem to show that it is the interaction between hedge rates and risk management values, rather than the hedge rates themselves, that act as the pivotal driver of value creation. They concur with Jin and Jorion's (2006) conjecture that previous findings by Allayannis and Weston (2001) which showed a positive relation between firm value and derivatives use may in fact be due to the competitive advantage of firms over individual investors in the financial derivatives markets. This advantage does not exist in the commodities market, and so, firms that hedge financial risks add to firm value, whilst firms that hedge operating risks, or both financial and operating risks, do not add value by means of these strategies.

In another study focusing primarily on a sample of oil and gas producers, Lookman (2004) tested the theory that hedging with derivatives increases firm value by decreasing deadweight costs associated with cash flow volatility. Lookman (2004) found that the value-increasing effects of using derivatives were marginal. By splitting the sample of firms into those that hedged primary risk versus those that hedged secondary risk, it was determined that firms that used derivatives to hedge primary risks traded at a discount to unhedged firms, whilst firms that hedged secondary risks traded at a premium. Lookman (2004) argues that his findings reflect the theory that hedging serves as a proxy for other drivers of firm value: specifically, hedging primary risks reflects poor management and high agency costs, while hedging secondary risks is a proxy for low shareholder-management conflicts.

In the last two decades, firms have begun to use derivatives to hedge against a range of different risks. More complex derivative instruments are constantly developed to hedge against a wider set of risks, not limited to the traditional financial risks that companies face. For example, Brockett, Wang and Yang (2005) explored the weather risk derivatives market, the effectiveness of hedging with weather derivatives and optimal hedging with weather derivatives, taking into consideration basis risk and credit risk. The weather derivatives market was then considered the fastest growing derivatives market, but it blurs the distinction between insurance and financial management. Firms should take into account that basis risk is carried by hedgers in standardized contracts, but firms must bear credit risk in OTC contracts. Brockett *et al*. (2005) noted that at the time of their study, there were neither actuarial valuation models nor complete market pricing models for pricing weather derivatives. Hence, users of such derivatives should take care, because a consistent pricing model is needed to grow the market. Such growth can have a huge impact on corporate dual hedging with both price and volume/quantity risks (Brockett *et al*., 2005).

In a world of perfect markets, such as one assumed by Modigliani and Miller's (1958) model of perfect markets, active corporate risk management cannot increase shareholder value. However, the existence of market imperfections, such as financial distress costs, taxes and the cost associated with external funding, can lead firms to try to increase shareholder value by managing these imperfections (Aretz & Bartram, 2010). Aretz and Bartram (2010) reviewed empirical research to identify conflicting rationales for corporate risk management strategies and the ability of such strategies to increase shareholder value. Most of the reviewed studies suggest that derivatives use was associated with debt levels and maturity, dividend policy, holding liquid assets and the degree of operating hedging (Aretz & Bartram, 2010). They also point out the limitations of empirical research with regard to investigating derivatives use by companies. These limitations and challenges include endogeneity and identification problems, difficulty in understanding and capturing the effects of underlying structural parameters in empirical analyses, and the fact that most empirical studies used a single variable, namely derivatives use, to proxy for firms' hedging strategies. Furthermore, and this is important for the current study, they point out that most of the reviewed studies classified firms either as hedgers or as non-hedgers, without allowing for the possibility that firms could move between these two groups over time (Aretz & Bartram, 2010). They also draw attention to the fact that the use of derivatives by firms often forms part of a larger risk management strategy that includes pass-through, operational hedging and foreign debt, and that the use of derivatives may only serve to fine-tune such an overall strategy.

The current study attempts to differentiate between firms that used derivatives for hedging, and those that used derivatives for speculative reasons, by analysing how derivatives use was disclosed by firms in the financial statements and the notes to the financial statements. The current study takes note of the caveat by Aretz and Bartram (2010) to be sensitive to the possibility that firms could move between hedging and speculating over time and that therefore firms may not necessarily be part of the same group for the entire period included in the sample. Furthermore, the current study also notes that firms could use derivatives for both hedging and speculating reasons within one year, or even within a single transaction. When firms use derivatives but time that use to expected market movements, that use is generally referred to as selective hedging.

The ability of firms to use derivatives effectively and to increase firm value by doing so can also depend on other firm characteristics. Fauver and Naranjo (2010) found a negative correlation between derivatives use and firm value, measured by Tobin's Q, for 1 746 firms headquartered in the US that exhibited agency and monitoring problems. Firms with greater agency problems, weaker corporate governance structures, greater information asymmetries and less transparency and monitoring displayed a negative association between derivatives use and firm value (Fauver & Naranjo, 2010). Their findings imply that other firm characteristics may influence whether firms are able to use derivatives successfully to increase firm value.

Fauver and Naranjo's (2010) findings have implications for the current study's empirical analysis of derivatives use compared to firm value. Researchers should be aware that derivatives use is influenced by several dependent variables (such as firm size, leverage, geographic diversification, liquidity and firm sector), and that other unidentified factors could also influence the success of a hedging policy, especially when researchers include a derivatives variable together with other known drivers of firm value (such as firm size, profitability, leverage, liquidity) to determine the effects on firm value. In other words, researchers should be aware of the fact that certain firm-specific characteristics can skew the results of empirical and statistical analyses simply because they have been omitted from a study. Some firm-specific characteristics that drive firm value may not yet be identified. It is therefore possible that some unidentified firm characteristics can influence the extent and motivation of companies' use of derivatives and hence the effects of such derivatives use on firm value.

No positive valuation effects for using derivatives were found for 250 French firms for the period from 2000 to 2002 (Ben Khediri, 2010). The firms were valued at a discount, depending on whether or not firms used derivatives, and the extent to which they did so, although the findings were not statistically significant in most cases (Ben Khediri, 2010). This suggests there are major differences between French and US firms. Possible reasons for French firms' derivatives use not adding value like that of their US counterparts may be differences in corporate governance and investors' perceived perceptions on insiders' motives, inherent risk aversion and the possible expropriation of minority shareholders by controlling shareholders. Furthermore, Ben Khediri (2010) suggests that it is managers' responsibility to disclose and explain adequately their firms' use of derivatives, whether the firms do so for hedging or speculative purposes, and how such use can increase firm value.

Other researchers have explored the impact of using derivatives on firm value for bigger samples of firms that incorporate many firms from different countries. Bartram, Brown and Conrad (2011) used a large sample of firms from 47 different countries, determining that derivatives use is associated with higher firm value, abnormal returns and larger profits, specifically during the economic decline of 2001 and 2002, indicating that firms were successful in hedging downside risk. Also, by using derivatives, firms were able to reduce both financial and systematic risk.

Campello, Lin, Ma and Zou (2011) explored the impact of hedging on firm value by focusing on how hedging can lower the probability of negative realizations and expected financial distress costs. They aimed to provide insight into how hedging influences corporate value. Specifically, Campello *et al.* (2011) investigated the consequences of companies' hedging policies on their ability to access capital and to make investments. The existing theories posit that hedging policies work as a commitment instrument that limits the set of possible cash flow realizations, which in turn makes it easier for firms to access external funding. This theory was confirmed by the Campello *et al.* (2011) study. This implies that hedging is able to affect corporate outcomes, and those effects are then reflected in firm valuation.

Belghitar *et al.* (2013) found little effect on firm value in the use of foreign currency derivatives in a sample of the largest French non-financial firms for the years 2002 to 2005. Although foreign currency derivatives were effective in reducing overall exposure, they were not able to create value, nor were programmes specifically targeting loss causing exposure effective in creating value (Belghitar *et al.*, 2013). Furthermore, Belghitar *et al.* (2013) split their sample between different types of currency, whether the currency was appreciating or depreciating, and between whether exposure was symmetric or asymmetric. Hedging policies ultimately had little positive impact on firm value, for a number of reasons (Belghitar *et al.*, 2013). These reasons included that the hedging programme was simply inappropriate, and that the risk exposure being hedged was influenced by economic factors which the hedging programme was ineffective in capturing. Moreover, gains from hedging policies were not enough to offset the costs of the financial, physical and human resources involved in running the hedging programme (Belghitar *et al.*, 2013). Furthermore, hedging policies acted as a shield against monitoring from external capital providers, and firms could use this protected capital for capital projects with a negative or zero net present value (value-reducing projects). Finally, an element of speculation can be included in the hedging policy, which could in turn increase exposure and thereby reduce the value creation abilities of a hedging programme (Belghitar *et al.*, 2013).

A study conducted on Australian data found little evidence that using derivatives added to firm value. Nguyen and Faff (2003) used both an aggregate measure of derivatives and individual types of derivatives to determine the impact on firm market value, proxied by Tobin's Q. They failed to find a positive relationship between using derivatives and firm value, and posit information asymmetry in the Australian market as a possible reason. Investors seem to be unable to distinguish the purpose for which Australian companies use derivatives and correspondingly value these users of derivatives at a discount (Nguyen & Faff, 2003).

Vivel Búa, Otero González, Fernández López and Durán Santomil (2015) reviewed the impact of hedging with currency derivatives on firm value, as measured by Tobin's Q, in the Spanish market. They found a significant value premium for firms that used currency derivatives, and that operational hedging did not produce a value premium. The value premium fluctuated with the volume of financial hedging. Previous studies relied on using dummy variables to approximate derivatives use, but Vivel Búa *et al.* (2015) argue that using dummy variables biased the results of those previous studies by treating firms homogeneously, regardless of hedging volume.

The use of derivatives by German non-financial firms did not add to firm value, according to univariate and multivariate tests (Bielmeier & Hansson Nansing, 2013). The impact of hedging with derivatives on firm value for 137 public firms in Germany for the period from 2006 to 2010 contradicted the results of studies in other countries, notably in other large, developed countries such as the US and the UK. Structural differences between the economies of Germany and the US, differences in corporate governance, internationalization and managerial abilities are possible reasons for the finding of different value-enhancing effects in German firms' derivatives use (Bielmeier & Hansson Nansing, 2013).

4.3.3.2 Derivatives and firm value in emerging market economies

In Colombia, Gómez-González, León Rincón and Leiton Rodríguez (2012) argue that the existence of frictions such as agency, bankruptcy and transaction costs, commissions, contracting and information costs and taxes violate the Modigliani and Miller (1958) financial irrelevance theorem that hedging will not have an effect on firm value. They found conclusive evidence from an emerging market that hedging practices have a positive impact on firm value in Colombia. A sample of 81 large non-financial firms listed in Colombia, showed a positive relationship between the growth rate of Tobin's Q and firm size and hedging. Gómez-González *et al.*'s (2012) findings are robust in respect of feasible general least squares (GLS), two least squares (2SLS) and the dynamic panel data generalized method of moments estimation techniques. An increase in hedging leads to an increase in firm value growth for Colombian firms, even when firm profitability, leverage and firm age are controlled for (Gómez-González *et al.*, 2012).

The effect of derivatives use on corporate value has received increasing attention in recent years in Asia as well. Researchers from different countries in Asia have, however, found conflicting evidence as to whether using derivatives is value-adding to Asian firms.

In China, the reformation of the exchange regime managing the Chinese Yuan (RMB) has caused the Chinese currency to appreciate upwards of 30% to the US dollar. However, the increase in trade in the RMB has also increased volatility in the currency, forcing many Chinese and multinational companies to use derivatives to counter the negative effects of that volatility. Using such foreign exchange derivatives had a positive, but insignificant, association between hedging premium and corporate value for Chinese multinational companies (Luo, 2016). The study by Luo (2016) employed a pooled OLS, fixed effects and random effects model to confirm the findings regarding the value-enhancing effects of using foreign currency exchange derivatives on corporate value. Smaller firms were found to have a higher value premium, and more profitable firms had a higher value-enhancing effect on firm value.

However, no such value premium was found by Lau (2016) for Malaysian firms. Three firm performance models, namely firm market value, ROA and ROE, and two-stage regression analysis were used to estimate performance and derivatives use simultaneously (Lau, 2016). Significantly, for the Asian market as well as for various developing countries, a discount was found for companies that used derivatives, in other words, using derivatives is negatively associated with firm market value (Lau, 2016). However, derivatives users performed better with regard to ROA and ROE, both of which are in themselves significant drivers of firm market value (Lau, 2016). Lau (2016) went further in his investigation to try to explain how the use of derivatives in Malaysian firms affected operations and firm value. Lau's (2016) study found that users of derivatives displayed lower mean and median values for operating income and net profit margins than non-users of derivatives did. These users of derivatives recorded lower volatility in operating income and net profit margin, indicating that these firms were successful in hedging financial risks that caused volatility in their operations. Furthermore, the higher ROA and ROE for firms that used derivatives can be ascribed to the fact that higher asset turnover had a more positive impact for those firms that used derivatives. This signifies that derivatives users are better able to manage the financial risks associated with operations, and are therefore better able to generate sales, given a particular level of assets (Lau, 2016).

4.3.4 Derivatives and corporate measures of risk, value and firm structure

Some studies sought to evaluate the impact of hedging with derivatives on other aspects of firm success, including the effectiveness of using derivatives to hedge cash flows to minimize reported earnings volatility. For example, Beneda (2013) reports a strong relationship between derivatives use by firms and low reported earnings volatility, and an increase in using hedge accounting with derivatives for this purpose over his sample period. This indicates a learning curve for firms in using derivatives and hedge accounting (Beneda, 2013).

Other researchers veered away from early studies that merely looked at whether using derivatives is consistent with hedging theories. They also started looking at the importance of using derivatives in managing firms' risk exposure. Guay and Kothari (2003) found the significance of the positions in the derivatives market of a sample of 234 large non-financial US firms to be small in relation to their entity-level risk exposure. They note that there was a trade-off between the benefits of maintaining a derivatives programme and the cost associated with such a programme, which, as Brown (2001, cited in Guay and Kothari, 2003) points out, is not insignificant. Guay and Kothari (2003) found that using derivatives did not decrease firm-level risk significantly. They therefore argue that derivatives use is consistent with firms merely fine-tuning an overall risk management strategy that includes other forms of hedging, such as operational hedging or decentralized decision-making, or that firms use derivatives for other purposes than traditional risk-management theory predicts, such as to speculate.

There are many factors to consider in analysing the value relevance of derivatives use on firm value, not least the impact of different accounting disclosure requirements on analyses. Jankensgård, Hoffmann and Rahmat (2014) considered the value relevance of corporate risk disclosure in Sweden, with somewhat counter-intuitive results: there was a decrease in firm value as measured by Tobin's Q and a fixed level of foreign exchange usage, given an increase in the level of risk disclosure for 114 Swedish firms. This negative result was mostly due to quantity disclosures, rather than qualitative and narrative disclosure requirements. Several reasons for their findings are discussed, including possible, if unlikely, endogeneity problems, and econometric misspecifications, the associated costs of disclosing risk management practices, and investors' perceptions about the cost of risk management. Jankensgård *et al*. (2014) also include the inherently negative view investors hold of the general use of derivatives and the agency costs of management's pursuit of risk management programmes, since these are not necessarily aimed at increasing firm value. An important finding for the current study is the influence of separate variables on the analyses of value relevance of using derivatives: in analysing the effect of derivatives use on firm value, researchers should be aware that the data collected from financial statements were disclosed according to a set of disclosure requirements. However, firms do have to some discretion to how, and how much information is disclosed with regard to derivatives use. Although accounting standards have improved over the years, the disclosure of such use could fundamentally change a number of salient factors, including investors' perceptions of a particular firm, and in particular the level of risk such a firm takes on by using derivatives. One should thus be aware when interpreting the findings from analyses that disclosure requirements could skew findings simply because disclosure requirements differ between jurisdictions.

Factors that are not necessarily limited to country-specific reasons can also influence whether using derivatives has a positive effect on firm value. Jankensgård (2015) looked at the effect of derivatives use on firm value, comparing Swedish companies that followed a central approach to managing foreign exchange exposure, and firms where subsidiaries retained their own bank contacts and decision-making authority. The value premium of derivatives use was significantly higher for firms that followed a centralised approach, whereas no value premium was found for firms that used a decentralised approach (Jankensgård, 2015). Three possible reasons are posited for these findings. Firstly, the efficiency explanation posits that the benefits of centralisation in exposure management are obtaining a lower bid-ask spread, fewer resources devoted to exposure management and more efficient netting of exposures. However, Jankensgård (2015) argues, secondly, that a decentralised approach is associated with less monitoring and a higher demand for derivatives (the agency explanation) and allows more business managers independently to manage business risk and capital structures (the business model explanation). Thirdly, the findings supported both the efficiency and business model explanations, but not the agency explanation. Firms with a decentralised approach were found to be characteristically low-growth firms, in the sense that those firms were older, larger, well diversified, paid more dividends and invested less. Jankensgård's (2015) findings are not only important in terms of whether using derivatives add value to firms, but also in that the study looks at specific factors that could influence such findings. By investigating several unique characteristics of the Swedish market, factors that had hitherto not been considered were included in the analysis by Jankensgård (2015). By including such variables, researchers can gain a better understanding of whether value creation abilities stem from particular country-specific reasons or from some hitherto unexplained characteristics in the derivatives themselves.

The studies by Jankensgård (2015) and Jankensgård *et al.* (2014) support earlier findings by Pramborg (2004) in Sweden that suggest that using foreign currency derivatives as part of hedging activities increased firm value. Firms that were geographically diversified and hedged were valued at a premium over other firms, but not all hedging activities necessarily increased firm value (Pramborg, 2004). The value premium found in Swedish firms was primarily due to hedging transaction exposure, which in theory adds to firm value by reducing cash flow volatility (Pramborg, 2004).

Although the firms in the study were able to reduce exposure somewhat by hedging translation exposure hedging, investors did not reward them with higher firm value, possibly because firms were not using translation exposure hedging for the correct purposes. Also, the net foreign currency position was found to be an important determinant of firm value. Translation exposure is the risk that a company's assets, equity and liabilities are denominated in foreign currency and the risk that the value of the assets, equities and liabilities will change when exchange rates change. This is opposed to transaction exposure, where companies face a risk that exchange rates will change after they have entered into financial obligations (Pramborg, 2004). The variable for derivatives in the current study captures derivatives values from the financial statements that take into account hedging volume.

Some researchers have also studied the effect of using derivatives on the cost of capital of a firm. Ameer, Mohd Isa and Abdullah (2011) drew on both reported annual data and a survey of CEOs to establish by way of multivariate analysis whether there is a negative relationship between using derivatives and companies' cost of equity for firms in Malaysia. They found that although foreign exchange exposure management is a key component of financial risk management, and although companies in Malaysia make widespread use of forward contracts to hedge currency risk and swaps to decrease interest rate risk, firms were unable to decrease their cost of capital significantly. This indicates that firms in Malaysia are not managing their risk exposure effectively (Ameer *et al.*, 2011). Malaysia is a Muslim country in which regulatory authorities have to take into account Shariah Law. Furthermore, many managers are concerned about the lack of expertise in handling derivatives and the difficulty in understanding complex derivative instruments, even though many companies have policies for derivatives activities and such activities are monitored by auditors. Moreover, value at risk (VaR) together with stress testing is used for risk evaluation. Other concerns about the effect of using derivatives on the cost of capital include liquidity risk, difficulty in pricing derivatives and tax and legal issues (Ameer *et al.*, 2011).

Coutinho, Sheng and Lora (2012) used a sample of 47 non-financial Brazilian firms to test whether derivatives use by these firms was successful in decreasing firms' cost of capital. The initial findings were that using derivatives was unable to decrease firms' cost of capital. To them, this confirms the theory that derivatives are not just used for hedging and risk management purposes, and they surmised that speculation played a role in how the sample firms used derivatives. This was substantiated by the findings of Tufano (1996) and Farhi and Borghi (2009). However, after introducing an additional dummy variable to separate data from between before and after the financial crisis of 2008/2009, they found a negative relationship between using derivatives and firms' cost of capital. In other words, after 2008 firms had a lower cost of capital if they used derivatives. Coutinho *et al.* (2012) posit that firms were perhaps more cautious after the financial crisis when using derivatives and that firms were scrutinised more closely by regulatory authorities and investors alike. Furthermore, by analysing the Total Average Cost of Capital (TACC) model, which states that to use derivatives correctly (for hedging and risk management purposes) firms should free up capital for use by the company, and since this freed-up capital is the highest cost in the capital structure, it would decrease firms' total cost of capital (Coutinho *et al.*, 2012).

Although the current study does not specifically address the effect that derivatives might have on companies' cost of capital, it is important to point out that a reduction of the cost of capital can have both direct and indirect effects on a firm's value. The purpose of the current study is to establish whether there is a relationship between the use of derivatives and firm value in South African firms; the study does not necessarily delve into the mechanism of the manner in which derivatives affect firm value. It is therefore possible that firms are able to increase firm value by using derivatives to decrease the cost of external financing.

Gay, Lin and Smith (2011) studied a large number of non-financial firms that form part of a database on derivatives users published by Swaps Monitor Publications Inc. to calculate and analyse the relative cost of equity for firms that use derivatives versus those that do not. They wanted to establish the change in the cost of equity for firms that implement derivatives programmes, and found that the cost of equity was lower for firms that used derivatives programmes than for those that did not. Gay *et al*. (2011) attributed the finding to the lower cost of equity in the reduction on both market beta and small minus big (SMB) beta. Firms are therefore able to reduce financial distress risk, and this financial risk component is factored into market pricing as a systemic component. The reduction in the cost of equity was largest for smaller firms, and for firms that used currency and interest rate futures (Gay *et al.*, 2011).

Other researchers explored the effect of using derivatives on the other components of capital structure. Chen and King (2014) found strong evidence that hedging is linked to a reduction in the cost of debt. They posited that hedging lowered the risk of bankruptcy, agency costs and information asymmetry. Furthermore, hedging mitigated the negative effects of rising borrowing costs on capital expenditure and firm value (Chen & King, 2014).

4.3.5 Variables that determine firm value

Corporate risk management and the use of derivatives as part of a corporate risk management programme can have an impact on firm value, because of the existence of real world capital market imperfections such as agency and transactions costs, taxes, and volatility in the cost of external financing. The implementation of risk management at the firm level, and not at the shareholder level, can offer a means of increasing firm value (Bartram, 2000).

Bartram (2000) argues that risk management can increase firm value by reducing the agency costs associated with underinvestment and asset substitution problems. Differences between the risk preferences of shareholders and managers also cause agency costs that can be alleviated by risk management. Furthermore, shareholder value can be increased by decreasing transaction costs, specifically the costs associated with financial distress, by lowering the likelihood of bankruptcy. Managers are also better able to understand the risk inherent in operations, which shareholders may not be. This information asymmetry may make corporate hedging more effective. Corporate hedging can further increase firm value by reducing the costs associated with underinvestment. Lastly, there are possible tax advantages for firms over individuals that could render corporate risk management more effective than shareholders' input in this regard.

Various researchers have in the past included numerous known drivers of firm value in their multiple regression statistical analyses to isolate the impact of using derivatives on firm value (Bielmeier & Hansson Nansing, 2013; Jankensgård *et al.*, 2014; Khediri & Folus, 2010; Vivel Búa *et al.*, 2015). These drivers of firm value included firm size, leverage, liquidity, economic profitability, growth opportunities, geographic diversification and the business sector in which firms operate. Other control variables included in past studies are

- the existence of financial restrictions (Vivel Búa *et al.*, 2015);
- access to financial markets and industrial diversification, time effects and volatility and stock returns (Bielmeier & Hansson Nansing, 2013);
- the degree of alignment between management and shareholders' incentives, the impact of large blocks of shareholders and financial constraints (Jankensgård *et al.*, 2014); and
- the amount of dividends paid out per year (Khediri & Folus, 2010).

The current study conducts multivariate regression analyses and attempts to isolate the impact of firms' using derivatives on firm value. The current study takes note of the control variables included in past studies, including many of these in the statistical analyses in the current study (see Chapter 5).

4.3.6 Value relevance research and general valuation research

The aim of the current study is primarily value relevance research. Specifically, the study investigates whether a recognized or disclosed amount (derivatives) in the financial statements of a company has a significant influence on firm value. It is important to note, however, that *value relevance* research is not *valuation* research. In other words, the current study neither attempts to value derivatives nor places a value on a firm. Rather, it seeks to establish whether using one (explanatory) variable has a significant effect on another (dependent) variable.

Value relevance research seeks to determine whether accounting information disclosed in financial statements is used by market participants to calculate firm value (Badenhorst, 2015; Barth *et al.*, 2001). This is premised on earlier research by Ball and Brown (1968) and Beaver (1968), who found that information in the financial statements (specifically on income) was correlated with firm market values, implying that income amounts are implicitly used for valuation purposes.

There is thus a narrow distinction between value relevance research and general valuation research. General valuation research seeks to establish the value of a firm. This can be done in a number of ways, employing a number of methods. Most commonly, however, the value of a firm can be thought of as the present value of its expected future cash flows. These cash flows represent the operating cash flows of the company in the future, and they are adjusted for growth. These cash flows are then discounted at an appropriate discount rate, often the weighted average cost of capital (WACC) of a company. These valuation methods generally rely on financial reporting information; for example, to calculate the inputs in valuation formulae, investors rely on information contained in the financial statements. The implication is therefore that figures in the financial statements can be thought of as 'value relevant' if they affect the valuation of a firm. Investors therefore either explicitly or implicitly incorporate the significance of a particular figure or amount in the financial statements when they attempt to establish firm value, and the effect of this amount is included then either as part of expected future cash flows (return element) or as part of the discount rate (risk element). In other words, if free cash flow valuations correlate with market value, as suggested in finance theory, then so must the accounting information pertaining to these valuations.

One approach in determining firm value is to consider the firm as an asset, or alternatively as the sum of its individual assets and liabilities. One can then determine the value of the firm by adding the sum of the individual present values from the expected future cash flows, derived from the individual assets and liabilities (Badenhorst, 2015). However, such an approach relies on the premise that there is no synergy between assets and liabilities by holding them together, and the value of such synergies should then be added to the sum of individual valuations to determine total firm value. For instance, Nissim and Penman (2001) argue that operating assets and liabilities should be separated from financial assets and liabilities during the valuation of a firm, and that any synergies that could exist between assets and liabilities should be added only to operational assets and liabilities. This is in line with most current valuation theories.

Nissim and Penman (2001) also claim that it is profitability and growth that drive equity (firm) value. Ratios aused in determining firm value are then in fact an analysis of future residual earnings, free cash flow and dividends. Ratios and by implication financial statement analysis therefore incorporate an element of forecasting. In other words, one can use the current financial information contained in published financial statements to determine firm value. The implication is that information contained in financial statements can therefore also be used to forecast future drivers of expected firm value.

In determining firm value, it is important to note that value relevance studies do not necessarily seek to determine the present value of the accounting item under scrutiny. Rather, they seek to determine whether the particular accounting amount can be associated with equity market values (Barth *et al.*, 2001). Therefore, value relevance studies assume that the market value of equity reflects the consensus view of market participants and by implication the valuation approach used.

Moreover, the inclusion of an asset or liability in the financial records of a company does not imply a direct or explicit influence on that company's value. In that sense, the inclusion of different items in the financial statements, as well as the value at which they should be included, remains a controversial and much researched topic. For instance, the calculation of goodwill and other intangible assets and the effect they have on firm value is hotly debated. Furthermore, accounting standards are dynamic and flexible in nature. For example, the process of moving away from traditional historical cost accounting (where items in the financial statements are recorded at cost, less deprecation) towards fair value accounting has important implications for both value relevance and general valuation research. It is, however, beyond the scope of the current study to investigate all these implications. The current study focuses only on whether using derivatives, as recognized and disclosed by the appropriate accounting standards, can be associated with firm value.

It also bears mentioning that the consensus view of a firm's value does not necessarily equate to its book value, and firms often trade either at a discount or at a premium to their book value. This discrepancy has been ascribed to various factors, including unrecognized assets and liabilities in the financial statements, tax consequences and the illiquidity of the underlying investments (Cherkes *et al.* 2009; Day *et al*., 2011; Easton & Pae, 2004; Khan & Watts, 2009; Watts, 2003, cited in Badenhorst, 2015). Firm value is therefore a subjective interpretation and incorporates available market information, as well as investors' individual assessment of the potential future earnings and risks of specific companies.

The valuation of derivatives has received a considerable amount of attention since the inception of modern derivative contracts, culminating in the Black-Scholes model of option pricing. It is not the purpose of the current study to provide an in-depth analysis of derivatives valuation and its accompanying research questions. The study does not delve into the finer intricacies of how either derivatives or firm value is calculated. Rather, the study seeks to establish whether derivatives use by a firm affects the firm value. This implies that if such a relationship does indeed exist, investors include either the perceived benefits from using derivatives (risk mitigation, potential returns) or increased risk (in the discount rate) in the valuation methods they use to determine firm value. However, a brief discussion of the valuation of derivatives is useful to provide better insight into the analytics of the current study.

This discussion shows that accounting amounts do not necessarily accurately reflect investors' valuation of a particular asset, and that investors often use their own interpretation of the value and risk of an item in calculating the value of the firm as a whole. Value-relevance research therefore has an important justification in the larger valuation arena because it investigates the associations between accounting amounts listed in the financial statements and firm valuation. If such associations exist, then investors either explicitly or implicitly include the potential return and risks associated with these individual items in the perceived valuation of the firm.

4.4 USING DERIVATIVES FOR HEDGING AND SPECULATING MOTIVES

The question whether firms use derivatives for hedging or speculative purposes is not easy to answer. Most of the previous research on derivatives use by companies has assumed that companies, in particular non-financial companies, use derivatives to protect themselves against adverse and unforeseen economic circumstances. Hence, those studies assumed that most non-financial companies included in the datasets only used derivatives instruments for hedging purposes. Section 3.2 has already discussed what factors determine derivatives use. This section addresses past studies to establish a better understanding of whether these determinants form part of an overall risk management strategy (hedging) or whether companies use derivatives to take advantage of profitable transactions (speculating).

There is a difference between financial and non-financial firms. Financial firms such as banks, insurance houses and investment companies use derivatives daily – it is therefore assumed that financial companies use these instruments in fulfilling their duties to maximise investment returns. Prior research has for the most part assumed that non-financial companies use derivatives purely for hedging reasons and these studies attempted to identify those determinants that motivate risk management behaviour. Given the limitations of accounting standards, it is often difficult to distinguish the purposes for which companies use derivative instruments. Recent research has tried to identify whether companies use derivatives to hedge or to speculate either by using surveys or through data captured from the financial statements.

If firms are successful in using derivatives to decrease firm risk, then one could argue that firms use derivatives for hedging reasons rather than for speculative purposes. Guay (1999) used a sample of 254 non-financial firms that started using derivatives to show that firm risk, measured in several ways, such as stock-return volatility, interest rate exposure and exchange rate exposure, decreased as a result of derivatives use. He argues that his findings show that corporations use derivatives to hedge, rather than to speculate.

Hedging can be referred to as risk management practices that reduce stock return volatility. By contrast, an increase in return volatility can be deemed speculation. Hentschel and Kothari (2001) conducted a study on 425 large US firms to investigate empirically whether firms' derivatives use was significantly related to stock return risk. They found the risk characteristics of firms using derivatives, even firms that used derivatives to the extreme, were similar to the risk characteristics of firms that did not use derivatives. Specifically, their sample showed no association between the volatility of firms' stock prices and the size of firms' derivative positions. They argue that if firms were using derivatives to speculate, then one would expect more volatile returns and larger exposures for firms with large derivative positions. Hentschel and Kothari (2001) also noted the limitations of the accounting standards in force at the time to reflect the magnitude and value of derivatives use accurately. As already explained in Section 2.4, the accounting standards have changed and have been updated frequently over the last 20 years. These changes determine how firms disclose their derivatives positions, but they can also affect the methodology and analyses that investors use to calculate the perceived riskiness of firms.

Even though derivatives use may be effective in reducing the overall risk of a company, it would be inaccurate to claim that all firms use derivatives solely for hedging purposes. When a firm takes a position in the derivatives market, it also exposes itself to the risk associated with the derivatives market. If the trade is effective, the firm is able to reduce its risk exposure, in other words, it is able to hedge. However, a trade in the derivatives market can theoretically move against the position that a firm takes, thereby increasing its exposure and its risk as well. This is then not necessarily indicative of speculation. Clearly, one has to analyse the motives for taking a specific position in the derivatives market (going either long or short on a particular derivatives contract). This can be done either by studying the financial statements to determine how the derivatives were disclosed, or by conducting surveys to establish the motives from the derivatives traders in the firms concerned for taking the position in the derivatives market. It is possible therefore that when companies use derivatives as part of an overall risk management strategy, an element of speculation can come in when these companies time the transactions (referred to as selective hedging). Investors and analysts find it difficult to interpret derivatives use by companies: they perceive the use (whether it is hedging or speculation) as distinctly different, and place a different value on the perceived use of derivatives.

Géczy, Minton and Schrand (2007) used survey data on publicly traded non-financial firms in the US to establish whether managers of firms take a view of market movements based on either foreign exchange or interest rate movements and then take a position in the derivatives markets in response to their perceptions of market movements. Their sample included 186 firms, of which 102 never speculated (in other words never used interest rates or foreign exchange derivatives to exploit an expected movement in the market), 61 firms sometimes uses derivatives to speculate, and 13 firms frequently speculated with derivatives. They posited that firms speculate with derivatives to take advantage of a profitable trade, and they do not simply increase potential risk without commensurate upward potential (returns). Those firms that indicated frequent speculation had weaker firm-wide governance mechanisms, but had more internal control mechanisms to manage abuse of these instruments. The study by Géczy *et al.* (2007) also has implications for the users of publicly available data on firms' hedging activities. Their analysis found that without access to confidential survey data, investors were unable to distinguish which firms speculated with derivatives based on only a firm's reported disclosures.

Chernenko and Faulkender (2011) argue that it is very difficult to identify whether firms use derivatives for hedging or for speculative reasons without drawing on panel data. Their study divided the interest rate risk management practices of companies into cross-sectional and time-series components using panel data. Assuming a stable hedge ratio, they found that the cross-sectional component identifies firm characteristics in line with hedging motives, while the time-series component is more likely to show results from speculation. The study by Chernenko and Faulkender (2011) confirms that firms use derivatives to hedge to limit their dependence on access to capital markets for investment opportunities. However, the time-series component of their study indicates that firms alter their use of interest rate swaps and floating rate debt over time, with movements in the term structure. This is especially significant when there is a strong incentive for managers to match derivatives positions with the underlying instruments' term structures and if it helps the company to meet analysts' forecasts. Companies thus frequently use derivatives to hedge and to speculate, but it is not easy to distinguish between the two activities (Chernenko & Faulkender, 2011).

In different parts of the world, research has found evidence that derivatives are used for speculation. Rossi (2013) investigated whether firms listed on the Brazilian stock exchange during the financial crisis period of 2008-2009 used derivatives for hedging, selective hedging, or speculating, by using data captured from the statement of financial position. The study used data on the net foreign exchange derivatives position and exchange rate exposure reported in the financial statements to divide the sample companies into hedgers, selective hedgers (companies that significantly changed the volume of derivatives used during the financial crisis), and active speculators (companies that took positions with their derivatives that were contradictory if the aim was to hedge currency exposure). Rossi (2013) confirmed that there were specific firm characteristics that corresponded to hedging motives: big firms with a higher ratio of foreign-denominated debt to total debt, better growth opportunities and higher corporate governance were more likely to use derivatives and use them for hedging. However, Rossi (2013) argues that the main determinant for companies to try to time the foreign exchange market was foreign exchange exposure. The higher the ratio of foreign sales to total sales, the more likely a firm was to hedge selectively, whereas the higher the ratio of foreign debt to total debt, the higher the likelihood was that a firm would speculate. Furthermore, common macroeconomic factors and weak corporate governance led to the likelihood that firms would selectively hedge or speculate respectively. Rossi (2013) shows that firms in Brazil used derivatives for different purposes, namely: hedging, selective hedging and speculating. The different motivations and firm characteristics that drove this behaviour were also identified by the study.

More recently, Bartram (2019) found no evidence of speculation with derivatives by companies in different countries or for different types of derivatives. Bartram's (2019) study collected data by means of using questionnaires to show that entities used derivatives for hedging purposes independent of country-level corporate governance, or access to derivatives. He noted marginally higher commodity price exposure for firms using commodity price derivatives, indicating a low level of speculation. Managers might adjust or time their firms' derivative positions in line with their market views, but he found that this practice occurred only in a minority of firms, and that most derivatives were used for the purposes of risk reduction. Derivatives can be used to limit the effects of an economic downturn (Bartram, 2019). Unfortunately, only limited research on using derivatives in South Africa has been done, so that the current study needs to expand on existing studies. The current study is also more elaborate than previous studies, because it includes different economic periods, and a control variable for the quality of derivatives disclosure.

Whether companies disclose derivatives use for hedging purposes or for speculative purposes should theoretically have an impact on the perceived riskiness of a company. It is assumed that companies which purposefully expose themselves to market movements to take advantage of profitable trades expose themselves to higher risk. In a sample of US manufacturing companies, however, the disclosure of investments as non-hedgers had no significant impact on the stock beta of the firm (Johnson & Xie, 2015). Possible reasons posited include that not all derivatives disclosed as used for non-hedging purposes are in fact used for speculative purposes, so classifying all derivatives that do not subscribe to hedging disclosure requirements did not capture the true nature of the use of these products. The complexity of accounting standards could lead companies to circumvent disclosure requirements, in turn leading to the misrepresentation or omission of some derivative instruments. Some companies may in fact trade in derivatives to increase profits. However, the incorrect disclosure of derivatives could also indicate that either companies themselves do not necessarily correctly identify which derivatives are used for hedging and which are used for speculating, or that investors do not distinguish between the two activities and rank them equally in terms of riskiness.

In a study of US oil and gas firms, Manchiraju, Pierce and Sridharan (2014) studied the effects of *SFAS no. 161* on the disclosure motives of firms. They found that firms did make use of cash flow hedges in a prudent manner to decrease risk, especially when they are faced with high financial contracting costs and have to meet performance benchmarks, but that most firms chose to use non-hedge designated derivatives. Their findings suggest that firms in this particular sector employed derivatives to beat performance benchmarks and hence used these derivative instruments in a speculative manner. They conclude that the accounting standard *SFAS no. 161* is effective in capturing the underlying economic motive for using derivatives.

Adam and Fernando (2006) explored the impact of using derivatives on 92 North American gold firms. Essentially, they challenge the claim that derivatives transactions have zero net present value. They found economically significant increases in cash flow gains for the gold firms from their derivatives transactions. Adam and Fernando (2006) argue that this increases shareholder value, since they found no evidence of a corresponding decline in firms' systematic risk. They argue that risk premiums (the additional returns companies receive for taking on additional risk) can be an important motive for companies to use derivatives. They acknowledge that their findings are not clear as to whether the increase in shareholder value is due to the alleviation of market imperfections, or to the risk premiums in the forward markets. If the cash flows from derivatives transactions are not zero, then even companies that use derivatives for hedging purposes may change the extent to which they hedge in the presence of these risk premiums. Furthermore, firms try to time the market when they use derivatives – there is thus evidence of selective hedging. However, the benefits of the cash flows gains from selective hedging are small at best (Adam & Fernando, 2006).

There is inconclusive proof on whether companies use derivative instruments for hedging or speculative purposes. For the purposes of the current study, all financial firms are specifically excluded, as these firms have the added incentive to speculate with derivatives. The current study will assume all non-financial firms used derivatives for hedging purposes. The use of derivatives thus becomes a proxy for companies' risk management activities. Any implications then of the value relevance of companies' derivatives use can then also be viewed as whether or not financial risk management is a value adding strategy for firms.

4.5 HYPOTHESES

From the discussion of the literature in Chapters 2, 3 and 4, a number of research questions have been identified. The literature on the extent of derivatives use does not necessarily include South African companies and therefore there is limited evidence on the extent to which companies listed on the JSE use derivatives. The current study first establishes the determinants for using derivatives by companies listed on the JSE to enhance understanding of these determinants, because the literature is inconclusive on the exact firm characteristics that influence companies' use of derivatives. Many theories based on the existence of market imperfections in finance literature try to explain the demand for corporate hedging.

Companies can try to reduce financial distress costs and underinvestment costs, and to minimize expected tax liabilities. Companies also hedge because of managerial risk aversion and to decrease information asymmetry between shareholders and managers. The current study investigates the firm characteristics that influence derivatives use specifically by firms listed on the JSE. The hypotheses for this investigation are the following:

> *$H1_1$: JSE-listed firms use derivatives to hedge financial risk exposure in order to reduce possible financial distress costs and the risk of bankruptcy.*
>
> *$H1_2$: JSE-listed firms use derivatives to reduce underinvestment costs.*
>
> *$H1_3$: JSE-listed firms use derivatives to reduce information asymmetry costs between shareholders and managers.*

$H1_4$: JSE-listed firms use derivatives to hedge financial risk exposure in response to tax incentives to minimize expected tax liability.

$H1_5$: JSE-listed firms use derivatives to hedge financial risk exposures and/or because of other operating characteristics.

Secondly, this study determines the value relevance of using derivatives by firms listed on the JSE. Prior research suggests that the value relevance of derivatives amounts in financial statements vary across different countries, but so far, the South African scenario has not yet been thoroughly investigated. The stated hypothesis for this investigation is the following:

H2: The disclosure of derivatives in the financial statements of JSE-listed firms is value relevant.

Prior research has found inconclusive evidence on the role that derivatives play during periods of economic uncertainty. Companies' use of derivatives as part of a risk management programme should mitigate risk and protect firm value during economic downturns. However, thus far, previous studies have not found conclusive evidence of the ability of derivatives to hedge firm value during periods of economic downturn. In order to investigate whether derivatives use by companies affects firm value during different economic periods, this study divided the data on the sample of firms in the dataset into different economic periods, namely the pre-crisis, during-the-crisis, and post-crisis periods. Therefore, the hypothesis to investigate this can be stated as follows:

H3: The value relevance of derivatives disclosed in the financial statements of JSE-listed firms is statistically significantly different during specific economic periods.

As discussed and demonstrated in Section 2.4, the quality of information disclosed as part of the financial statements can have a significant impact for value relevance studies. Hence, the sample of 200 non-financial firms is separated into firms that disclosed derivatives as part of their annual reports and those who did not. The annual reports of firms which disclosed information on derivatives were investigated to assess the quality of their disclosure. The stated hypothesis to investigate whether the quality of derivatives disclosure has an effect on firm value is the following:

> *H4: The value relevance of derivatives disclosures for JSE-listed firms is statistically significantly different for different levels of quality of disclosure of information in the financial statements of these entities.*

The current study primarily investigates derivatives use for the 200 largest non-financial firms listed on the JSE. Prior studies suggest that derivatives use by firms is value relevant, but such findings are country-specific. Derivatives use by firms listed on the JSE has not yet been thoroughly investigated. Furthermore, prior research is inconclusive regarding the value relevance of derivatives use during different economic periods. Prior research is also inconclusive as to whether the quality of disclosure significantly influences the value relevance of amounts disclosed in the financial statements. These gaps identified in the prior research form the basis of the current study. The research methodology by means of which these gaps were addressed is discussed in detail in Chapter 5.

4.6 SUMMARY AND CONCLUSION

Previous research on derivatives use by companies has focused on the determinants of such use, as well as the value creation potential that using these instruments has for firm value. However, past studies have not yet found conclusive evidence of the factors that motivate a company to use derivatives. Furthermore, past studies have produced only conflicting proof that derivatives use creates firm value. The findings of past studies have often differed, depending on the countries from which the data came, and have tended to be sample-specific. The investigation on derivatives use by companies listed on the JSE can add to this debate by providing findings that may be useful for a comparison between differences in the value relevance of derivatives use in different countries.

The current study attempts to add to the recent discourses on derivatives use by exploring determinants of derivatives disclosure by firms listed on the JSE to gain a better understanding of the firm characteristics that determine derivatives use. The study also investigates the value relevance of derivatives disclosure. This study adds to the value relevance discussion by including a measure for the quality of disclosure. Furthermore, the current study uses different sub-set sample periods from the original dataset to compare the value relevance of derivatives use during different economic cycles. A further contribution to the existing research on the topic of derivatives use by companies is the exploration of derivatives use from the perspective of an emerging market. The JSE is unique in this regard, in that South Africa is classified as an emerging market economy, but has well-developed financial institutions and a well-run and efficient derivatives market. The current study can thus provide valuable insight on the role of derivatives markets in an emerging market economy. Chapter 5 discusses the research methods used in this study, and Chapters 6 and 7 discuss the results. The study concludes with a summary of the findings, conclusions and recommendations in Chapter 8.

CHAPTER 5:
RESEARCH DESIGN AND METHODS

5.1 INTRODUCTION

This chapter discusses the research design and methods used in this study. The overall research paradigm and philosophy are set out, followed by the inquiry strategy and research design. Next, details of the data collection and sampling are described, as well as of the data analysis. This is followed by the research model and instruments. Finally, the rigour of the study is considered, by looking at the treatment of outliers and other potential anomalies, as well as the assumptions that apply in the data analysis, followed by a summary and conclusion.

The general approach to testing the hypotheses identified in Chapter 4 begins by establishing whether the ways in which JSE-listed firms use derivatives for corporate hedging purposes are in line with the rationale(s) for corporate hedging described in the finance literature. Moreover, this study investigates whether or not using derivatives as recognized or disclosed in the financial statements has an impact on firm value. In other words, the study attempts to determine the value relevance of derivatives, as recognized or disclosed in a company's financial statements.

The hypotheses of the current study relate to previous studies on using derivatives. Hence, the models employed to test the value relevance of using derivatives are based on models used in such prior research, but are adjusted and modified for the specific requirements of this study. The value relevance models are also expanded to investigate the effects that different economic periods and the quality of disclosure have on the value relevance of derivatives disclosures.

5.2 RESEARCH PARADIGM AND PHILOSOPHY

Early studies such as those by Smith and Stulz (1985) and Nance *et al*. (1993) had to rely on surveys to capture and analyse data on the use of derivatives. The introduction of new accounting standards and changes in the disclosure requirements for companies that employ derivatives have made it possible to use published financial statements to analyse the use of derivatives as disclosed by these companies (Abdel-

Khalik & Chen, 2015). The current study draws on secondary data, as disclosed in the financial statements of the companies included in the sample.

The study can be considered to subscribe to a positivist paradigm and approach to research, because the researcher is independent from the study, and because the study uses quantitative methods and deductive reasoning to determine the causes and effects of social phenomena.

5.3 DESCRIPTION OF INQUIRY STRATEGY AND BROAD RESEARCH DESIGN

The inquiry strategy and broad research design of this study are discussed in this section to provide an overview of the general characteristics of the study. This study applies an empirical research inquiry strategy. The design is experimental and quantitative, combining fundamental, descriptive and explanatory elements. The study also applies both a cross-sectional and a longitudinal research design. The rationale underpinning the choice of this inquiry strategy is discussed below.

Empirical research refers to any research in which a researcher collects new data (primary data), or re-analyses data that have already been collected by another researcher (secondary data). This study is an empirical study which investigates secondary quantitative (numeric data) drawn from appropriate sources such as financial data repositories and company financial statements.

The study is a basic (pure/fundamental) study, which attempts to determine the impact of the use of derivatives on firm value. The study can also be considered an applied study, because the findings can be applied in solving organisational and managerial problems.

The purpose of the current study is both descriptive and explanatory, because the study describes the firm characteristics that determine companies’ use of derivatives. The study then attempts to draw conclusions on whether using derivatives have had an impact on the value of the firm over the period under review.

The study is longitudinal in that it looks at the 13-year period between 2005 up to and including 2017. The sample period represents the most recent years in which companies have completed their annual financial statements before the start of the study. It is also a particularly interesting period because it includes the 2008/2009 global financial crisis. This review period makes it possible to investigate the impact of hedging strategies on firm value during a period of economic uncertainty. This choice follows previous research which has focused on the usefulness of using derivatives as a hedging tool during times of economic downturn (Allayannis & Weston, 2001; Bartram *et al*., 2011)

The study is quantitative because it conducts statistical analyses of numerical data to reach conclusions to address the research questions. The advantage of a quantitative study for this particular research topic is that it allows for greater objectivity and accuracy of results. It permits some generalization of the results and allows for a broader scope of subjects under review. Quantitative research provides conclusions based on the quantification of a problem and enhances understanding of the problem by allowing the researcher to project the results to a larger population.

5.4 SAMPLING AND DATA COLLECTION

The data for the current study were captured from a sample of non-financial firms ranked by market capitalization on the JSE. The sample period included the years 2005 to 2017, encompassing the full period during which derivatives were disclosed by South African companies under the accounting standard *IAS 39*. The dataset included only non-financial firms. These firms represented the largest firms by market capitalization listed on the JSE (excluding firms in the financial sector, such as banks, investment companies and property brokers).

The data were collected from the financial statements of listed companies. The IFRS requirements prescribe the disclosure of listed companies, and the study therefore assumed that in the financial statements of JSE-listed companies, which have to be compliant with this regime, the disclosed values display accuracy, reliability and veracity. Nevertheless, it is acknowledged that a certain amount of flexibility and discretion is allowed in the accounting standards, which could lead to misleading comparisons where firms apply the accounting standards differently.

The data were captured from the information disclosed in the financial statements and the accompanying notes to the financial statements of the top 200 non-financial companies listed on the JSE, using Thomson Reuters Datastream, as follows:

- The derivatives amounts were collected as non-current assets, current assets, non-current liabilities and current liabilities.
- The individual line items for derivatives amounts were added together to determine an amount for total exposure to derivatives instruments.

Companies listed on the JSE publish their financial statements in different currencies, at the discretion of these companies. The total derivatives amounts captured from the financial statements are also disclosed in different currencies, including rand (South Africa), dollars (US), pounds (UK) and euros (Europe). For the sake of comparison, the total derivatives amounts captured were quantified into a single currency, South African rand, using appropriate exchange rates.

Only the top 200 non-financial firms listed on the JSE were included in the sample. Companies listed in the financial sector (banks, non-life insurance, real estate investment and services, real estate investment trusts, financial services, and equity investment instruments) were excluded from the study. Companies in the financial sector are different in their nature and structure from companies in other sectors. These companies have an added incentive to use derivatives in a speculative manner in an attempt to time market movements in order to gain profits from these market movements. It is difficult to differentiate between firms' use of derivatives as hedging or speculating activities (Chernenko & Faulkender, 2011; Géczy *et al.*, 2007; Hentschel & Kothari, 2001). It was therefore assumed for the purposes of the study that all firms that are not listed as part of the financial sector on the JSE but that used derivatives would disclose their reasons for using derivatives (either for hedging or speculative purposes) based on the IFRS disclosure requirements.

The data collected for the study can be considered panel data, since they included both time-series and cross-sectional observations. The advantage of using panel data to test the first hypothesis is that it allowed the study to collect information on both the cross-sectional and the time-series component of the analyses. The cross-sectional component reflected the differences observed between the individual firms in the sample, while the time-series component reflected the differences for the same firm over the period in the sample. The study was therefore better able to explore explanatory variables and relationships that existed between these variables when investigating the first hypothesis. Using panel data also allowed the study to consider the heterogeneity and collinearity of the observations, and made the results from the analyses more generalizable, as explained by Bielmeier and Hansson Nansing (2013). For the final three hypotheses, the study used dummy variables to account for time-series observations, as this approach was more appropriate for the value relevance models.

The sample period was chosen to reflect the period in which companies listed on the JSE in South Africa have been required to disclose derivatives information according to *IAS 39*. A new accounting standard, *IFRS 9*, became effective from 2017. The sample period allowed the current study to determine the value relevance of derivatives disclosure under *IAS 39*.

Furthermore, the sample period included the years 2008/2009, during which the world economy went through a financial crisis. The impact that derivatives played in exacerbating the crisis has been the topic of much research (see Section 3.2). The current study conducted comparative analyses between three different periods: a pre-crisis sample, a sample of the period during the crisis, and a post-crisis sample. These comparative analyses statistically test firstly what the determinants of derivatives disclosure were in the different periods, and secondly whether there was a significant difference between derivatives use before and after the financial crisis.

Statistical analyses were performed to determine the impact of derivatives disclosure on firm value. Comparative analyses between the different periods were conducted to determine whether the financial crisis had an impact on firms' decision to use derivatives and whether such use had a statistically different influence on firm value, before, during, or after the financial crisis.

An unbalanced data set exists when there are an unequal number of data points for each observation. In terms of this definition, the dataset used to test the hypotheses was unbalanced, because the data set created for the current study consisted of 200 non-financial companies listed on the JSE, but not all these companies provided information for each variable for every single year in the 2005 to 2017 sample period.

The omissions arose for various reasons; for example, some companies either listed or de-listed during the sample period, in which case, data would not exist for the company for the years when it was not listed. Some companies also had missing data for particular years because of a change in the financial year-end, because they did not have a particular variable as part of their financial statements (for example, foreign sales), or because of some other unknown factor.

There are several advantages to using an unbalanced data structure (Pindado & Requejo, 2015). Researchers in financial economics are often unable to capture all the information on all individual companies for all the periods of their studies. This can be due to companies' listing or delisting from an exchange, or companies' going bankrupt or merging with other companies. An unbalanced data structure thus offers the advantage of mitigating attrition bias. Attrition bias in research refers to participants leaving a study (or in this case, companies in the sample disappearing), which could introduce bias in the results of the study.

Some missing data for particular years were addressed by calculating the average between the year before and the year after. This was done for specific data points where there were relevant data for the sample period for the firm, but specific individual variable amounts were missing for a particular year for some reason. Where companies missed two consecutive years' information, the median for the sample years 2005 to 2017 was used for both years. Where a company's data were missing at the beginning or the end of the period, the data were not adjusted, but they were still included in the unbalanced data set.

Variables used in the testing of the hypotheses were by nature different. Some of the non-disclosed amounts cannot be 'missing', for example, where a firm is supposed to disclose its total assets, EBIT or sales – it is theoretically possible for a firm to have zero earnings or sales in a given year, but this is highly unlikely if the previous and following years indicate any earnings or sales. Similarly, a company cannot have zero assets, as this would indicate the company has disposed of all assets without replacing them in a particular year, which it obviously cannot do. The ratios that use assets, EBIT and sales therefore also have to exist, since both the denominator and numerator have to be a non-zero amount. Not all companies used derivatives, had foreign sales, did R&D, or had accumulated carried-over tax losses, and therefore a missing amount was treated as zero, rather than as missing. A zero amount indicated that the company did not use said variable in a particular year.

The current study used several data sources from which to collect and analyse information pertaining to the study. The study primarily used Thomson Reuters Datastream and IRESS as sources of secondary quantitative data from company financial statements, as well as qualitative data for the purposes of constructing a quality disclosure index from the financial accounts and notes to the financial statements. These data are classified as secondary, because the data collected from Thomson Reuters Datastream and IRESS are in the public domain and were not produced specifically for this study. Thomson Reuters Datastream and IRESS are data repository systems that collect and store economic and financial information as well as annual reports and financial statements, together with the notes to the financial statements of companies, including those listed on the JSE. The data on both the Thomson Reuters Datastream and IRESS systems are collected from published company financial statements. Hence, the data collected from these financial statements are deemed accurate and reliable to the extent that they were reliably transcribed by Thomson Reuters Datastream and IRESS. The veracity, reliability and accuracy of the data captured from the Thomson Reuters Datastream and IRESS systems therefore had to be assumed. Any discrepancies or inaccuracies that were found were duly noted.

The study also assumed that all published financial statements are ethical, reliable and accurate in respect of the extent of derivatives use by those companies. The study assumed that all derivatives used by companies were disclosed in the financial statements, that the value amounts are an accurate reflection of firms' derivative positions, and that there were no omissions (except as noted). Furthermore, the study assumed that all the companies in the sample subscribed to the same accounting standard and therefore reported their derivatives use according to the prescribed accounting standard, namely *IAS 39*.

Where data could not be found on Thomson Reuters Datastream or IRESS, the study drew on other data sources, such as published financial statements and annual reports by individual companies, to collect, sample and analyse the financial statements and their accompanying notes of companies listed on the JSE for the sample period.

5.4.1 Descriptive statistics

The data sample was analysed and the mean, standard deviation, median, skewness and kurtosis for the variables in the sample are reported.

5.4.2 Correlation analyses

The section of the study analysing correlations addressed the research objective of establishing whether investors reward companies' use of derivatives with a higher firm valuation. If using derivatives has a positive impact on firm value, it should be reflected in a higher value of the correlation coefficients for the dependent variables that are the proxies for firm value as measured by Tobin's Q.

Pearson's correlation can be used to establish whether there is a relationship between two variables. The Pearson correlation coefficient then reflects the strength of a linear relationship between two variables. In the current study, the Pearson correlation coefficients are reported for two reasons. Firstly, they show the presence or absence of a relationship between particular firm characteristics such as size, profitability, liquidity, leverage, geographic diversification, growth prospects, financial distress and industry, and the use of derivatives. Secondly, the Pearson correlation coefficients are reported to establish any linear relationship between the use of derivatives and firm value.

5.4.3 Multivariate regression analyses

To examine the determinants of derivatives disclosure, previous studies have adopted several different approaches.

For example, a dummy variable approach was used in some studies, in which the users of derivatives were denoted by 1, and non-users of derivatives were denoted by 0. A binary logistic estimation method was then used to model the odds that firms would use derivatives against those that firms would not (Khediri & Folus, 2010; Pennings, 2002; Whidbee & Wohar, 1999).

A second approach was to use the gross value or notional amounts of derivatives disclosed in the financial statements in a multiple linear regression framework (Allayannis & Ofek, 2001; Ameer, 2010; Berkman & Bradbury, 1996; Fok *et al.*, 1997; Hardwick & Adams, 1999; Hentschel & Kothari, 2001). Although it is possible for firms to hold two offsetting positions simultaneously, thereby doubling the contract size but in effect halving their exposure, Hentschel and Kothari (2001) and Nguyen and Faff (2002) argue that in reality the likelihood of this happening is small and one can therefore assume general proportionality between contract size and exposure. Since the current study attempts to establish the determinants of derivatives disclosure, as well as the impact of derivatives use on firm value, a binary logistic regression approach was found to be more appropriate to test the first hypothesis, which posits that specific rationales for corporate hedging make it more likely that firms will use derivatives, though a multiple variable regression model was also included for comparative purposes. Both approaches to testing for derivatives use, either as a dichotomous variable or as a continuous variable, were investigated in the value relevance models.

The next section details the research models and instruments that were adopted to analyse the hypotheses identified in Section 4.5. These research models and instruments are based on prior research on the use of derivatives and value relevance research, but were adjusted to fit the parameters of the current study.

5.5 RESEARCH MODEL AND INSTRUMENTS

Panel data is longitudinal data for a set of cross-sections. For the current study, the data sample consisted of different financial variables from accounting financial statements captured for specific companies over a particular period, namely 2005 to 2017. In the current study, it refers to annual observations (longitudinal) for a set of firms (cross-section).

The various hypotheses for the study, as stated in Section 4.5, required somewhat different approaches to the regression models used. The research models and instruments that were used for each hypothesis are discussed in the subsections below. A summary of the different variables used in the models is presented in Table 5.1.

Table 5.1: Summary of variables used to measure the value relevance and determinants of derivatives disclosure

	Variable	Calculation/Description	Symbol	Hyp. sign
Dependent variable:	Derivative	Derivatives total amount as binary value 1/(0)	*DERTOTAL_BIN*	
	Derivative	Total Derivatives amount: continuous variable	*DERTOTAL*	
Independent variables: **Bankruptcy and financial distress costs**	Leverage	Debt to equity ratio / Debt to total assets ratio	*LEVDE / LEVDA*	+
	Liquidity	Current ratio	*CR*	+
	Dividend payment	Dividend yield	*DIVYIELD*	+/-
	Interest coverage ratio	(Logarithm of) Earnings before interest and tax ÷ interest expense	*INTCOVER*	+/-
	Profitability	Return on assets	*ROA*	-
	Firm size	Logarithm of total assets	*LNTOTASS*	+/-
Underinvestment cost	R&D expenses	Research and development cost scaled by total sales	*RD/SALES*	+
	Tobin's Q	(Logarithm of) market value of firm ÷ book value of assets	*LNTOBINSQ*	+/-
Asymmetric information and agency conflict of equity	Share ownership	Total Directors Shareholding (Logarithm of) Number, percentage or market value of shares held by managers or directors	*DIRTOTSHARES*	+/-
Corporate taxes	Corporate taxes	Dummy variable of if accumulated computed tax loss is reported	*ACTLDV*	+
Other operating characteristics	Foreign sales	Foreign sales/Total sales	*FOR/SALES*	+
	Sector	Dummy variable of industry segment	*SECTOR*	+/-
Variables included in value relevance models	Time dummy	Specific periods were controlled for by using dummy variables	*DUMPERIOD*	+/-
	QDI	Quality of disclosure index	*QDI*	+

Source: Own compilation

5.5.1 The determinants of derivatives disclosure

The first step in analysing the data was to establish the extent of derivatives use by companies listed on the JSE. The next step was to analyse the data focusing on the firm characteristics that influence the top 200 non-financial firms, listed by market capitalization and included in the sample, to use derivative instruments. Though market capitalization can vary, the JSE is dominated by relatively few large companies. The top 40 largest companies by market capitalization represent over

80% of total market capitalization on the stock exchange. The 200 companies were selected as the top 200 non-financial companies by market capitalization listed on the JSE on the date the data collection was started. The 200 companies included in the sample is thus a fair representation of the total market capitalization of all the non-financial companies listed on the JSE (JSE, n.d.). Thus the focus in testing for the first hypothesis (H_1) was to establish which specific firm characteristics can be associated with using derivatives for 200 non-financial companies listed on the JSE. For this purpose, the following regression model was used:

$$Ln\ (\pi/1\text{-}\pi) = \alpha + \Sigma SECTOR + \beta_1 LEVDE + \beta_2 CR + \beta_3 DIVYIELD + \beta_4 ROA + \beta_5 LNTOTASS + \beta_6 RD/SALES + \beta_7 LNTOBINSQ + \beta_8 DIRTOTSHARES + \beta_9 ACTLDV + \beta_{10} FORSALES + \beta_{11} INTCOVER + \varepsilon_i \quad (5.1)$$

Where

π	=	the probability that a company uses derivatives, dummy variable of 1/(0) if a company uses derivatives/(does not use derivatives)
α	=	intercept
ΣSECTOR	=	different sectors in which the firms in the sample operate, controlling for firm effects
LEVDE	=	level of leverage for each firm = the ratio of total debt divided by shareholders' equity
CR	=	liquidity = current ratio
DIVYIELD	=	dividend yield
	=	profitability = ROA
LNTOTASS	=	size = logarithm of total assets
RD/SALES	=	research and development (R&D) costs divided by total sales
LNTOBINSQ	=	logarithm of Tobin's Q
DIRTOTSHARES	=	Total Directors Shareholding = Dummy variable if company reported number, percentage or market value of shares held by managers or directors
ACTDLV	=	dummy variable if accumulated computed tax loss is reported
FOR/SALES	=	foreign sales/total sales
INTCOVER	=	interest cover
ε_i	=	residual term

The first regression model (Equation 5.1) provides answers on the determinants of derivatives use by firms listed on the JSE. Prior research suggests that several economic variables, including firm size, profitability, leverage, financial distress, geographic diversification and liquidity and growth prospects may influence the decision to use derivatives. The research model for the first set of hypotheses ($H1_1$ to $H1_5$) answers which of these explanatory variables influenced the use of derivatives for the sample over the period under review. Table 5.1 summarizes the proxies used for the first regression model, followed by a short discussion on the various proxy variables used in the statistical models.

- *Size (LNTOTASS):*

  *T*he logarithm of total assets was used to proxy firm size. Larger companies are more likely to hedge (Berkman & Bradbury, 1996; Berkman *et al.*, 2002; Géczy *et al.*, 1997; Heaney & Winata, 2005) because they have better access to larger economies of scale in operations, and better access to financial markets and expertise. However, Bodnar *et al.* (2013) argue that smaller firms might have a larger incentive to hedge to reduce the risk of financial distress. There is inconclusive evidence about the effect of company size on firm value, and hence, the natural logarithm of total assets was used to control for company size, *ln(Total assets)*.

- *Profitability (ROA):*

  More profitable firms were expected to have used derivative instruments to avoid extreme losses due to financial volatility. The profitability of firms in the study was proxied by ROA. ROA is calculated as return divided by total assets.

- *Leverage (INTCOVER):*

  Firms that are highly leveraged, in other words, are more heavily dependent on debt financing than on equity financing, have a higher incentive to use derivatives (Bartram *et al.*, 2009; Shu & Chen, 2003). Firms with high debt obligations also have higher interest payments and therefore a higher incentive to hedge credit risk. Firms that are highly leveraged have a higher incentive to hedge exposures posed by low coverage ratios. The gearing ratio of debt to equity was used as a proxy for leverage.

- *Financial distress (LEVDE):*

  Companies hedge to avoid the costs of financial distress (Froot, 1993; Smith & Stulz, 1985). The debt ratio (total debt to total equity) was used as a proxy for potential financial distress. Past studies have shown that hedging increases as the debt ratio increases (Dolde, 1995; Froot, 1993; Haushalter, 2000). Graham and Rogers (2002) point out that hedging and leverage causality can go both ways, in that hedging can increase debt capacity, which in turn increases leverage, which could then again result in an incentive to hedge.

- *Geographic diversification (FOR/SALES):*
  Firms that face a higher likelihood of exchange rate risk are more likely to hedge themselves against such risk (Afza & Alam, 2011). Firms with a higher amount of foreign sales to normal sales were therefore expected to be more likely to use and thus disclose derivatives.
- *Growth prospects (RD/SALES):*
  Firms with higher growth prospects are more likely to use derivatives (Géczy *et al.*, 1997). Firms' growth prospects were measured by the ratio of capital expenditure to total assets, as well as the ratio of R&D costs to total sales (Géczy *et al.*, 1997; Rogers, 2002).
- *Liquidity (CR):*
  The current ratio and quick ratio were used to express a company's liquidity. According to Berkman *et al.* (2002), derivatives use increases with firms' internal financial requirements, as well as with liquidity.

5.5.2 The value relevance of derivatives disclosure

Once the determinants of derivatives use by companies listed on the JSE were established, the study attempted to ascertain the value relevance of derivatives disclosure for firm value. Firm value was approximated by Tobin's Q (see Sections 1.1 and 2.4).

Tobin's Q is the ratio of the market value of equity plus the book value of assets minus the book value of equity to the book value of assets. To address potential skewness in the sample, the natural logarithm of Tobin's Q was used, which had the added benefit that changes in this variable can be interpreted as percentage changes in firm value (Allayannis & Weston, 2001; Ben Khediri & Folus, 2010; Clark & Mefteh, 2010).

In line with previous research, the study attempted to isolate derivatives use as a driver of firm value by including other known drivers of firm value as control variables in the multivariate analysis. These control variables included size, industry, liquidity, profitability, sector, growth prospects and geographic diversification. As was established in Section 3.2, these are the main determinants of derivatives use. Hence, to establish value relevance, the study adjusted for the fact that certain firm characteristics influence the use of derivatives by firms.

To determine the impact of derivatives use on firm value, the following model was used:

$$Firm\ value = \alpha + \Sigma SECTOR + \beta_1 DERTOTAL\_BIN + \beta_2 LNTOTASS + \beta_3 CR + \beta_4 LEVDA + \beta_5 ROA + \beta_6 RD/SALES + \beta_7 FOR/SALES + \beta_8 DIVYIELD + \varepsilon_i \qquad (5.2)$$

Where

Dependent value	=	Firm value proxied by Tobin's Q
α	=	intercept
ΣSECTOR	=	different sectors in which the firms in the sample operate
DEROTAL_BIN / DERTOTALWINSB	=	Hedging/derivatives. Dichotomous of 1/(0) if the company uses derivatives/(does not use derivatives) and/or logarithm of the total derivatives amount disclosed in the financial statements as a continuous variable
LNTOTASS	=	Firm size = logarithm of total assets
CR	=	Liquidity = current ratio
LEVDA	=	Leverage ratio of total debt divided by total assets
ROA	=	Profitability = ratio of EBIT divided by total assets (ROA)
RD/SALES	=	Growth prospects = ratio of R&D expenses divided by total sales
FOR/SALES	=	Geographic diversification =ratio of foreign sales divided by total sales
DIVYIELD	=	Dividends = dichotomous variable of 1/(0) if company paid/(did not pay) dividends during the year
ε_i	=	residual term

A short discussion of the various variables used in the statistical models is presented below:

- *Dependent variable (LNTOBINSQ):*

  Most researchers employ some version of Tobin's Q as a proxy for firm value. Tobin's Q is calculated as the total book value of assets minus the book value of equity plus the market value of assets decided by the total book value of assets. This study followed the past practice in the literature by using the natural log to control for any skewed distribution. This had the added advantage that it allowed the regression coefficients to be interpreted in percentage terms. The variable used to proxy firm value was Tobin's Q.

- *Explanatory variable (DERTOTAL_BIN):*

  To measure the value effect arising from the disclosure of derivatives for hedging purposes, two measures were used: a dummy variable equal to 1 if companies disclosed a derivatives amount during the sample period, and the natural logarithm of the total derivatives amount disclosed in the financial statements during the sample period. A positive (negative) value of the coefficient indicated for these proxies of corporate hedging increased (decreased) firm value. *Derbin/DerTot* represents the dependent variable for both the decision to hedge (*Derbin*) and the extent of hedging practices (*DerTot*).

To isolate the impact that using derivatives had on firm value, other known drivers of firm value were included in the regression, including firm size, profitability, growth prospects, geographic diversification, liquidity, leverage and firm industry (Jankensgård, 2015; Khediri & Folus, 2010):

- *Size (LNTOTASS):*

  The logarithm of total assets was used as a proxy of firm size. Larger companies are more likely to hedge (Berkman & Bradbury, 1996; Berkman *et al.*, 2002; Géczy *et al.*, 1997; Heaney & Winata, 2005), because they have better access to larger economies of scale in operations and better access to financial markets and expertise. However, Bodnar *et al.* (2013) argue that smaller firms might have a larger incentive to hedge to reduce the risk of financial distress. Firm size should thus be controlled for. Furthermore, there is inconclusive evidence about the effect of company size on firm value, and hence, the natural logarithm of total assets was used to control for company size, as was also done in the studies by Bielmeier and Hansson Nansing (2013), Jankensgård *et al*. (2014), and Khediri and Folus (2010).

- *Profitability (ROA):*

  More profitable firms were expected to derivative instruments more to avoid extreme losses due to financial volatility. More profitable firms tend to be valued higher by the market (Bielmeier & Hansson Nansing, 2013); hence, the effects of profitability have to be controlled for. The profitability of firms in the study was proxied by ROA, as in Bielmeier and Hansson Nansing (2013), Jankensgård *et al*. (2014) and Khediri and Folus (2010).

- *Leverage (LEVDA)*:

  Firms that are highly leveraged, in other words, are more dependent on using debt financing than equity financing, have a higher incentive to use derivatives (Bartram *et al.*, 2009; Shu & Chen, 2003). Firms with high debt obligations have higher interest payments and therefore a higher incentive to hedge credit risk. Firms that are highly leveraged have a higher incentive to hedge exposures posed by low coverage ratios. The effects that leverage (the comparison of the amount of debt used to finance a firm in relation to the extent it is financed by equity) on firm value has been a topic of much research in finance. Firm value can be influenced by leverage because trade-off theory suggests that leverage affects cost of capital (Bielmeier & Hansson Nansing, 2013). Firm value can thus be affected by tax shields, as well as by an increase in financial distress costs, which increases when more debt is used in the capital structure. Allayannis and Weston (2001) found evidence of a negative relationship between Tobin's Q and leverage. The present study therefore controlled for firm value by using leverage ratios: total debt/total capital, total debt/equity, total debt/total assets (Bielmeier & Hansson Nansing, 2013; Jankensgård *et al.*, 2014; Khediri & Folus, 2010).

- *Access to financial markets (DIVYIELD) Dummy variable = 1:*

  Companies without easy access to financial markets have an incentive to invest only in very profitable projects with positive net present values, thereby increasing firm value. Firms that pay dividends have fewer restrictions in the financial markets, and the issue of dividends itself sends a positive signal and increases firm value (Asquith & Mullins, 1983; Fazzari, Hubbard & Petersen, 1988). A dummy variable equal to 1 was used if a firm paid a dividend, to control for its effect on firm value (Ben Khediri & Folus, 2010; Pramborg, 2004).

- *Geographic diversification (FOR/SALES):*

  Firms that face a higher likelihood of exchange rate risk are more likely to hedge themselves against such risk (Afza & Alam, 2011). Firms with a higher ratio of foreign sales to normal sales were therefore expected to be more likely to disclose derivatives. Firms that operate in more than one country may be more likely to be valued higher (Allayannis, Ihrig & Weston, 2001). This study therefore controlled for geographic diversification by using a dummy variable equal to 1 if a sample company reported foreign sales.

- *Growth prospects (RD/SALES):*

  Firms with higher growth prospects are more likely to hedge (Géczy *et al.*, 1997), and firm value is affected by a company's future investment opportunities. Firms' growth prospects were measured by the ratio of capital expenditure and total assets, as well as the ratio of R&D costs to total sales (Géczy *et al.*, 1997; Rogers, 2002).

- *Liquidity Current ratio (CR):*

  The current ratio and quick ratio were used to express a company's liquidity. Berkman *et al.* (2002) maintain that derivatives use increases with firms' internal financial requirements, as well as liquidity. Firms with a relative high amount of free cash flow are more likely to invest in projects with a negative net present value, so firms that are cash constrained are more likely to have higher values (Fama & French, 1998; Pramborg, 2004).

- *Industry effects (SECTOR):*

  This study used dummy variables to control for industry effects and take into account industry effects. Companies were classified according to their sector, as provided by IRESS.

- *Time effects (DUMPERIOD):*

  Firm value fluctuates over time as different macroeconomic factors influence the broader economy in which a company operates. Time effects were controlled for by using a panel data approach or period dummy variables. A core objective in this study was to examine the time effects of corporate hedging practices more closely, hence this concept is studied in more detail in Section 8.2.

5.5.3 The value relevance of derivatives disclosure in different economic periods

The third hypothesis relates to the value relevance of derivatives use during different economic cycles. A further contribution of the current study lies in providing comparative analyses of derivatives use over different periods. The study investigates the effect of using derivatives on firm value before the financial crisis of 2008/2009, during the financial crisis and the period since the financial crisis. The particular time frame from which the dataset was compiled (2005-2017) can provide valuable insight on derivatives use during different economic cycles. This is because the data captured includes an economic upswing (2005-2007), an economic downturn (2008-2009) and an economic recovery (2010-2017). The total period of the data sample is also the total period in which derivatives had to be disclosed according to *IAS 39*. Since the purpose of using derivatives is to hedge against unforeseen economic downturns, the separation of the dataset into three different periods can provide valuable insight as to the effectiveness of using derivatives to protect firm value during recessionary economic periods. The regression model applied to test the third hypothesis, which states that the value relevance of derivatives disclosed in the financial statements of JSE-listed entities is statistically significantly different during specific economic periods, was similar to the regression models previously discussed. As with Eq. 5.2 (discussed in Section 5.5.2), the dataset was differentiated into different economic periods, namely a pre-crisis period (2005-2007), a during-the-crisis period (2008-2009) and a post-crisis period (2010-2017). The model used was the following:

$$Firm\ value = \alpha + \Sigma SECTOR + \beta_1 DERTOTAL\_BIN + \beta_2 LNTOTASS + \beta_3 CR + \beta_4 LEVDA + \beta_5 ROA + \beta_6 RD/SALES + \beta_7 FOR/SALES + \beta_8 DIVYIELD + \beta_9 DUMPERIOD + \varepsilon_i \quad (5.3)$$

Where

Dependent value	=	Firm value proxied by Tobin's Q
α	=	intercept
ΣSECTOR	=	different sectors in which the firms in the sample operate
DEROTAL_BIN / DERTOTALWINSB	=	Hedging/derivatives. Dichotomous of 1/(0) if the company uses derivatives/(does not use derivatives) and/or logarithm of the total derivatives amount disclosed in the financial statements as a continuous variable
LNTOTASS	=	Firm size = logarithm of total assets
CR	=	Liquidity = current ratio
LEVDA	=	Leverage ratio of total debt divided by total assets
ROA	=	Profitability = ratio of EBIT divided by total assets (ROA)
RD/SALES	=	Growth prospects = ratio of R&D expenses divided by total sales
FOR/SALES	=	Geographic diversification =ratio of foreign sales divided by total sales
DIVYIELD	=	Dividends = dichotomous variable of 1/(0) if company paid/(did not pay) dividends during the year

DUMPERIOD = Time dummy = Specific periods were controlled for by using dummy variables

ε_i = residual term

Since prior research relating to the disclosure of using derivatives during different economic cycles was limited, no prediction was made regarding the sign of the coefficients in the regression model. However, it was clear that if no variation was found in the coefficients, it would suggest that investors viewed the information regarding derivatives use to have the same informational content even during different economic periods.

5.5.4 The value relevance of derivatives disclosure, controlling for different levels of quality of information

Previous researchers who assessed the quality of derivatives disclosure applied an unweighted index of derivatives disclosure to represent the transparency and quality of the derivatives information contained in companies' financial statements (Hassan *et al.*, 2006). To construct the index, five categories of disclosure requirement were created: policy information, hedges of anticipated future transactions, risk information, net fair value of information, and commodity contracts regarded as financial instruments. A score of 1 was given if the information, either quantitative or qualitative, was given in the financial statements, or 0 if the company failed to give any information.

The quality of disclosure was measured as follows:

Quality = firm's disclosure score as measured by the QDI

The annual reports of company financial statements of 200 non-financial companies listed on the JSE during the sample period were manually examined for information regarding derivatives disclosure. A sub-sample of companies that disclosed information on derivatives was created, as captured from Thomson Reuters Datastream, and was investigated for the quality of their disclosure of their used of derivative instruments. This sub-sample of firms included all the firms that disclosed derivatives at least once during the sample period. Firms that did not disclose any information on derivatives instruments were excluded from this sub-sample since.

The sub-sample of firms that did disclose derivatives was divided between companies which were scored as having ‘excellent’ and ‘good’ quality of disclosure and ones which were scored as having ‘average’ quality of disclosure. A comparative regression analysis of the value effect of derivatives use on firm value was conducted to compare the two different sub-samples of firms that did disclose derivatives. The analysis attempted to distinguish whether there was a difference between the value relevance of derivatives use for companies that were considered to have ‘excellent’ and ‘good’ quality of information disclosure, compared to firms that were considered to have ‘average’ quality of information disclosure.

A disclosure index was created in line with that used by Hassan *et al.* (2006) and using the report on user perspectives on derivatives and hedging activities disclosures under IFRS by the CFA institute as a reference, as well as Huang and Huang (2012). The quality of disclosure indexes by Hassan *et al.* (2006), Huang and Huang (2012) and the CFA institute are included in Tables 5.2, 5.3 and 5.4. The quality of disclosure index for JSE-listed firms included in the current study is presented in Table 5.5.

Table 5.2: Components of Derivatives Disclosure Index

Policy Information
Accounting policies and method adopted
a) Extent and nature of the underlying financial instruments, b) Including significant terms and conditions that may affect the amount timing, and uncertainty of future cash flows.
Objectives for holding or issuing derivative financial instruments
Component score
Hedge of Anticipated Transaction
a) A description of the anticipated transaction, b) including the period of time until they are expected to occur.
A description of the hedging instruments.
a) Amount of any deferred or unrecognized gain or loss and b) the expected timing of recognition as revenue or expense.
Risk Information
Contractual re-pricing or maturity dates for interest rate risk
Effective interest rates or weighted average
The maximum amount of credit risk exposure at reporting date
Net Fair Value Information
a) The aggregate net fair value as at the reporting date,

b) showing separately the aggregate net fair value of those financial assets or financial liabilities which are not readily traded on organized markets in standardized form.
The method or methods adopted in determining net fair value.
Any significant assumptions made in determining net fair value.
The carrying amount and the net fair value of either the individual asset or appropriate groupings of those individual assets.
a)The reasons for not reducing the carrying amount, b) including the nature of the evidence that provides the basis for management's belief that the carrying amount will be recovered.
Commodity Contracts Information
Contract for commodity gold

Source: Adapted from Hassan *et al.* (2006:29)

Table 5.3: Overall scores of questions in FDDI

Questions
Does the firm specify the objectives for holding or issuing derivative instruments?
Does the firm provide other disclosures related to its use of derivative instruments?
Does the firm disclose the principal, stated, face, or other similar amount of derivative instruments?
Does the firm specify the existence of derivative features in its compound financial instruments?
Does the firm disclose the net market value for derivative instruments?
Does the firm disclose the date of maturity, expiry, or execution of derivative instruments?
Does the firm disclose the fair value of derivative instruments?
Does the firm specify the accounting policies for derivative instruments?
Does the firm disclose the carrying amount of derivative instruments?
Does the firm separately provide information for embedded derivatives and liability component of a compound financial instrument?
Does the firm specify the methods used in determining the value of derivative instruments?
Does the firm specify its hedging policy?
Does the firm specify how it monitors and manage the risks associated with derivative instruments?
Does the firm discuss any changes to the above disclosures from the previous reporting period?
Does the firm segregate information by risk categories (i.e. credit risk, liquidity risk, and market risk)?
Does the firm sort its derivative instruments into appropriate financial instruments' categories (held for trading or hedging instruments)?
Does the firm specify the associated risks provided by derivative instruments?
Does the firm disclose the early settlement and conversion options, including details of its exercise of derivative instruments?
Does the firm disclose the amount and timing of scheduled future cash flows related to derivatives' principal amount?
Does the firm disclose the interest, dividends, or other periodic returns on principal and its timing related to derivative instruments?
Does the firm disclose the effective interest rates of derivative instruments?
Does the firm specify to whom it has credit risk exposures?
Does the firm provide the estimated maximum credit risk exposures at the reporting date?
Does the firm use the sensitivity analysis to demonstrate the impact of possible movements in each market risk variable on profit and loss and equity?

Source: Adapted from Huang and Huang (2012:305-308)

Table 5.4: Derivatives and Hedge Accounting Disclosure Quality Index

Disclosure Dimension (22 Dimensions)
Sufficient use of tabular presentation
Ease of use (i.e. related disclosures mostly in one location or adequately cross-referenced)
Notional amount of derivatives
Notional amount disaggregated by risk type and by use (i.e. hedging versus trading)
Adequately disaggregated quantitative risk exposure (e.g. disaggregate assets or liabilities by foreign currency type, proportion of fixed versus floating-rate debt, exposure to commodities)*
Market risk — sensitivity analysis of derivatives*
Credit risk of derivatives counterparties [e.g. disaggregation into credit rating buckets of derivatives assets and provision of details of underlying credit quality of each bucket (e.g. probability of default)]
Funding liquidity risk — derivatives-related covenants (e.g. credit risk contingent commitments)
Financial instrument liquidity risk — fair value hierarchy* (i.e. helpful to assess derivatives instrument liquidity risk)
Disaggregation of derivatives assets and liabilities by hedge accounting category* (i.e. cash flow, fair value and net investment hedge accounting)
Non-designated derivatives — disaggregation between trading derivatives and derivatives that are economic hedges (i.e. they do not qualify as accounting hedges)
Breakdown of derivatives by instrument type* (e.g. futures, forwards, swaps, options, synthetic and exotic instruments)
Qualitative and quantitative disclosures adequately describe hedging strategies (e.g. describing items being hedged and explaining related quantitative disclosures)
Quantitative amount of hedging ratio (i.e. describes expected change in value of hedged instrument/expected change in value of hedged item. Hedging ratio can be in expressed in terms of a quantity of risk factor or monetary terms)
Disclosure of sources of ineffectiveness (e.g. basis risk due to the mismatch of maturity or underlying risk factor, time value of options)
Fair value hedges — breakdown of hedged item including amount hedged versus amount unhedged and balance sheet item categorization
Fair value hedges — details of gains or losses of hedged item and hedging instrument presented jointly in the disclosures*
Fair value hedges — disclosure of cumulative gains or losses of hedging instrument and hedged item for fair value hedging relationships
Cash flow hedges — companies with cash flow hedges provide sufficient income statement disclosures of cash flow hedge ineffectiveness*
Cash flow hedges — sufficient disclosure of items reclassified from OCI to income statement* (i.e. differentiating between hedges discontinued due to de-designation, realised hedges, and ineffective hedges)
Cash flow hedges — the periods in which the cash flows hedges are expected to be reflected in the profit or loss*
Disclosure of the impacts of hedges on cash flows (e.g. within operating, investment or financing categories of the cash flow statement)

* Items required or mandatory IFRS disclosures

Source: Adapted from CFA Institute (2013:44-45)

Content analysis is a subjective study by its very nature and it is important to reiterate that the function of the QDI is to create a relative measure of the quality of information disclosure to assess whether such disclosure has an impact on the value relevance of an accounting item. An amalgamation of the most important disclosure requirements from previous studies was used to create the QDI presented in Table 5.5. It is important to note at this point that the core focus of the current study was not the *quality* of disclosure of derivatives by firms listed on the JSE; rather, it was a value relevance study. Therefore, it was important to include a measure of the quality of the disclosure of derivatives to be able to assess the value derived from such information obtained from the financial records of business entities better. It was beneficial as a comparative measure of usefulness, transparency and value relevance of derivatives information in the financial statements. In other words, it was expected that firms with higher quality of disclosure would have more value relevant information. The QDI that was created had to include only the most important disclosure requirements that were *expected* to be included in the financial statements.

The annual reports of the companies in the sub-sample of firms that did disclose derivatives were examined for information on derivatives in the accounting policy, disclosure on hedges of anticipated future transactions, information pertaining to risk, net fair value of information and whether or not information on derivatives were disclosed as part of the financial statements or only in the notes to the financial statements. The regression models used to assess the value relevance of derivatives disclosure is thus adjusted with the additional variable for quality of the disclosure.

Table 5.5 summarizes how the QDI for the current study was compiled.

Table 5.5: Disclosure quality index (QDI) – desirable presentation of disclosures

Questions	Score
To what extent does the firm use tabular presentation and what is the general ease of use (are derivatives in one location or is there sufficient cross-referencing?)	2,1,(0)
Does the firm disclose the fair value, notional or principal amount of derivatives and derivative characteristics such as the date of maturity, expiry, or execution of derivatives?	1(0)
To what extent does the firm disclose additional amounts for derivatives amounts such as net market value, additional fair values or carrying amounts?	2,1(0)

Questions	Score
Is the notional amount disaggregated by risk type (commodity, credit, foreign exchange) or by use (hedging versus trading)?	1(0)
To what extent are derivatives assets and liabilities disaggregated by hedge accounting category (cash flow, fair value, or net investment hedge accounting)?	2,1(0)
Is the notional amount disaggregated by instrument type (forwards, futures, options and swaps, exotic instruments)?	1(0)
Does the firm disclose the objectives or reasons for using derivatives and/or the terms of the hedging policy?	1(0)
Does the firm disclose accounting policies for derivative instruments and/or how the value for derivatives is derived, and/or any changes or reclassifications to the accounting policy for derivatives?	2,1(0)
To what extent does the firm specify the existence of derivative features in compound financial instruments or discuss any information on embedded derivatives and liability components of compound financial instruments?	2,1(0)
To what extent does the firm specify the risks associated with derivatives, how it monitors and manages these risks, and/or does the firm segregate information by risk categories, or whom it has credit risk exposure to and/or does it disclose any sources of ineffectiveness?	2,1(0)
Does the firm provide additional information pertaining to details and specified characteristics on different derivative contracts including the timing of scheduled future cash flows, early settlement and conversion options, interest, dividends or other periodic returns on principal and their timing, the exercise of options, effective interest rates, and/or maximum risk exposure of derivatives instruments?	2,1(0)
Does the firm use sensitivity analysis?	1(0)

Source: Own compilation

The following equation was used:

$$Firm\ value = \alpha + \Sigma SECTOR + \beta_1 DERTOTAL\_BIN + \beta_2 LNTOTASS + \beta_3 CR + \beta_4 LEVDA + \beta_5 ROA + \beta_6 RD/SALES + \beta_7 FOR/SALES + \beta_8 DIVYIELD + \beta_9 QDI + \varepsilon_i \quad (5.4)$$

Where

Dependent value	=	Firm value proxied by Tobin's Q
α	=	intercept
ΣSECTOR	=	different sectors in which the firms in the sample operate
DEROTAL_BIN /	=	Hedging/derivatives. Dichotomous of 1/(0) if the company

DERTOTALWINSB		uses derivatives/(does not use derivatives) and/or logarithm of the total derivatives amount disclosed in the financial statements as a continuous variable
LNTOTASS	=	Firm size = logarithm of total assets
CR	=	Liquidity = current ratio
LEVDA	=	Leverage ratio of total debt divided by total assets
ROA	=	Profitability = ratio of EBIT divided by total assets (ROA)
RD/SALES	=	Growth prospects = ratio of R&D expenses divided by total sales
FOR/SALES	=	Geographic diversification =ratio of foreign sales divided by total sales
DIVYIELD	=	Dividends = dichotomous variable of 1/(0) if company paid/(did not pay) dividends during the year
QDI	=	proxy variable to control for the quality of derivatives disclosure
ε	=	residual term

Some pertinent data points from the CFA report and the study by Huang and Huang (2012) were excluded from the QDI because those studies revealed little compliance with these disclosure requirements by their sample companies. The CFA report's sample included South African companies. It was therefore expected that these data points would also be missing from the financial statements of companies in the current data sample. Some of the data points were also voluntary in nature. Some questions that had low inclusion were combined in the QDI for the current study for ease of use.

It was also expected that firms that used derivatives in larger volumes and more often were likely to have better quality of disclosure. The absolute total value of derivatives disclosed, as well as the number of years the company used derivatives in the sample period was known for each company and could be used later in the study to scale the QDI to test the robustness of the variables included in the sample.

5.6 ASSESSING AND DEMONSTRATING THE QUALITY AND RIGOUR OF THE RESEARCH DESIGN

This section discusses in detail the different ways in which the quality and rigour of the research design were enhanced.

5.6.1 Testing for the presence of outliers

The existence of outliers in a dataset can skew the results and statistical inferences that are made based on a particular sample. This study predominately investigated the determinants of derivatives use by firms listed on the JSE, as well as the relationship between derivatives use and firm value. These relationships were further investigated during different economic periods, namely prior to, during and after the global financial crisis of 2008/2009. Therefore, the study had to be sensitive to the presence of outliers that could potentially affect the findings from the statistical analyses. Outliers can be graphically identified by means of a box-plot. Such outliers can either be removed from the statistical analysis, or the data can be winsorized. Winsorization is a process applied to the study's dataset by which identified outliers at the top and bottom are replaced by the value associated at lower and higher percentiles respectively. The identified outliers at the top in the current study were replaced with the 95% percentile, and identified outliers at the bottom were replaced by the 5% percentile value.

5.6.2 Panel data unit root test

The unit root test ascertains whether a time series variable is non-stationary and possesses a unit root. The null hypothesis for the unit root test is generally defined as the presence of a unit root, while the alternate hypothesis would then be either stationarity, trend stationarity or an explosive root. A unit root is a feature of some stochastic processes that can cause problems in statistical inferences when time-series variables are used. The current study used the Levin, Lin and Chu (2002) test to test for a unit root.

5.6.3 Heteroskedasticity

Heteroskedasticity is the violation of homoskedasticity, and it is present when the error term differs across the values of an independent variable. This study used the Breusch-Pagan test to determine whether heteroskedasticity was present.

5.6.4 Serial correlation

Serial correlation, or autocorrelation, is the relationship between a given variable and a lagged version of itself over various time intervals. This study used the Durbin-Watson test to check for serial correlation.

5.6.5 Endogeneity

A correlation between the error term and one or more of the independent variables is referred to as endogeneity. Potential endogeneity between the dependent variable and some explanatory variables could lead to biased results in statistical analyses. The Durbin-Wu-Hausman test evaluates the consistency of an estimator when compared to an alternative, less efficient estimator which is already known to be consistent.

5.6.6 Multicollinearity

Multicollinearity occurs when two or more predictor variables are highly correlated and could result in unstable parameter estimates, which could influence the assessment of the effects of an independent variable on a dependent variable. Finance research is particularly prone to multicollinearity; variables sourced from financial statements in particular tend to be correlated with each other, for example, variables such as firm size, profitability and liquidity etc. can influence each other and cannot be assumed to be totally independent of each other.

A Pearson correlation matrix (PCM) and variance inflation factor (VIF) were used in this study to identify the presence of multicollinearity. A correlation matrix between the independent variables was created to detect potential multicollinearity. Any correlation coefficient exceeding 0.8 was considered to be indicative of multicollinearity of the corresponding variables. The VIF was used to check whether the independent variables had existing problems of multicollinearity. If the VIF value of each variable was smaller than the recommended value of 10 it indicated that there were no multicollinearity problems.

5.6.7 Normality

An analysis of the skewness and kurtosis was used to signal possible violations of the normality of variables, where applicable. General guidelines advise that kurtosis and skewness values should be within +/- 2. The Jarque-Bera test was performed to test for non-normality of the residuals. A p-value of 0 indicated that the null hypothesis that the distribution of the residuals is normal should be rejected.

5.6.8 Test for fixed or random effects

Hausman's specification test (Hausman, 1978) was conducted to test for a firm fixed or random effects model. A fixed effects regression for panel data is an estimation technique that allows for the control of time-invariant unobserved individual characteristics that can be correlated with the observed independent variables. This implies that the group means are fixed, as opposed to the random effects model, where group means are a random sample from the population. A rejection of the null hypothesis ($p<0.05$) for Hausman's (1978) test for specification indicates that the fixed effects model is preferred alternatively to the random effects model.

5.6.9 Linearity assumptions of binary logistic regression models

Linearity of the continuous variables in respect of the logit of the dependent variable was assessed by means of the Box-Tidwell (Box & Tidwell, 1962) procedure. Based on this assessment, all continuous independent variables were found to be linearly related to the logit of the dependent variable.

5.7 SUMMARY AND CONCLUSION

This chapter has presented the research methodology adopted to conduct the research in this study. The research models are based on those employed in prior value relevance research. The current study conducted both correlation analyses and multivariate regression analyses to establish the determinants of derivatives use by companies listed on the JSE, as well as to determine the value relevance of disclosure of that use. These regression analyses provided answers as to whether derivatives use by firms in South Africa added to firm value in the sample period. Furthermore, separating the data sample into different periods (the periods before, during and after the global financial crisis), and including a measure of disclosure quality, provided comparative statistical answers to enhance understanding of how the derivatives markets influence value creation (or destruction) in different periods for different types of firms that use derivatives for different motives. Chapters 6 to 8 present the results, and specifically, Chapter 6 discusses the results of the descriptive statistics and regression models for the determinants of derivatives disclosures.

CHAPTER 6:
RESULTS AND DISCUSSION:
THE DETERMINANTS OF DERIVATIVES USE FOR CORPORATE HEDGING

6.1 INTRODUCTION

This chapter discusses the results from the detailed analyses of the data elicited from the sample. The statistical analyses discussed in this study focus on testing the four main hypotheses (see Section 4.5), and the results are set out in Chapters 6 to 8.

The first hypothesis (divided into five sub-hypotheses) relates to the determinants of derivatives use by firms listed on the JSE from 2005 to 2017, which was tested by examining whether JSE-listed firms included in the sample use derivatives to hedge financial risk exposures in order to reduce possible financial distress costs and the risk of bankruptcy ($H1_1$), to reduce underinvestment costs ($H1_2$), to reduce information asymmetry costs between shareholders and managers ($H1_3$), to respond to tax incentives to minimize expected tax liability ($H1_4$), and/or to address other operating characteristics ($H1_5$). The results relating to these issues are discussed in this chapter.

In considering the five sub-hypotheses of the first hypothesis of the study, it was assumed that the JSE-listed companies in the sample used derivatives only for hedging purposes and not for profit-seeking by speculation. The use of derivatives by these companies thus became a proxy for the corporate hedging practices of the firm. In the discussion below, the details of the findings are set out. These results laid the groundwork for the subsequent analyses and discussion of the hypotheses and the related results.

The other three hypotheses are concerned with the value relevance of derivatives disclosure (*H2*) (discussed in Chapter 7), and whether the value relevance of derivatives disclosure is different during different (specific) economic periods (*H3*), and the value relevance of derivatives disclosure whilst controlling for the quality of such disclosure (*H4*) (both discussed in Chapter 8).

The first section below (Section 6.2) discusses all the descriptive statistics of the data sample. Each of the subsequent discussions with regard to the individual hypotheses is divided into consideration of the findings from the univariate correlations and the findings from the multiple variable regression models. At the end of Chapter 8, there is a discussion of the various robustness tests performed, before the findings are summarised in Chapter 9, which also contains the conclusion to the study.

6.2 DESCRIPTIVE STATISTICS

6.2.1 Descriptive statistics regarding the determinants of derivatives use by JSE-listed firms

The descriptive statistics for the sample firm-years of non-financial companies listed on the JSE are detailed in Tables 6.1 and 6.2. The tables present a summary of the statistics for the sample of observations. Table 6.1 shows amongst others the mean, median, first and third quartile and standard deviations for the dependent variable while Table 6.2 shows these data for the independent variables. The analysis of the descriptive statistics for the various dependent and explanatory variables in the study produced several interesting findings, as discussed below.

As indicated in Chapter 5, data for all the sample firms were collected from Thomson Reuters Datastream and IRESS, and these are presented in ZAR for comparative purposes.[1] Values expressed in ZAR are denoted with an 'R'. Companies listed on the JSE main board tend to be large by market capitalization (the largest is Naspers). The market capitalization data were winsorized to take into account extreme and unrealistic values and address potential skewness. Winsorizing data entails transforming data by limiting extreme values to reduce the effect of extreme outliers. The data were winsorized by replacing extreme values with a minimum and maximum threshold calculated at the 5% and 95% percentiles. (Descriptive statistics for unwinsorized data are presented in Table A.1 in Appendix A).

Companies included in the sample represented the top 200 non-financial firms by total assets listed on the JSE for which data could be found on Thomson Reuters

[1] The amounts are referred to as the ZAR amount throughout the remainder of the study to prevent confusion with the quantity of disclosure.

Datastream and IRESS. Total assets refers to the firm size. A mean of R9 638 881 (*SD* = R16 040 889, *N* = 2 398) shows that on average firms listed on the JSE had total assets worth R9 638 881 in the sample period. The variable total assets were adjusted to exclude firms that showed R0 amount for total assets (one observation was excluded). A minimum value of R130 and a maximum value of R395 million shows the presence of outliers and some skewness in the sample (there was a skewness factor of 6). The data were therefore winsorized to exclude extreme and unrealistic values. The 5% and 95% quartiles were used as the minimum and maximum thresholds respectively. The resulting minimum and maximum values of total assets amounted to R42 672 and R58 million respectively. To further adjust for skewness, this study followed the practice in financial research to use the natural logarithm of total assets to adjust for potential skewness. The variable *LnTotalAssets* was created to proxy for firm size (M = 14.4, SD = 2.3, N = 2 398, skewness = -0.4).

Table 6.1: Descriptive statistics for the dependent variable (ZAR amount of derivatives used by firms listed on the JSE)

	Derivatives Current Assets	Derivatives Non-current Assets	Derivatives Non-current Liabilities	Derivatives Current Liabilities	Derivatives Total	Derivatives Total winsorized
N Valid	537	151	196	579	783	783
Missing	2193	2579	2534	2151	1947	1947
Mean (R)	108 514	107 700	364 807	186 199	324 197	154 278
Median (R)	11 000	26 000	69 000	11 416	27 344	27 344
Std. Dev. (R)	452 558	205 215	926 852	1 427 054	1 709 766	299 158
Skewness	8.02	3.78	4.77	11.45	11.05	2.57
Std. Error of Skewness	0.105	0.197	0.174	0.102	0.087	0.087371
Kurtosis	73.703	17.568	26.483	136.293	133.116	5.610147
Std. Error of Kurtosis	0.21	0.392	0.346	0.203	0.175	0.17452
Minimum (R)	1	75	25	2	1	219.8
Maximum (R)	5 386 000	1 453 000	7 433 000	18 770 000	23 389 000	1 179 827
Percentile 5%	161.8	1101.4	1034.9	200	219.8	
95%	375 900	562 041	1 703 500	315 589	1 179 827	

Source: Own compilation

From the sample of 200 non-financial firms over the sample period, four determinants of derivatives disclosed in the financial statements of these entities were captured: derivatives amounts disclosed as non-current assets, current assets, non-current liabilities and current liabilities. These amounts reflected companies' exposure to, or use of, derivatives in a particular year within the study period.

Of the 200 companies in the initial unbalanced panel data set, a total of 114 companies used at least one type of disclosed derivative during the sample period (2005-2017). This means that more than half of the sample companies listed on the JSE during the sample period used derivatives (57%). Derivatives disclosed as current assets had a mean value of R108 515 and a standard deviation of R452 558 (N=537). The variable was positively skewed, with a skewness value of 8.021. The maximum amount of derivatives disclosed amounted to R5 386 000. There were slightly fewer observations for derivatives disclosed as non-current assets, 151 observations against 537. Derivatives disclosed as non-current assets had a mean value of R107 700, with a standard deviation of R205 215. This could be indicative of the fact that financial instruments are by nature short-term assets or liabilities.

Financial instruments can be disclosed either as assets or liabilities, depending on how they adhere to the definition requirements of each item. The classification of either a current or a non-current asset/liability depends on the time frame in which these economic flows are expected to occur. If the flow of economic benefits is expected to occur within 12 months, the asset/liability is disclosed as current; if the flow will only occur after 12 months, the asset/liability is disclosed as non-current. It was therefore expected that based on how these financial derivatives were used, most derivatives instruments would be disclosed as current assets or current liabilities.

Most derivatives contracts are set up for short term periods (three- or six-month term contracts, but companies may also choose longer contracts, as shown by the disclosure of some derivatives as non-current assets and non-current liabilities. Fewer observations of derivatives were disclosed as non-current assets (N = 151) than as current assets (N = 537), indicating that companies mainly used derivatives for short-term periods. This could indicate that companies were hedging themselves, at least in the short term, rather than using derivatives for investment (speculative) purposes. The mean value of R107 700 (median = R26 000, SD = R205 215) for non-current assets was similar to that for current derivatives (mean = R108 514, median = R11 000, SD = R452 557). The maximum amount of current derivatives (R5 386 000) exceeded that for non-current asset derivatives (R1 453 000).

A total of N = 579 observations for derivatives disclosed as current liabilities indicated that more derivatives were disclosed as current liabilities than as current assets. Derivatives disclosed as current liabilities had a mean of R186 199 and a standard deviation of R1.4 million. A minimum of R2 and a maximum of R18 million were reported. Derivatives disclosed as non-current liabilities (N = 196) had slightly more observations than those disclosed as non-current assets. Fewer derivatives disclosed as current liabilities were observed. Derivatives disclosed as non-current liabilities had a mean value of R364 807 (median = R69 000, SD = R926 851).

The values disclosed as derivatives were also added together to determine the total use of derivatives by companies. This result should be interpreted with caution, because as assets and liabilities represent different accounting elements. However, adding the amounts disclosed for both assets and liabilities showed a total amount of disclosed derivatives, which implied the total exposure companies had to derivatives instruments. A binary (dichotomous) variable using this total amount was created to show whether or not a company used a derivative instrument during the year. Adding the values together makes sense if one wishes to estimate a company's total use of derivatives, because it is possible for a company to take several positions in the derivatives markets. A company would then disclose these positions either as assets or liabilities, depending on the effect of market movements on these derivative positions. This implies that, for example, a company with both disclosed assets and liability derivatives amounts would have greater exposure to the derivatives markets than a company with only an asset exposure.

This total amount for derivatives use was also employed as a continuous variable in some of the statistical analyses. Using a continuous variable enabled the study to apply statistical analysis tools such as the Pearson's correlation and multiple linear regression analysis, in addition to binary logistic regression analysis. Incremental information can be gained from using a continuous variable, rather than a binary variable, and therefore additional statistical analyses could be run using this total derivatives disclosure variable in addition to the binary logistic regressions. Using a continuous variable indicates relative size and exposure in the *amount* of use of derivatives, and not just whether or not a company has *used* derivatives.

There were a total of 783 observations for the total derivatives variable. Thus, for each firm in the original sample of 200 firms over the sample period, at least one derivatives amount was disclosed in the year-end company financial statements. A mean of R324 197 (median = R27 344) and a standard deviation R1 709 765 were observed, with a skewness factor of 11.05 and kurtosis of 133.12, indicating some skewness in the sample. The maximum amount of R23 389 000 was the greatest extent to which a firm was exposed to derivatives for the period under review.

From the interpretation of these descriptive statistics for current assets and current liabilities, it was clear that companies disclosed slightly higher amounts for liabilities than for assets. This could indicate some negativity in the market, as the market moved against the positions taken by these companies to hedge themselves. This finding could also indicate that companies were not very adept at reading market movements, and hence their derivative positions moved against them. However, one has to be wary of interpreting assets as 'good' and liabilities as 'bad'. Positions in the derivatives market are assumed to hedge a pre-existing exposure in an underlying instrument, for example, a foreign exchange transaction or a debt instrument: positions in the derivatives therefore de facto indicate a hedge transaction. Companies thus take positions in the derivatives market so that any gain from the movement in the derivatives market will offset any loss in the underlying instrument. Depending on the type of transaction, the net result of a hedge transaction is thus often zero. The gain from an exposure in the derivatives market should offset the loss in the underlying instrument, but things can go the other way as well: a loss in the derivatives market may offset a gain in the underlying instrument. The purpose of taking a position in the derivatives market, as previously discussed, is not necessarily to gain a profit on the transaction (taking a speculative position), but to lock in the value of the underlying asset or transaction.

6.2.2 Descriptive statistics for the independent variables to investigate the determinants of derivatives use by firms listed on the JSE

The descriptive statistics for the independent variables for the sample are presented in Table 6.2, overleaf.

Table 6.2: Descriptive statistics: independent variables

	N		Mean	Median	Std. Deviation	Skewness	Kurtosis	Minimum	Maximum
	Valid	Missing							
Total Assets (R)	2 398	332	9 638 881	2 121 024	16 040 889	2.07	3.154	130	58 580 710
Tobin's Q	2 227	503	1.58	1.33	0.82	1.15	0.559	0.28	3.69
Current Ratio	2 377	353	1.84	1.51	1.10	1.38	1.377	0.01	4.84
Dividend Yield	1 552	1 178	3.64	3.26	1.94	0.86	0.349	0.14	8.51
Directors Shares	1 950	780	37 677	128 589	52520	1.67	1.762	1.00	185 862
Leverage: Debt/Assets	2 730	0	33	33	29	23	-1.331	0.00	85
Leverage: Debt/Equity	2 143	587	43.14	33.25	226.85	-32.84	1262	-9 079	232.32
Foreign sales/Sales	973	1757	33.9	24.39	28.12	0.82	-0.554	0.01	92.59
R&D/Sales	415	2315	0.28	0.17	0.29	1.37	1.126	0.01	1.07
ROA	2 316	414	8.67	8.64	9.22	-0.32	0.313	-13.08	26.58
Interest Cover	2 730	0	1074.92	246	2 154.92	2.64	6.059	-230	8 674
Derivatives Total	783	1 947	154 278	27344	299 158	2.57	5.610	220	1 179 827

Key to variables in Table 6.2:

R&D/Sales	Ratio of research and development costs divided by sales
ROA	Return on assets for the year

Source: Own compilation

The descriptive statistics for the independent variables after winsorization indicated that potential outliers which affected the means and resulted in skewed distributions, were largely addressed by the winsorization process. The only exception was leverage in terms of debt/equity.

Elements identified in the descriptive statistics with potential consequences for the analyses were addressed in several ways. Skewness in the dependent and independent variables was addressed by winsorizing the data for both the dependent and continuous independent variables.

The sections below discuss the detailed findings from the univariate and multivariate investigations. The robustness analyses used to assess the rigour of the different statistical analyses are presented in Chapter 8.

6.3 THE DETERMINANTS OF DERIVATIVES USE

The first hypothesis examined in this study refers to the determinants of derivatives use by the top 200 non-financial firms listed on JSE for the period 2005 to 2017. The various possible rationales for companies' use of derivatives include the following: the bankruptcy and financial distress costs hypothesis (as posited in the first hypothesis and subsequent sub-hypotheses), but also the underinvestment cost or the coordination of financing and investment policy and agency conflict of debt hypothesis, and the asymmetric information and agency conflict of equity hypothesis. The possibility that derivatives were also used for corporate tax reasons was also examined. Various proxy variables were used.

The advantage of using regression modelling is that it uncovers the relative importance of a predictor, as well as the direction (positive or negative) of the relationship. This study was interested in whether certain firm characteristics can be used to predict how likely a company is to use derivatives, and the binomial logistic regression model was most appropriate for this purpose. In addition, a multiple linear regression model was conducted, employing the value of the derivatives used as a continuous dependent variable, to determine to what extent the absolute size of derivatives can be explained by the independent variables. The findings from the correlation analysis and multiple regression models used to analyse the applicability of the hypotheses mentioned in the paragraph above are presented below.

6.3.1 Results: Correlations analysis

Before the regression analysis was performed, correlation analysis was conducted to determine the size and direction of the linear relationship between the extent of derivatives use as the dependent variable, and the independent variables (firm size, firm liquidity and profitability, leverage, the dividend yield, geographic diversification, growth prospects, tax incentives and share ownership), as well as the relationships between all pairs of the independent variable.

These findings are set out in Table 6.3, overleaf.

Table 6.3: Results of the correlation analysis of variables used to find the determinants of derivatives use by the top 200 non-financial firms listed on the JSE

		Derivatives Total	Derivatives Binary	Total Assets	ROA	Interest cover	Leverage Debt/Equity	Current Ratio	Dividend yield	Tobin's Q	R&D/Sales	Directors Shares	Foreign sales/Sales
Derivatives Total	Pearson Correlation	1											
	N	783											
Derivatives Binary	Pearson Correlation		1										
	N		2535										
Total Assets	Pearson Correlation	0.586**	0.485**	1									
	N	783	2265	2398									
ROA	Pearson Correlation	-0.083*	0.008	-0.0215	1								
	N	765	2192	2316	2316								
Interest cover	Pearson Correlation	-0.115**	-0.011	-0.053**	0.301**	1							
	N	783	2535	2398	2316	2730							
Leverage Debt/Equity	Pearson Correlation	0.074*	0.181**	0.072**	-0.167**	-0.267**	1						
	N	739	2021	2143	2072	2143	2143						
Current ratio	Pearson Correlation	-0.110**	-0.143**	-0.133**	0.102**	0.179**	-0.305**	1					
	N	783	2245	2377	2297	2377	2134	2377					
Dividend yield	Pearson Correlation	-0.131**	0.270**	-0.163**	0.184**	0.105**	0.003811	0.168**	1				
	N	607	2535	1546	1537	1552	1405	1546	1552				
Tobin's Q	Pearson Correlation	0.042654	0.046*	0.061**	0.431**	0.264**	-0.02877	-0.088**	-0.060*	1			
	N	744	2110	2226	2203	2227	1981	2207	1543	2227			
R&D/Sales	Pearson Correlation	0.109116	0.194**	0.066457	-0.03754	0.130**	0.009414	0.030042	0.088084	0.107*	1		
	N	200	2535	415	406	415	408	415	304	396	415		
Directors Shares	Pearson Correlation	-0.143**	-0.185**	-0.222**	-0.084**	-0.02619	0.027844	-0.02296	0.003069	-0.075**	-0.147**	1	
	N	672	1852	1947	1929	1950	1761	1931	1385	1929	365	1950	
Foreign sales/Sales	Pearson Correlation	0.278**	0.376**	0.347**	-0.183**	0.00911	-0.01615	0.119**	-0.03157	-0.192**	0.107218	-0.01865	1
	N	495	2535	973	955	973	933	973	788	934	262	840	973

** Significant at the 1% level (using two-tailed significance); * Significant at the 5% level (using two-tailed significance);
Key to variables in Table 6.3: R&D/Sales= Ratio of research and development costs divided by sales; ROA= Return on assets for the year
Source: Own compilation

The strongest relationship between the extent of derivatives use and the explanatory variables was found for firm size, as measured by the natural logarithm of total assets ($p<0.01$), indicating that firm size was an important factor determining the total value of derivatives used by companies.

Correlation analysis was conducted between derivatives as a binary variable and as a continuous variable to examine the relationship between the various firm characteristics and derivatives use. A statistically strong relationship was found between whether a company uses derivatives or not, and firm size (0.485, $p<0.01$) and leverage (*LevDE*, 0.18, $p<0.01$; *LevDA*, 0.22, $p<0.01$). Statistically significantly strong relationships were also found between whether or not a company uses derivatives and geographic diversification (0.38, $p<0.01$), growth prospects (0.19, $p<0.01$) and the number of shares held by directors (-0.19, $p<0.01$).

Supporting the financial distress rationale for corporate hedging, an inverse relationship was found between profitability (*ROA*, -0.08, $p<0.05$; *ROE*, -0.09, $p<0.05$) and derivatives disclosure, indicating that $H1_1$ cannot be rejected. A statistically significant negative relationship between liquidity (*CR*, -0.11, $p<0.01$; *QR*, -0.12, $p<0.01$) further supported the financial distress argument, and thus $H1_1$. Less liquid firms are more likely to experience financial distress (for example, cash flow problems where firms are unable to pay debt obligations), which gives firms an incentive to hedge to decrease cash flow volatility. This argument was supported by the strong positive relationship between the leverage ratio (*LevDE*, 0.07, $p<0.05$) and derivatives disclosure.

The more debt a company had (the higher the leverage), the more likely a company was to make use of derivatives. This supported the financial distress argument: the more debt a company has, the more likely the company is to experience financial distress and the higher the threat of bankruptcy but corporate risk management can reduce cash flow volatility, the expected cost of financial distress, and the risk of bankruptcy. In addition, one can argue that companies with more debt obligations have higher interest payments, and hence there is a larger incentive for firms to hedge movements in interest rates. This therefore makes it more likely that firms will use derivatives to hedge against adverse movements in interest rates. This argument was supported by the statistically significant negative relationship found between the interest cover ratio and derivatives disclosure (*Intcover* -0.12, $p<0.01$). The interest cover ratio measures the extent to which a firm's profits are able to cover the interest payments that are due, in other words how well a company is able to finance its debt obligations with its profits. A negative relationship between the interest cover and derivatives disclosure indicates that firms that are less able to cover interest payments with their profits are more likely to use derivatives, supporting the financial distress rationale for using derivatives.

The relationship between dividend yield and derivatives disclosure can be argued in two ways. Firstly, companies that pay dividends have less cash available; hence paying a dividend can be viewed as similar to reducing liquidity, in the sense that a negative relationship between dividend yield and derivatives disclosure indicates that a firm is less liquid and thus more inclined to experience financial distress. Alternatively, if companies pay a dividend, it could signal that they have enough confidence in their profits and liquidity to pay a dividend (they do not anticipate the threat of financial distress and bankruptcy). In the current study, the findings from the univariate regression indicated a negative relationship between companies that paid a dividend and used derivatives (-0.13, $p<0.01$), indicating that firms that did not pay a dividend were more likely to use derivatives. This could mean firms that were unable or unwilling to pay a dividend were more likely to disclose derivatives, providing additional support for the financial distress hypothesis. Alternatively, not paying a dividend could indicate a firm was in a growth phase and keeping profits for investment purposes. Since firms with higher growth prospects are more likely to use derivatives (because external financing is expensive and because they want to avoid agency conflicts with external providers of finance), a negative relationship between dividend yield and derivatives disclosure was expected.

A strong positive relationship between firm size (*Lntotass* 0.59, $p<0.01$) and derivatives disclosure supported the economies of scale rationale that larger firms are more likely to use derivatives. Larger firms have better access to skilled risk managers and are better able to afford the costs associated with running a successful risk management programme.

The underinvestment rationale posits that companies with better growth prospects are more likely to use derivatives, especially firms that have many investment opportunities, but are financially constrained. Hedging can alleviate the problem that the proceeds of investing in profitable projects accrue to debt holders, rather than to shareholders. Hedging can also ensure the availability of cheaper internally generated funds to pursue investment opportunities. No statistically significant relationship between derivatives disclosure proxies for growth prospects (the ratio of R&D costs over sales, or the natural logarithm of Tobin's Q) was found.

A negative relationship was found between the number of shares held by directors and derivatives disclosure, indicating that firms where a large number of shares were held by directors were less likely to disclose derivatives. This finding contradicted the agency cost rationale of hedging, which posits that firms characterized by high ownership concentration are less likely to suffer from agency conflicts and mainly hedge to protect invested wealth and increase firm value. Managers with more wealth invested in a firm's equity have a higher incentive to protect their investments and pursue hedging strategies to reduce financial risk. The negative relationship was statistically significant (-0.14, $p<0.01$), indicating that companies with more closely held shares were less likely to disclose derivatives.

The study found a positive relationship between foreign sales and derivatives disclosure. This finding indicated that firms with more foreign operations were more likely to hedge. The results revealed a significantly strong positive relationship between foreign sales/sales ratio and derivatives disclosure, which suggested that JSE-listed firms with a higher number of foreign operations were more likely to use derivatives, possibly to hedge against exchange rate movements.

Finally, the positive relationship found between the tax proxy and derivatives disclosure proxy supported for the argument that there is a tax incentive to hedge. The tax incentive suggests that using derivatives can decrease the variability of taxable income for firms which face a convex tax table (where tax liabilities decrease disproportionately with a decrease in profits).

6.3.2 Results to find the determinants of derivatives use by the top 200 non-financial firms listed on the JSE

Univariate analysis (Pearson's correlation) takes into account only the relationship between two variables, without distinguishing between the independent and dependent variables. Univariate analysis also does not provide the relative size of the relationship between an independent variable and the dependent variable, given all the other independent variables also considered. Hence, multiple regression analysis was conducted to determine the effect of each of the independent variables (given all the other independent variables) on using derivatives and the extent of derivatives use by firms. Two multiple regression tests were conducted. First, a binary logistic regression analysis was conducted in which the dependent variable was a dichotomous variable of either 1 or 0, with 1 indicating derivatives use, and 0 indicating no use of derivatives. A second multiple linear regression analysis was conducted using a continuous variable of total derivatives as the dependent variable.

The model tested was the following (repeated for the reader's convenience):

$$Ln\ (\pi/1\text{-}\pi) = \Sigma SECTOR + \beta_1 LEVDE + \beta_2 CR + \beta_3 DIVYIELD + \beta_4 ROA + \beta_5 LNTOTASS + \beta_6 RD/SALES + \beta_7 LNTOBINSQ + \beta_8 DIRTOTSHARES + \beta_9 ACTLDV + \beta_{10} FORSALES + \beta_{11} INTCOVER + \varepsilon_i \qquad (5.1)$$

where:

π	=	the probability that a company uses derivatives, dummy variable of 1/(0) if a company uses derivatives/(does not use derivatives)
α	=	intercept
ΣSECTOR	=	different sectors in which the firms in the sample operate, controlling for firm effects
LEVDE	=	level of leverage for each firm = the ratio of total debt divided by shareholders' equity
CR	=	liquidity = current ratio
DIVYIELD	=	dividend yield
	=	profitability = ROA
LNTOTASS	=	size = logarithm of total assets

RD/SALES	=	research and development (R&D) costs divided by total sales
LNTOBINSQ	=	logarithm of Tobin's Q
DIRTOTSHARES	=	Total Directors Shareholding = Dummy variable if company reported number, percentage or market value of shares held by managers or directors
ACTDLV	=	dummy variable if accumulated computed tax loss is reported
FOR/SALES	=	foreign sales/total sales
INTCOVER	=	interest cover
ε_i	=	residual term

The results are set out in Table 6.4.

Table 6.4: Logistic regression analysis in the study to identify the determinants of derivatives use by the top 200 non-financial firms listed on JSE

Dependent Variable: *DERTOTAL_BIN*
Method: ML - Binary Logit (Newton-Raphson / Marquardt steps)
Date: 04/20/20 Time: 09:01
Sample: 2005 2017
Included observations: 1758
Convergence achieved after 5 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-10.43902	0.723340	-14.43169	0.0000
LNTOBINSQ	0.000869	0.152085	0.005714	0.9954
LNTOTASS	0.561924	0.043297	12.97847	0.0000
DIVYIELD	0.266107	0.161731	1.645373	0.0999
RD/SALES	0.579037	0.142081	4.075403	0.0000
FOR/SALES	0.183498	0.138569	1.324233	0.1854
ROA	-0.010545	0.010209	-1.032995	0.3016
CR	-0.115329	0.073297	-1.573443	0.1156
LEV/DE	0.006220	0.001208	5.148745	0.0000
DIRTOTSHARES	1.080554	0.250195	4.318856	0.0000
INTCOVER	-4.27E-05	3.39E-05	-1.260269	0.2076
ACTLDV	-0.013586	0.121041	-0.112241	0.9106

McFadden R-squared	0.230102	Mean dependent var	0.378271
S.D. dependent var	0.485094	S.E. of regression	0.413191
Akaike info criterion	1.034862	Sum squared resid	298.0886
Schwarz criterion	1.072213	Log likelihood	-897.6434
Hannan-Quinn criterion	1.048666	Deviance	1795.287
Restr. deviance	2331.851	Restr. log likelihood	-1165.925
LR statistic	536.5639	Avg. log likelihood	-0.510605
Prob(LR statistic)	0.000000		

Obs with Dep=0	1093	Total obs	1758
Obs with Dep=1	665		

Key to variables in Table 6.4:
DERTOTAL_BIN Dummy variable of 1/(0) if derivatives amount is/(not) reported

LNTOBINSQ	Natural logarithm of Tobin's Q
LNTOTASS	Natural logarithm of total assets
DIVYIELD	Dividend yield
RD/SALES	Ratio of research and development costs divided by sales
FOR/SALESWINS	Ratio of foreign sales divided by sales
ROA	Return on assets
CR	Current ratio
LEV/DE	Leverage calculated as the ratio of debt to equity
DIRTOTSHARES	Total number of directors' shares
INTCOVER	Interest coverage ratio
ACTLDV	Dummy variable of 1/(0) if accumulated computed tax loss is/(not) reported

Source: Own compilation

Linearity of the continuous variables in respect of the logit of the dependent variable was assessed via the Box-Tidwell (1962) procedure. Based on this assessment, all the continuous independent variables were found to be linearly related to the logit of the dependent variable.

The results of the binary logistic regression presented in Table 6.4 indicate that firm size proxied by the logarithm of total assets (*LNTOTASS)* was statistically significant at the 1% level of significance. Therefore, the larger the firm, the higher is the likelihood (1.75 times higher odds) that a company would disclose derivatives as assets or liabilities. This finding supported the economies of scale rationale for using derivatives (Nance *et al.,* 1993; Géczy *et al.*,1997; Aretz & Bartram, 2010; Choi *et al.*, 2015), in that larger firms were better able to afford risk management strategies that incorporated derivatives. In other words, larger firms possibly had larger exposures to manage, and hence were more likely to hedge. Larger firms are also better able to afford to employ staff with the necessary expertise to manage the risk management operations of an entity (see Section 3.2). Smaller firms are not always able to afford to pay individuals to specifically manage a derivatives trading desk to manage exposures, whilst bigger companies are more able to do so.

The binary logistic model further identified leverage as an important factor in the likelihood of companies' disclosing derivatives use. The larger the proportion of debt in the company, as measured by the debt to equity ratio, the higher is the likelihood by an odds ratio of 1.01 that the company would use derivatives. This finding supported the bankruptcy and financial distress cost rationale for using derivatives (Aretz & Bartram, 2010; Campello *et al*., 2011; Choi *et al*., 2015). Derivatives use to hedge can decrease the present value of financial distress costs (the higher the proportion of debt in a company, the higher the expected cost of financial distress and thus the incentive to hedge) (See Section 3.2). Companies with a higher leverage, in other words, a higher proportion of debt in their capital structure, are expected to have more financial risk due to the fixed nature of interest payments and debt servicing charges. Interest payments and capital repayments are due regardless of whether or not a firm makes a profit. This puts pressure on a company's cash flow and increases the risk that a company will be unable to service its debt, pay for its operations and increases the likelihood of bankruptcy. Using derivatives can decrease cash flow volatility caused by an increase in leverage. In addition, the larger the proportion of debt is in a company, the higher the interest payments to service the debt are. Companies therefore have higher exposure to interest rate fluctuations and therefore a higher need to manage exposure to interest rate fluctuations by using derivatives.

Firms with higher growth prospects as measured by the ratio of R&D costs over sales were also found to be more likely to hedge in this study. The odds that firms with R&D costs would use derivatives were 1.78 times higher. This finding supported the underinvestment rationale of corporate hedging motives (Nance *et al*., 1993; Aretz & Bartram, 2010; Choi *et al*., 2015). The underinvestment problem describes a situation in which shareholders forego profitable projects because the benefits of those projects will flow to debt holders rather than to the shareholders. Companies with a lot of investment opportunities, but that may struggle to access funding, are particularly at risk of experiencing this problem and hence have an incentive to hedge by alleviating their cash flow volatility so that enough cash is available to pursue investment opportunities (see Section 3.2). In the current study, the positive coefficient of R&D costs (0.58, $p<0.01$) indicated that firms with higher growth opportunities were more likely to disclose derivatives.

Managerial risk aversion provides an incentive for corporate hedging because managers' compensation is often linked to the performance of a firm. Risk management can lower equilibrium managerial compensation (Geyer-Klingeberg, Hang, Rathgeber, Stöckl & Walter, 2018) (Geyer-Klingeberg *et al*., 2018). The proxy used for managerial risk aversion in the current study separated firms into companies where directors own shares in the company, and firms whose directors do not. The companies in the sample whose directors held a higher number of shares were indeed more likely to use derivatives (1.1, p<0.01). Companies where directors had a higher number of shares had odds of using derivatives 2.95 times higher than other companies.

Finally, the binary logistic model indicated that those companies which paid a dividend were more likely to disclose derivatives use, and the finding was statistically significant at the 10% level of significance. Companies that paid a dividend had odds of using derivatives 1.3 times higher than those of companies who did not pay out a dividend. The positive sign of the coefficient contradicted the financial distress cost rationale for using derivatives. Companies that paid dividends were less likely to be financially constrained and had stable cash flows from which to pay the dividend. It could also, however, be indicative of the possibility that larger, more established firms which are more likely to be able to pay dividends were more likely to use derivatives, and that smaller firms in a growth phase of development were retaining profits in order to pursue expansion programmes, providing some support for the underinvestment rationale (Geyer-Klingeberg *et al.*, 2018).

The current study applied the panel data technique and different empirical models were considered. It was possible that there was large heterogeneity across firms in the sample. The Hausman (1978) specification test was used to test statistically which empirical model between fixed effects and random effects was the most suitable to the current study (the results from the Hausman specification test for fixed or random effects for the value relevance model are presented in Table A.7 in Appendix A). The null hypothesis that the unique errors are uncorrelated with other regressors was rejected at the 1% level of significance, indicating that the fixed effect model was the most appropriate estimation model. Furthermore, the possible presence of heteroskedasticity was controlled for by applying the Panel Corrected standard error estimation in the final regression.

In addition to the binary logistic model, a multiple linear regression model was employed. In this additional test, the binary dependent variable for derivatives use was replaced by a continuous variable calculated by the total amount of derivatives disclosed by companies during the sample period. This was done to determine whether there was incremental informational content available in the values disclosed as derivatives. The findings from the multiple variable regression analysis are presented in Table 6.5.

An important distinction needs to be made at this point. Care should be taken in interpreting the results and comparing the findings of the binary logistic regression model to the findings of the multiple linear regression model. The research objective of testing the first hypothesis of the current study was to determine whether certain corporate hedging motives influenced whether a company decided to use derivatives or not. Hence, in the binary logistic model, the dependent variable was constructed from the financial statements to represent one of two outcomes: either a firm used derivatives, or it did not. The findings from the binary logistic regression model thus implied the likelihood that these motives for corporate hedging influenced derivatives use and thus provided an answer in the simplest terms to fulfil the core research objective. The multiple linear regression model can add value to this discussion in that it tested the relationship between the proxies for the rationales for corporate hedging, taking into account the different factors that could influence the decision to use derivatives in a multivariate setting (as opposed to just the univariate analysis).

The multiple linear regression model can offer some additional insight into companies' use of derivatives, in the sense that one can interpret the findings as follows: the higher the leverage (as found using the multiple linear model presented in Table 6.5), the higher the amount of derivatives used. Statistical significance in a binary logistic regression model indicates the likelihood that the dependent variable will influence a dichotomous outcome (Field, 2009). The multiple linear regression model uses a continuous dependent variable. Therefore, the multiple linear regression model seeks to find a relationship between the dependent and independent variables – statistical significance in a multiple linear regression model indicates that the higher the value or amount of the independent variable, the higher the expected value of the dependent variable should be (Field, 2009).

In the current study, the first objective was to establish whether companies listed on the JSE conformed to certain rationales for corporate hedging (by using derivatives) as set out in the finance literature. In this case, the multiple linear regression model did not meet the core research objective of establishing whether certain key rationales influenced whether companies used derivatives or not. In other words, it was unable to confirm that these rationales for hedging influenced a company's decision to hedge various risk exposures, such as credit risk, the exchange rate risk of commodity price risk. The model did, however, provide some insight into the key characteristics of the type of firm that used derivatives. The results of the multiple linear regression model thus illuminated the extent to which a company used derivatives, and not just whether or not a company decided to use derivatives.

The findings from the multiple variable regressions are presented in Table 6.5, overleaf. The results indicated an adjusted R-squared of 64% – thus the model explained 64% of the variance in the dependent variable. However, it is important to keep in mind the dummy variables introduced in the fixed effect model when interpreting the overall results. Furthermore, the F-statistic ($F=11,13$; $p<0.01$) indicated that the regression coefficients differed significantly from zero. Although the Durbin-Watson statistic was slightly lower than the generally acceptable threshold of 1.5, it was not considered a serious autocorrelation, because Field (2009) suggests that only values below 1 are a definite cause for concern. Results from the linear regression model indicated that leverage, measured as total debt against equity and firm size, was the only statistical significant indicator of the value of derivatives (*LevDE*= 509 (Beta coefficient), $p<0.05$). The positive relationship between the leverage ratio and the continuous variable for the total amount of derivatives used indicated that firms with a higher amount of debt against equity were more likely to disclose a higher amount derivatives.

Table 6.5: Multiple linear regression analysis to determine the extent of derivatives use by the top 200 non-financial firms listed on the JSE

Dependent Variable: *DERTOTALWINSB*
Method: Panel Least Squares
Date: 04/20/20 Time: 15:01
Sample: 2005 2017
Periods included: 13
Cross-sections included: 99
Total panel (unbalanced) observations: 627
Cross-section weights (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-220296.2	266085.3	-0.827916	0.4081
DIVYIELD	-3605.425	31935.39	-0.112898	0.9102
RD/SALES	-20006.20	29559.25	-0.676817	0.4988
FOR/SALES	31249.71	26863.21	1.163290	0.2452
ACTLDV	-15281.14	29333.36	-0.520948	0.6026
ROA	2576.580	1815.390	1.419299	0.1564
LNTOBINSQ	-55496.29	35605.46	-1.558646	0.1197
LNTOTASS	23864.95	16719.42	1.427379	0.1541
INTCOVER	-7.635900	6.598865	-1.157154	0.2477
LEVDE	508.8484	204.2703	2.491054	0.0130
CR	-34790.09	21801.93	-1.595734	0.1112
DIRTOTSHARES	0.311092	0.235947	1.318486	0.1879

Effects Specification

Cross-section fixed (dummy variables)

Root MSE	153607.8	R-squared	0.701197
Mean dependent var	143665.6	Adjusted R-squared	0.638200
S.D. dependent var	281233.8	S.E. of regression	169161.5
Akaike info criterion	27.07307	Sum squared resid	1.48E+13
Schwarz criterion	27.85218	Log likelihood	-8377.407
Hannan-Quinn criterion	27.37576	F-statistic	11.13063
Durbin-Watson statistic	1.414986	Prob(F-statistic)	0.000000

Key to variables in Table 6.5:

DERTOTALWINSB	Total amount of derivatives reported in the financial statements
LNTOBINSQ	Natural logarithm of Tobin's Q
LNTOTASS	Natural logarithm of total assets
DIVYIELD	Dividend yield
RD/SALES	Ratio of research and development costs divided by sales
FOR/SALESWINS	Ratio of foreign sales divided by sales
ROA	Return on assets
CR	Current ratio
LEV/DE	Leverage calculated as the ratio of debt to equity
DIRTOTSHARES	Total number of directors' shares
INTCOVER	Interest coverage ratio
ACTLDV	Dummy variable of 1/(0) if accumulated computed tax loss is/(not) reported

Source: Own compilation

6.3.3 Discussion of the multiple linear regression analysis to determine the extent of derivatives use by the top 200 non-financial JSE-listed firms

The first hypothesis of this study relates to the determinants of derivatives use for the top 200 non-financial JSE-listed firms. Both a binomial logistic regression and a multivariate regression were used to determine possible explanations for firms' decision to hedge, using derivatives disclosed in the financial statements as a proxy for corporate hedging.

When the dependent variable is modelled as a dichotomous variable, multivariate analysis is generally either *logit* or *probit* (Dinardo, Johnston & Johnston, 1997). Although there could be a difference in the relative performance of these models, Dinardo *et al.* (1997) argue that both these models generally provide similar results for economic data. Dinardo *et al.* (1997) also maintain that statistical results from *logit*, *probit* and *OLS* may not differ substantially for different models using economic data. A comparison between the results of the *logit* and of the fixed effect *OLS* models used in the current study showed similar general findings, with somewhat stronger significant relationships found for the determinants of derivatives use when employing the binary logistic model.

The variables tested in the multivariate analysis were based on the determinants that were presented in the literature review as the key rationales for corporate hedging. The logistic model tested the four main reasons to hedge or not to hedge as a function of bankruptcy and financial distress costs, the underinvestment or external financing agency conflicts of the debt hypothesis, asymmetric information and agency conflicts of equity, and tax issues. The different variables used to proxy these rationales have already been discussed in detail in Section 5.5.1.

The findings from this study suggested some support for the bankruptcy and financial distress cost and underinvestment hypothesis, which states that larger companies, companies with higher leverage and companies with higher growth prospects are more likely to use derivatives (Geyer-Klingeberg *et al*., 2018). The findings also supported the argument that companies use derivatives because of managerial risk aversion.

The next section offers a detailed discussion of the results relating to the first hypothesis of this study, regarding the determinants of using derivatives. This first hypothesis was separated into the four separate key rationales mentioned in the finance literature as motives for corporate hedging practices by firms, together with other motives for corporate hedging. Each of these four key rationales for corporate hedging, as well as the other motives is discussed in a separate section.

6.3.3.1 Findings for $H1_1$ on the risk of bankruptcy and financial distress costs as a hedging incentive

The main results for this hypothesis, *JSE-listed firms use derivatives to hedge financial risk exposure in order to reduce possible financial distress costs and the risk of bankruptcy*, are compared to the findings of a number of studies in this field of research. For the bankruptcy and financial distress costs rationale, the findings from the current study confirmed the existing hedging rationale.

In respect of leverage, the results from the current study confirmed the findings of Aretz and Bartram (2010), Arnold *et al.* (2014), Campello *et al.* (2011) and Choi, Mao and Upadhyay, (2015) that more leveraged firms are more likely to use derivatives. The proxy of current assets as a liquidity measurement did not provide significant results, which is similar to findings from previous studies that also did not find a significant effect for this hedging determinant.

As was previously discussed in the literature review, the risk of bankruptcy and financial distress costs, together with costly external financing, may encourage firms that have high levels of debt (measured by the leverage ratios), that have a high dividend pay-out and high interest payments, and that are less liquid and have lower profitability, to use derivatives. The findings from the current study offer significant evidence on these arguments. A strong statistically significant positive relationship was found between the leverage ratio and derivatives use, which the financial distress cost rationale, $H1_1$.

The financial distress argument suggests that there should be a positive relationship between the likelihood that a firm will use derivatives, and the use of debt (measured by the leverage ratios), because an increase in debt increases the likelihood of financial distress (Mian, 1996; Nguyen & Faff, 2002). The findings of the current study confirmed this financial distress rationale and were also in line of the results reported by Aretz and Bartram (2010) and Haushalter (2000), who also found the risk of financial distress to be positively associated with the likelihood of using derivatives. These findings suggest that companies listed on the JSE subscribe to the financial distress rationale of corporate hedging and that companies that use debt more are also more likely to hedge and therefore use derivatives to do so.

A positive relationship was expected between the use of derivatives and financial distress costs: the higher the risk of financial distress, proxied by the amount of debt in the capital structure of a firm, the higher the likelihood that a company will engage in risk management, proxied by derivatives use. This was confirmed by both the binomial logistic regression analysis and the multiple linear regression model. Companies that had more debt were indeed more likely to use derivatives, and the higher the amount of debt in the company, the higher the amount of derivatives disclosure. Higher leverage increases the likelihood that a company will experience financial distress and will be unable to service its interest payments and repay the debt obligations. Corporate hedging can thus smooth earnings, reduce cash flow volatility and decrease the likelihood that a company will experience financial distress.

An important note on the findings with regard to the leverage ratio is that the amount of debt a company uses in its capital structure is a choice and it thus becomes difficult to isolate the cause and effect of debt and derivatives use (Nguyen & Faff, 2002). In other words, it is difficult to differentiate the choice to use debt from the choice to use derivatives, because the choice could be made simultaneously. Companies might decide at the outset, when they opt to acquire debt, that they will also hedge interest rate movements.

Companies with low interest coverage ratios are at greater risk of being unable to generate enough cash from their operations to honour promised payments on their debt. Authors such as Bartram *et al*. (2009), Berkman and Bradbury (1996) and Nance *et al.* (1993) have included the interest cover ratio as a measure of financial distress. In the current study, both the binary logistic model (see Table 6.4) and the multiple linear model (see Table 6.5) showed a negative coefficient for the interest cover ratio and derivatives used, although this relationship was not statistically significant. The negative relationship supported the financial distress rationale that firms that are less able to cover debt obligations from their operations are more likely to use derivatives.

The statistically significant ($p<0.1$) and positive coefficient for dividend yield found in this study confirmed findings by Arnold *et al*. (2014), Choi *et al*. (2014) and Nance *et al.* (1993) that companies' having a higher dividend yield has a positive effect on the hedging decision. Dividend yield forms part of the bankruptcy and financial distress costs hypothesis of derivatives usage and can have either a positive or a negative relationship with a firm's hedging decision. A negative relationship between dividend yield and derivatives use is expected, because a dividend payment implies that there is less information asymmetry between debt holders and shareholders and lower expected financial distress costs, and therefore firms are less likely to have to use derivatives. On the other hand, older, more established companies are more likely to pay a dividend than newer entities, thus a positive coefficient could be a sign that older, more established companies do use derivatives, as larger, more established companies can use economies of scale and employ permanent risk managers to take advantage of opportunities in the derivatives market for risk management. It is possible that the cost of a financial risk management programme or a lack of knowledge excludes smaller companies from using derivatives as part of a hedging or risk management strategy within the firms. The binary proxy variable for dividend yield in the current study was positive and statistically significant at the 10% level of significance, indicating that companies that paid out a dividend were more likely to disclose derivatives providing support for $H1_1$.

Profitability as measured by ROA displayed a negative relationship, as predicted in the binary logistic model, but a positive relationship was found between derivatives use and a firm's profitability in the continuous variable model, though neither model provided a statistically significant result. A negative relationship between profitability and the hedging motive was expected and was indeed confirmed by the results in the binary logistic regression model. This finding is in line with the argument that less profitable firms are more likely to use derivatives in an attempt to decrease cash flow volatility and therefore decrease default probability and reduce financial distress cost, thereby adding to firm value (Brown & Toft, 2002; Smith & Stulz, 1985; Stulz, 1996). This result was, however, somewhat contradicted by the results from the multiple linear model, where the higher the profitability, the higher the amount of derivatives. The findings from the binary logistic regression model supported the bankruptcy and financial distress cost hypothesis $H1_1$, similar to the findings for companies listed in the US and Australia.

6.3.3.2 Findings for $H1_2$ on underinvestment costs as a hedging incentive

Companies can use derivatives to enhance shareholder value by coordinating the need and availability of internal finance, since raising external funding can be expensive, due, for example, to transaction costs (Bartram *et al.*, 2009). In addition, conflicts of interest between shareholders and debt holders can lead to underinvestment: if the profits of profitable projects accrue mostly to bondholders, managers may reject such projects because the shareholders do not receive the benefits from investing in these projects. Hence $H1_2$ stated that *JSE-listed firms use derivatives to reduce underinvestment costs.*

A strong, statistically significant ($p<0.01$) relationship was found between R&D costs, scaled by total sales, and derivatives use. This result supported the underinvestment hypothesis $H1_2$ for corporate hedging. R&D is a widely used variable (Fok *et al*., 1997; Gay & Nam, 1998; Graham & Rogers, 2002; Knopf, Nam & Thornton, 2002; Nance *et al*., 1993) on the grounds that is offers a reasonable indicator of a firm's future investment projects' development. The positive and significant coefficient found in the current study is similar to findings by Gay and Nam (1998), Graham and Rogers (2002) and Nance *et al.* (1993), but differs from the results of Howton and Perfect (1998), who reported an insignificant relationship.

The growth variable can furthermore proxy the extent of information asymmetry regarding a company's project quality or the financial constraints facing firms. Gay and Nam (1998) argue that the relationship between R&D expenses and hedging might be driven by agency costs, since incompetent managers could mask their poor performance by spending more on R&D and mimicking the risk management

strategies of good quality risk managers. These managers could then be attracted to hedging to hide their real performance and the quality of their projects.
In the current study, a statistically significant positive relationship between R&D and derivatives use indicated that firms that disclosed amounts for R&D costs were more likely to disclose derivatives. From this, it was inferred that companies that pursued investment opportunities and incurred R&D costs (for whichever reason) were more likely to experience financial constraints, as they looked for financing from external providers of finance to pursue these projects. Hedging can alleviate the problems of underinvestment where costly external financing is higher than the cost of internal funding, because hedging can ensure the availability of internally generated funds to pursue company's investment opportunities (Froot *et al.*, 1993). Thus firms with higher growth prospects are more likely to hedge to ensure the availability of funds to pursue investment opportunities.

The underinvestment problem can further be illustrated by liquidity measures to proxy for investment opportunities, the logic being that companies are more likely to forego investment opportunities if their cash holdings are low. The current study provided no statistically significant results on liquidity, as measured by the current ratio, although the negative coefficient confirmed the argument that less liquid firms are more likely to hedge because they have a greater need to look for costly external funding (Heaney & Winata, 2005; Nguyen & Faff, 2002). For both the binary logistic regression model and the multiple linear regression model, the coefficients for liquidity were negative as predicted, but not at a statistically significant level, indicating that the JSE-listed firms' liquidity did not have an effect on the likelihood of their disclosing derivatives.

As mentioned in the previous section, dividend yield can also be interpreted in the underinvestment context, as companies are better able to store cash reserves by retaining dividend payments. In this context, it was expected that there would be a negative relationship between dividend payments and derivatives use (as was found using the multiple linear regression model, see Table 6.5). In other words, the higher the dividend payments, the less liquidity a firm had and the more likely it was to use derivatives.

For both conflict of interest of debt as part of the underinvestment rationale, and asymmetric information and agency conflicts of equity (managerial risk aversion), a statistically significant relationship was found between derivatives use and the proxy variables (R&D and the number of shares held by directors). These findings were in line with those of studies by Nance *et al.* (1993), Gezcy *et al.* (1997), Aretz and Bartram (2010) and Choi *et al*. (2014).

A negative relationship between leverage and hedging can also imply conflicts of interest between shareholders and debt-holders, where shareholders benefit from investing in high risk projects with positive net present values, or even projects with a negative NPV, rather than safer investment projects that would benefit bondholders (Aretz & Bartram, 2010; Birkeland & Wang, 2017). A reduction of cash flow volatility increases the probability that shareholders will have something left after reimbursing bondholders. In other words, hedging should reduce cash flow volatility, which serves as an incentive for shareholders to invest in projects that will benefit bondholders as well as themselves.

Companies can use derivatives to give themselves easier access to external funding, but they may have less incentive to use derivatives once the financing is in place. The agency cost argument suggests that an increase in derivatives use is associated with growth opportunities. The higher the growth potential, the higher the likelihood that companies will use derivatives to avoid foregoing the chance to invest in profitable projects and investment opportunities that could enhance firm value. A company's growth prospects can also be used to measure this relationship and a positive relationship was expected. The positive and statistically significant results for R&D over sales confirmed this argument, indicating firms with higher growth opportunities were more likely to make use of derivatives to avoid agency conflicts of interest between debt holders and shareholders.

Researchers such as Allayannis and Ofek (2001), Géczy *et al.* (1997) and Graham and Rogers (2002) used the market to book ratio or its inverse to proxy for a firm's investment opportunities. Tobin's Q is similar to the market to book ratio but differs in that the replacement cost of assets is used, rather than the book value of assets. Tobin's Q is slightly more conservative approach to the same measure and has been used by Geyer-Klingeberg *et al.* (2018). The ratio indicates that the observed market value of the company represents the assessment of its assets in place and the value of its investment opportunities. In the current study, the coefficient of Tobin's Q, although it was positive as expected in the binary logistic regression, was not statistically significant. The relationship in the multiple linear regression model was negative, but also not at a statistically significant level.

6.3.3.3 Findings for $H1_3$ on managerial risk aversion as a hedging incentive

Managerial compensation affects derivatives use (Smith & Stulz, 1985). Information asymmetries can arise from managers' proprietary information on a firm's dividend stream, and therefore shareholders are not necessarily able to replicate a firm's hedging decisions, since managers have preferential access to information (DeMarzo & Duffie, 1995). Hence, firms are better able to hedge more effectively than individuals. Based on these arguments, $H1_3$ states that *JSE-listed firms use derivatives to reduce information asymmetry costs between shareholders and managers.*

Corporate hedging can be used as a method to decrease information asymmetries by lowering cash flow variability and decreasing noise in the dividend stream (Geyer-Klingeberg *et al.*, 2018). The proxy variable for information asymmetry and agency conflict of equity was directors' shareholding and the relationship was found to be positive and statistically significant for both the binary logistic regression model and the multiple linear regression model, which is in line with the theory.

Firms on the JSE used derivatives to reduce information asymmetry and to mitigate agency conflicts of equity. Furthermore, the hypothesis implies that firms with a high degree of managerial ownership would be more likely to hedge to protect managerial wealth within the firm (Aretz, Bartram & Dufey, 2007; Smith & Stulz, 1985). Therefore, it was expected that there would be a positive relationship between the proxy for the number of shares held by management and the likelihood of derivatives use. The results confirmed this expectation: in the binomial logistic regression model there was a strong positive association, indicating that the more shares were held by directors, the more likely companies were to use derivatives.

In prior studies by Gay and Nam (1998), Géczy *et al.* (1997), Haushalter (2000) and Tufano (1996), a logarithm specification of the value of the common shares held by a company's directors and shareholders was used. Similarly, the current study employed a proxy variable to determine whether shares were held by directors. The strong positive relationship in the binary logistic model supported the assumption that firms where directors hold a significant portion of shares are more likely to hedge, given that managers might have undiversified financial positions, since they derive substantial monetary and non-monetary benefits from their firms. It was therefore expected that managers had an incentive to deviate from actions that were purely to the benefit of shareholders and would hedge financial risks (using derivatives) to protect their own interest, as posited by Bartram *et al.* (2009).

6.3.3.4 Findings for $H1_4$ on tax incentives to hedge risk exposures with derivatives

Companies can in theory increase firm value with corporate hedging by taking advantage of tax convexity (Graham & Rogers, 2002). Although this strategy is advocated in the literature, there is little empirical evidence in past studies for this position: most studies have found a positive association between tax convexity and hedging, but few results have been statistically significant (Aretz & Bartram, 2010; Arnold *et al*., 2014; Donohoe, 2015; Heaney & Winata, 2005; Pincus & Rajgopal, 2002).

$H1_4$ thus states that *JSE-listed firms use derivatives to hedge financial risk exposure in response to tax incentives to minimize expected tax liability.* The binary logistic regression model and the multiple linear regression model found a negative relationship, which is opposite to what was predicted.

If a company's taxes increase disproportionately to its taxable income, corporate hedging can increase the after-tax firm value by lessening the volatility of the pre-tax income. In other words, corporate hedging to minimize cash flow volatility should enhance the value of a company after tax is taken into consideration, giving an incentive for companies to use derivatives. However, the findings from the regression models suggest that companies on the JSE were not able to do so or did not use derivatives for the purpose of taking advantage of tax convexity. The negative coefficients in the regression models were at odds with the findings of most previous studies, which found positive coefficients, albeit not necessarily at statistically significant levels (Aretz & Bartram, 2010; Arnold *et al.*, 2014).

The proxy variable used to assess tax incentives for hedging motives was *ACTLV*, which included tax loss carry forwards. Tax loss carry forwards have been criticized in the literature for being an ineffective proxy for tax convexity, and hence being the cause of statistically insignificant results. There has been a call for better proxies for tax incentives to be used, such as tax code, tax progressivity dummies, marginal tax rate dummies, or tax credits. In the current study, the dummy variable accumulated computed tax loss (*ACTLV*) comprised the total amount of computed taxation losses of the company or group, as calculated by the company or group which would apply to future taxable profits that would apply to the company. The tax variable was found to be not statistically significant in the current study.

A deferred tax liability may be reduced by a corresponding reduction in computed taxation losses. Computed taxation losses are not recognized by the company if it is unlikely that sufficient taxation allowable profits would be made to use the taxation losses in the company. This amount includes the tax loss carry forwards variable, which is normally used as a proxy variable in these studies. This study used accumulated taxation losses as a proxy variable to explain why companies would hedge for tax reasons. It is possible that this specific variable offers some incremental information that represents the tax convexity of firms and thus supports the argument that companies hedge for tax reasons. The current study did not find statistically significant support that JSE-listed companies hedge in response to tax incentives to hedge.

6.3.3.5 Findings on $H1_5$ on other firm characteristics that determine hedging with derivatives

In addition to the key rationales for corporate hedging that have already been explored, this study also investigated whether firm size and foreign operations had an impact on the likelihood that a company would disclose derivatives. Firm size can have both a positive or negative relationship with the likelihood of derivatives use. Larger firms are better able to take advantage of economies of scale to manage a corporate risk management system, while smaller firms are more likely to become financially constrained, because they are more likely to suffer from information asymmetry and face higher transaction costs in external financing (Bartram *et al*., 2009; Froot *et al.*, 1993), providing an incentive for firms to hedge by using derivatives to avoid financial distress costs and the risk of bankruptcy. Larger firms might also be more likely to hedge as they have more complex operations and more geographically dispersed operations and hence have a greater need for risk management (Triki, 2005). Companies with a significant proportion of foreign operations are expected to make use of derivatives to manage financial risk exposure to fluctuating exchange rates. Based on these arguments, $H1_5$ stated that *JSE-listed firms use derivatives to hedge financial risk exposures and/or because of other operating characteristics.*

A strong, positive and statistically significant relationship ($p<0.01$) was found in the binary logistic regression model between the natural logarithm of total assets and derivatives use. The strong positive association confirmed the hypothesis that larger firms are better able to exploit economies of scale and are therefore more likely to use derivatives. This is in line with findings by Berkman and Bradbury (1996), Géczy *et al*. (1997), Haushalter (2000), Mian (1996), and Nance *et al*. (1993).

Although a positive relationship was found between foreign sales and derivatives used for both the binary logistic regression model and the multiple linear regression model, neither relationship was statistically significant. A positive relationship between foreign sales and using derivatives in the models indicated that companies with more foreign sales were more likely to make use of derivatives, probably in response to exchange rate movements, but again, these relationships were not found to be statistically significant. It is possible that firms with foreign operations rely on other forms of corporate hedging to mitigate risks from foreign operations, such as pass-through, operational hedges and foreign debt or other substitutes for hedging practices, and that decision the hedge foreign risk exposure using derivatives was thus not purely a function of the existence of foreign operations.

6.4 SUMMARY AND CONCLUSION

Results from both the univariate analysis and multiple regression analysis using an unbalanced panel data set of the top 200 non-financial companies listed on the JSE from 2005 to 2017 confirmed some of the corporate hedging motives discussed in the literature. The findings from the statistical analyses indicated that firm size as measured by total assets was one of the strongest indicators of whether or not firms would use derivatives: larger firms were more likely to use them. This could indicate economies of scale, in that bigger firms are able to afford more sophisticated risk mitigation strategies that include using derivatives. Smaller firms might lack the need or the expertise to make use of derivatives. Only 57% of firms in the sample reported derivatives use during the sample period. The JSE is dominated by some large firms, with the top 40 listed companies representing more than 80% of the total market capitalization of the JSE.

The analyses also provided evidence that the top 200 non-financial firms listed on the JSE from 2005 to 2017 (the sample period) used derivatives as part of a corporate hedging strategy in response to the key rationales for risk management motives suggested by the finance literature. In particular, findings from the binary logistic regression analysis provided evidence that companies hedged according to the financial distress cost hypothesis, the underinvestment hypothesis and because of managerial risk aversion. Proxy variables that tested the impact of the corporate hedging decision of firms indicated that firms listed on the JSE used derivatives to limit the risk of bankruptcy and financial distress costs, to coordinate their financing and investment policy, and to mitigate agency conflicts of debt.

The next chapter discusses the results for the second main hypothesis set out by the thesis, which relates to the value relevance of derivatives disclosure. The data sample used to examine the value relevance of derivatives disclosures was the same as that used to examine the determinants of the derivatives disclosure as discussed in this chapter.

CHAPTER 7: RESULTS AND DISCUSSION – THE VALUE RELEVANCE OF DERIVATIVES DISCLOSURE

7.1 INTRODUCTION

Value relevance can be defined as the ability of the information disclosed in the financial statements to capture and summarize firm value (Barth *et al.*, 2001). This chapter examines the findings regarding the value relevance of derivatives disclosure for the sample of 200 JSE-listed firms for the period from 2005 to 2017, the full period during which firms had to disclose derivatives according to one specific accounting standard, namely *IAS 39*.

The identification of value relevance in essence refers to the study of a company's financial statements and whether the information contained in them materially influences the valuation of the company. This chapter explores the results of the current study regarding whether companies are valued differently if an amount (presented for the purposes of the study in ZAR and noted R) relating to the derivatives they used appears in the financial statements or the notes to the financial statements.

The same multiple linear regression models that were employed to test whether the disclosed derivatives amount in JSE-listed firms' financial statements is value relevant (see Section 5.5.2) were also expanded to investigate the effects that different economic cycles and specifically the effects the 2008/2009 financial crisis had on the value relevance of derivatives disclosure (see Section 5.5.3). Then a variable was added to test whether different levels of quality of information available in the financial statements were related to value relevance (see Section 5.5.4).

This study used two models. In the first model, the financial statements were analysed using Thomson Reuters Datastream to determine whether or not a (ZAR) amount for the derivatives used was disclosed somewhere in the financial statements of the entity. This variable was then used to as a binary or dichotomous variable to establish whether the decision to hedge was value relevant for firms listed on the JSE. The second model employed a continuous variable, calculated as the total ZAR amount of derivatives disclosed in the financial statements. These amounts were again captured from the financial statements of the entities using Thomson Reuters Datastream as a data source. The derivatives variable represents the combined ZAR amounts that were disclosed as either assets or liabilities in the financial statements and represents the total derivatives exposure or total ZAR amount of derivatives used by JSE-listed companies. Given that the higher the ZAR amount of derivatives used by a company, the higher the figure of this total amount disclosed in the financial statements was, the second model tested whether the *size* of derivatives use was value relevant.

This chapter also investigates in more detail the effects that the *disclosure* of derivatives during specific periods had on the value relevance of such disclosure. It was assumed that companies used derivatives for hedging purposes, in other words, to protect firm value against adverse effects during times of economic uncertainty. The period of 2005 to 2017, when a single accounting standard was used, can offer valuable insight into the value relevance of derivatives disclosure as this time, especially because, as already indicated, the study period includes the financial crisis of 2008/2009.

Period dummy variables can disproportionally influence the disclosure of derivatives specifically, since derivatives instruments by their nature incorporates a timing element. Unlike general value relevance research, which looks at various disclosed amounts or line items in the financial statements of entities, the current study focuses only on the disclosure of derivatives, the value relevance of which, if any, is intrinsically linked to the timing of the disclosure. By their very nature, derivative instruments already encompass a timing element, unlike most other accounting items. It was therefore expected that the disclosure of derivatives (and its possible value relevance) would be more time dependent because of the embedded time characteristic in a derivatives contract. Secondly, derivatives are used for corporate hedging. Thus derivatives are expected to have a marked effect in smoothing the volatility created by fluctuating business cycles. It could therefore be argued that the value relevance of derivatives disclosure could differ depending on the time horizon, and more specifically the economic conditions within a specified time horizon.

In addition, the study investigates in more detail the value relevance of derivatives disclosure if a measure is introduced on the quality of such disclosure. Companies provide additional information over and above the ZAR amount of derivatives they have used. The pertinent information that should be disclosed is mandated by accounting standards. The manner in which this information is disclosed can, however, differ across the companies included in the sample. It is important to assess whether or not companies have disclosed such information as prescribed by the accounting standards and the extent to which they comply with the standards. A quality of disclosure index was therefore created to classify the assessed quality of disclosure, and it was assumed that if more information was given and if the presentation of such information was better, it would materially affect the value relevance of the disclosed derivatives (ZAR) amount. Quality of disclosure in the context of this specific research objective refers to the completeness of information presented and how closely preparers of financial reports have followed the disclosure requirements prescribed by the relevant accounting standards.

7.2 THE VALUE RELEVANCE OF DERIVATIVES DISCLOSURE

This section presents the results and discussion on *H2*, which states that *the disclosure of derivatives in the financial statements of JSE-listed firms is value relevant*. The second hypothesis explores the effect of derivatives use on firm value for the top 200 non-financial companies listed on the JSE for the period from 2005 to 2017. Multiple linear regression models (see Section 5.5.2) were used to establish whether derivatives use by these firms in the study period was value relevant. The descriptive statistics for the data sample have already been discussed in Section 6.2.2.

The study adopted two approaches to determine the value relevance of derivatives disclosure and the (ZAR) amounts given. The first multiple linear regression model employed a binary variable for derivatives use to establish whether the *decision to hedge* (as revealed by derivatives use) was value relevant. The second multiple linear regression model employed a continuous variable for derivatives use to take into account whether the *extent of the disclosure* in the form of the (ZAR) amount of derivatives use was value relevant. The models also incorporated control variables (known drivers of firm value) as well as dummy variables for industry and time effects.

7.2.1 Results: Correlation analyses for variables to determine the value relevance of derivatives use

H2 relates to the value relevance of the disclosure of derivatives in the financial statements of JSE-listed firms, implying that investors reward firms that disclose derivatives use, indicative of hedging, with a higher valuation. To test this hypothesis, the firm value (proxied by Tobin's Q) of companies that disclosed derivatives was compared to the firm value of companies that did not disclose derivatives.

The findings from both the univariate and multiple linear regression models suggested companies that disclosed the value of derivatives as assets/liabilities in their financial statements were valued significantly differently to companies that did not do so. The univariate model indicated that the decision to hedge was value relevant, whereas the multiple linear regression model suggested that the *extent* of derivatives use was not factored into the valuation of the company. These results are discussed below.

Table 7.1 reports the Pearson correlation coefficients between Tobin's Q and the explanatory variables. The dependent variable, Tobin's Q, is a proxy of the market value of a firm. Derivatives use, proxied by the total (ZAR) amount of derivatives disclosed and captured from the financial statements, was positively correlated with firm value, but this relationship was not statistically significant (0.043, p=0.25). Firm value was positively correlated with profitability (measured by ROA, 0.431, p<0.01), with firm size (measured by the logarithm of total assets, 0.061, p=0.004), and with growth opportunities (measured by R&D costs scaled by total sales 0.107, p=0.033). Firm value was also negatively and significantly correlated with liquidity (proxied by the current ratio, -0.088, p<0.01), geographic diversification (measured by the amount of foreign sales scaled by total sales, -0.192, p<0.01), and dividend yield (-0.06, p=0.018). This implies that the firm value for JSE-listed companies was a function of their size, liquidity, growth opportunities, the amount of foreign operations and whether or not they issued a dividend. Leverage or the use of derivatives did not relate to firm value at a statistically significant level, based on the results of the univariate analysis.

Table 7.1: Correlation analysis of sample firm-years of firm value, disclosed derivatives (ZAR) amounts and other firm characteristics

		Derivatives Total	Derivatives Binary	Total Assets	ROA	Interest cover	Leverage Debt/Assets	Current Ratio	Dividend yield	Tobin's Q	R&D/Sales	Foreign sales/Sales
Derivatives Total	Pearson Correlation	1										
	N	783										
Derivatives Binary	Pearson Correlation		1									
	N		2535									
Total Assets	Pearson Correlation	0.586**	0.485**	1								
	N	783	2265	2398								
ROA	Pearson Correlation	-0.083*	0.008	-0.0215	1							
	N	765	2192	2316	2316							
Interest cover	Pearson Correlation	-0.115**	-0.011	-0.053**	0.301**	1						
	N	783	2535	2398	2316	2730						
Leverage Debt/Assets	Pearson Correlation	0.003283	0.219**	0.058**	-0.089**	0.101**	1					
	N	783	2535	2398	2316	2730	2730					
Current ratio	Pearson Correlation	-0.110**	-0.143**	-0.133**	0.102**	0.179**	-0.400**	1				
	N	783	2245	2377	2297	2377	2377	2377				
Dividend yield	Pearson Correlation	-0.131**	0.270**	-0.163**	0.184**	0.105**	-0.057*	0.168**	1			
	N	607	2535	1546	1537	1552	1552	1546	1552			
Tobin's Q	Pearson Correlation	0.042654	0.046*	0.061**	0.431**	0.264**	0.081**	-0.088**	-0.060*	1		
	N	744	2110	2226	2203	2227	2227	2207	1543	2227		
R&D/Sales	Pearson Correlation	0.109116	0.194**	0.066457	-0.03754	0.130**	-0.01133	0.030042	0.088084	0.107*	1	
	N	200	2535	415	406	415	415	415	304	396	415	
Foreign sales/Sales	Pearson Correlation	0.278**	0.376**	0.347**	-0.183**	0.00911	-0.102**	0.119**	-0.03157	-0.192**	0.107218	1
	N	495	2535	973	955	973	973	973	788	934	262	973

** Significant at the 1% level (using two-tailed significance), * Significant at the 5% level (using two-tailed significance)

Key to variables in Table 7.1: R&D/SALES=Ratio of research and development costs divided by sales; ROA=Return on assets

Source: Own compilation

The first linear regression model determined the relationship between Tobin's Q and the amount of derivatives disclosed. The results are presented in Table 7.2.

Table 7.2: Correlation analysis of sample firm-years

Dependent Variable: *TOBINQ*
Method: Panel Least Squares
Date: 05/07/20 Time: 13:07
Sample: 2005 2017
Periods included: 13
Cross-sections included: 193
Total panel (unbalanced) observations: 2111
Period weights (PCSE) standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.622881	0.020933	77.52888	0.0000
DERTOTAL_BIN	-0.106857	0.043587	-2.451603	0.0143

Effects Specification

Cross-section fixed (dummy variables)

Root MSE	0.546167	R-squared	0.569609
Mean dependent var	1.585220	Adjusted R-squared	0.526278
S.D. dependent var	0.832717	S.E. of regression	0.573137
Akaike info criterion	1.812017	Sum squared resid	629.7087
Schwarz criterion	2.331701	Log likelihood	-1718.583
Hannan-Quinn criterion	2.002313	F-statistic	13.14556
Durbin-Watson statistic	0.830140	Prob(F-statistic)	0.000000

Key to variables in Table 7.2:
TOBINQ =Tobin'sQ
DERTOTAL_BIN =Dummy variable of 1/(0) if derivatives (ZAR) amount is/is not reported
Source: Own compilation

The results displayed an adjusted R-squared of 53%, which implies that the model explained 53% of the variance in the dependent variable. Furthermore, the F-statistic ($F= 13.15$, $p<0.01$) indicated that the regression coefficients differed significantly from zero. The Durbin-Watson statistic was below 1, and was considered a concern as Field (2009) suggests that values below 1 are a definite cause for concern. Although autocorrelation is indeed a cause for concern in this particular model, this model was only provided for comparative purposes in explaining the relationship between derivatives and firm value.

The preliminary results indicated a statistically significant negative relationship between derivatives use (-0.11, p=0.01) and firm value, measured by Tobin's Q. Investors valued firms lower if they disclosed (ZAR) amounts for derivatives used in the financial statements. This negative coefficient contradicted the findings in most previous studies, which found a positive value premium for derivatives use. However, the value adding characteristics of derivatives use by JSE-listed companies should be interpreted in relation to other known drivers of firm value. This was done using a multivariate linear regression, based *inter alia*, on the initial framework set out by Allayannis and Weston (2001). These models included control variables that could have a significant effect on Tobin's Q as well. The findings of the multivariate approach are presented in the next section.

7.2.2 Results: The value relevance of derivatives disclosures

The value effect of using derivatives was further investigated using a multiple linear regression model. The study employed pooled Ordinary Least Squares (OLS), which is frequently used for estimating linear regressions among variables and has been extensively used in previous value relevance studies (e.g. Allayannis & Weston, 2001; Pramborg, 2004; Jin & Jorion, 2006). Pooled OLS was performed to estimate linear regression between variables – in this instance, the outcome variable of Tobin's Q as a proxy of firm value, and a set of regressors which constituted the explanatory variable of the ZAR amount of derivatives disclosed in the financial statements of JSE-listed firms in the sample. A set of control variables of other known drivers of firm value was also included to isolate the effects of derivatives disclosure on firm value. These specifications are similar to those employed in other studies that used proxy variables to control for other drivers of firm value, and dummy variables to control for firm sector and year effects.

The panel data approach was not used for the model, due to the follow-up model, which tested three periods, each represented by a dummy variable. Separate analyses of the three periods were conducted (for two of which the time span was only two and three years respectively) and panel regressions for these short periods and associated small sample sizes were not deemed appropriate.

Although a single independent variable regression analysis can tell whether there is a relationship between two variables, in the finance environment, such relationships can be spurious. Analysis thus has to take into account the known variables that influence the dependent variable as control variables. Therefore, the current study explored the impact of derivatives use on firm value in the context of other firm variables that could influence firm value. Pooled OLS multiple linear regression models were used to explore these principles. To document the relationship between hedging with the derivatives and firm value, control variables that can also influence Tobin's Q should be included. The first model as reflected by Equation 5.2, repeated here for the convenience of the reader, includes the proxies for net exposure (the total amount of derivatives disclosed in the financial statements) and the control variables.

$$Firm\ value = \alpha + \Sigma SECTOR + \beta_1 DERTOTAL\_BIN + \beta_2 LNTOTASS + \beta_3 CR + \beta_4 LEVDA + \beta_5 ROA + \beta_6 RD/SALES + \beta_7 FOR/SALES + \beta_8 DIVYIELD + \varepsilon_i \quad (5.2)$$

where

Dependent value	=	Firm value proxied by Tobin's Q
α	=	intercept
ΣSECTOR	=	different sectors in which the firms in the sample operate
DEROTAL_BIN / DERTOTALWINSB	=	Hedging/derivatives. Dichotomous of 1/(0) if the company uses derivatives/(does not use derivatives) and/or logarithm of the total derivatives amount disclosed in the financial statements as a continuous variable
LNTOTASS	=	Firm size = logarithm of total assets
CR	=	Liquidity = current ratio
LEVDA	=	Leverage ratio of total debt divided by total assets
ROA	=	Profitability = ratio of EBIT divided by total assets (ROA)
RD/SALES	=	Growth prospects = ratio of R&D expenses divided by total sales
FOR/SALES	=	Geographic diversification =ratio of foreign sales divided by total sales
DIVYIELD	=	Dividends = dichotomous variable of 1/(0) if company paid/(did not pay) dividends during the year
ε_i	=	residual term

For $i = 1,\ldots,N$, N is the number of firm year observations. In Equation 5.2 the variables included are those discussed in Section 4.5.2, and ε_i is the residual for observation i. The results from this regression are presented in Table 5.8.

The pooled OLS regression model is robust in meeting the assumptions necessary for the analysis of the data. Diagnostic tests were conducted for the presence of endogeneity, multi-collinearity, heteroskedasticity, autocorrelation and normality to ensure the robustness of the regression results. Outliers in the original data sample were excluded by winsorizing the data at the 5% and 95% percentiles. Since none of the tolerance values were below 0.1 and none of the VIF values were above 10, the assumption of no multicollinearity was met. The Durbin-Watson statistics (2.1 and 2, respectively) fell within the expected range of 1.5 to 2.5, indicating that the assumption of no serious autocorrelation was met. The absence of heteroskedasticity was confirmed by conducting the Breusch-Pagan test. Normality of the residuals can be assumed – although the Jarque-Bera test indicated that the assumption was not met, it is known that the test and the skewness and kurtosis values were used to provide a reasonable justification if the assumption was met/not met. The adjusted R-squared was 36% and the F-statistic was 45.59, $p<0.01$.

The current study adopted a two-pronged approach to establish whether the disclosure of the (ZAR) amount of derivatives was value relevant. In the first model, a binary variable was created, depending on whether or not a company disclosed a (ZAR) amount for derivatives in the financial years during the sample period. The findings from this regression model, presented in Table 7.3, show that derivatives use by companies was indeed statistically significant (0.12, $p<0.01$) and hence was value relevant. Investors did reward companies with a higher valuation, as measured by Tobin's Q, if an amount for derivatives was disclosed in the financial statements of the entity, confirming *H2*.

Table 7.3: The value relevance of derivatives (dichotomous model)

Dependent Variable: *TOBINSQ*
Method: Least Squares
Date: 05/19/20 Time: 21:09
Sample (adjusted): 2 2535
Included observations: 2070 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.347865	0.244341	9.608987	0.0000
DERTOTAL_BIN	0.124097	0.035621	3.483791	0.0005
DIVYIELD	-0.039827	0.035957	-1.107610	0.2682
RD/SALES	0.018504	0.037585	0.492327	0.6225
FOR/SALES	0.291375	0.037555	7.758640	0.0000
CR	-0.112259	0.019430	-5.777610	0.0000
ROA	0.037789	0.002650	14.26063	0.0000
LNTOTASS	-0.069256	0.014837	-4.667669	0.0000
LEVDA	0.008948	0.074100	0.120754	0.9039
DUM2006	0.221725	0.097591	2.271997	0.0232
DUM2007	0.313840	0.090736	3.458833	0.0006
DUM2008	-0.167054	0.085686	-1.949607	0.0514
DUM2009	-0.311941	0.083477	-3.736831	0.0002
DUM2010	-0.158106	0.086678	-1.824063	0.0683
DUM2011	-0.079579	0.085038	-0.935806	0.3495
DUM2012	-0.028694	0.086004	-0.333636	0.7387
DUM2013	0.035301	0.086502	0.408093	0.6832
DUM2014	0.069480	0.088504	0.785050	0.4325
DUM2015	0.005888	0.088623	0.066438	0.9470
DUM2016	-0.055878	0.086357	-0.647059	0.5177
DUM2017	-0.027042	0.088059	-0.307093	0.7588
HEALTHCAREDUM	0.389413	0.088435	4.403385	0.0000
INDUSTRIALSDUM	-0.238151	0.045876	-5.191236	0.0000
CONSGOODSDUM	-0.035315	0.057592	-0.613194	0.5398
CONSSERVDUM	0.452430	0.067163	6.736258	0.0000
OILGASDUM	0.774909	0.345884	2.240371	0.0252
TECHDUM	-0.010072	0.073661	-0.136739	0.8913

R-squared	0.367166	Mean dependent var	1.583004
Adjusted R-squared	0.359112	S.D. dependent var	0.827679
S.E. of regression	0.662602	Akaike info criterion	2.027673
Sum squared resid	896.9615	Schwarz criterion	2.101177
Log likelihood	-2071.642	Hannan-Quinn criterion	2.054615
F-statistic	45.58983	Durbin-Watson statistic	2.065036
Prob(F-statistic)	0.000000	Wald F-statistic	47.27269
Prob(Wald F-statistic)	0.000000		

Key to variables in Table 7.3:

TOBINSQ	Tobin's Q
DERTOTAL_BIN	Dummy variable of 1/(0) if derivatives amount is/(not) reported
LNTOTASS	Natural logarithm of total assets
DIVYIELD	Dividend yield
RD/SALES	Ratio of research and development costs divided by sales
FOR/SALES	Ratio of foreign sales divided by sales
ROA	Return on assets
CR	Current ratio
LEVDA	Leverage calculated as the ratio of debt to assets
DUM2006	Year dummy variable
HEALTHCAREDUM	Sector dummy variable

Source: Own compilation

A short discussion on the results for the different control variables in the regression model follows. It is important to understand that there are different variables that can contribute to firm value, and that these variables can influence the results of the current models. In interpreting the results and comparing them to those of other studies, it is also important to remember to interpret these control factors in relation to each other, and to take into account the country in which the study concerned was conducted. These details should be taken into account in interpreting the results of derivatives disclosures as well, since the various variables can influence each other. A more expansive explanation of the results from the control variables in the regression model is provided here to serve as counter-reference for the further regression models that follow, to enable comparison of the results when additional control variables for specific periods and the level of quality are introduced, as well as to confirm the robustness of the results of the different regression models.

The results from this multiple linear regression model show that firm profitability, measured by ROA (0.04, $p<0.01$), was statistically significantly and positively related to Tobin's Q. This result supports the findings of Allayannis and Weston (2001), Pramborg (2004) and Bielmeier and Hansson Nansing (2013). More profitable firms were thus rewarded with a value premium. In addition, geographic diversification (measured by the ratio of foreign sales to total sales, 0.3, $p<0.01$) was also positively and statistically significantly related to firm value (measured by Tobin's Q). Investors thus accorded higher value to firms with significant foreign operations.

By contrast, firm size (proxied by the natural logarithm of total assets, -0.07, $p<0.01$) and firm liquidity (proxied by the current ratio, -0.11, $p<0.01$) were statistically significantly and negatively related to Tobin's Q. Smaller firms were valued higher, as measured by Tobin's Q. This finding is consistent with previous results reported by Allayannis and Weston (2001), Pramborg (2004) and Bielmeier and Hansson Nansing (2013), who also found a discount for smaller firms. Firms were also punished for excess liquidity: firms with higher cash reserves, more short-term assets compared to short-term debt were accorded lower value. One reason could be that investors prefer companies to use cash reserves more efficiently, either by paying out dividends, engaging in share buy-backs or investing in more profitable projects.

Dividend yield was negatively, but not statistically significantly, related to Tobin's Q (-0.04, p=0.27), implying that firm value was independent of dividend policy. This finding is in line with those of Pramborg (2004) and Bielmeier and Hansson Nansing (2013). Investors seem not to value a company differently based on whether or not it pays a dividend. Growth prospects, measured by R&D costs divided by sales (*R&D/Sales*), was positively, but not statistically significantly, related to Tobin's Q (0.02, p=0.62). Companies were not rewarded with a higher value for better growth opportunities. Leverage was positively, but not statistically significantly, related to Tobin's Q (0.01, p=0.9), showing that a company's value was independent of its capital structure.

Furthermore, the statistically significant results for some of the firms' sector dummy variables and the mixed signs for the different sectors indicated that the sample companies in the different sectors of the JSE were valued differently during the sample period, depending on the sector in which they operate. The results of statistical significance for a particular year's dummy variables were of consequence for this particular study. Positive and statistically significant results for the year dummy variables in 2006 and 2007 were found with positive coefficients for 2006 (0.22, p=0.02) and 2007 (0.31, p<0.01). However, the coefficients for the year dummy variables were negative and statistically significant for the years 2008 (-0.17, p=0.05), 2009 (-0.31, p<0.01), and 2010 (-0.16, p=0.07). This shows that particular macroeconomic events, such as the global financial crisis of 2008/2009, may have had a significant impact on the market values of the publicly listed sample firms. This concept and particular findings are explored in more detail in Section 7.3 and Section 8.2.

The purpose of the second regression model was to establish whether the extent of derivatives use was value relevant. In other words, did investors reward companies with a higher value if the firms used derivatives more, or the greater the (ZAR) amount of the total disclosed derivatives?

Table 7.4: The value relevance of derivatives (continuous model)

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 05/19/20 Time: 21:36
Sample (adjusted): 17 2532
Included observations: 736 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.706329	0.323908	2.180644	0.0295
DERTOTALWINSB	1.37E-07	1.11E-07	1.240860	0.2151
DIVYIELD	0.074975	0.063053	1.189078	0.2348
RD/SALES	0.058396	0.056096	1.041007	0.2982
FOR/SALES	0.157565	0.046995	3.352780	0.0008
ROA	0.059001	0.004933	11.96087	0.0000
LEVDA	0.036731	0.091014	0.403576	0.6866
DUM2006	0.135041	0.153306	0.880860	0.3787
DUM2007	0.186136	0.125148	1.487333	0.1374
DUM2008	-0.342429	0.105458	-3.247064	0.0012
DUM2009	-0.203763	0.099523	-2.047391	0.0410
DUM2010	-0.052054	0.098953	-0.526041	0.5990
DUM2011	-0.102030	0.092278	-1.105678	0.2692
DUM2012	0.012082	0.093499	0.129219	0.8972
DUM2013	0.130679	0.091574	1.427032	0.1540
DUM2014	0.120651	0.114060	1.057791	0.2905
DUM2015	-0.030081	0.095168	-0.316088	0.7520
DUM2016	-0.121188	0.089549	-1.353323	0.1764
HEALTHCAREDUM	0.411797	0.116113	3.546532	0.0004
INDUSTRIALSDUM	-0.111973	0.060007	-1.866009	0.0625
CONSGOODSDUM	0.029715	0.079849	0.372142	0.7099
CONSSERVDUM	0.578618	0.134908	4.288985	0.0000
TECHDUM	0.052332	0.129177	0.405119	0.6855
LNTOTASS	0.018899	0.019331	0.977628	0.3286
CR	-0.098340	0.037177	-2.645205	0.0083

R-squared	0.534590	Mean dependent var	1.630614
Adjusted R-squared	0.518880	S.D. dependent var	0.817717
S.E. of regression	0.567191	Akaike info criterion	1.737136
Sum squared resid	228.7328	Schwarz criterion	1.893428
Log likelihood	-614.2662	Hannan-Quinn criterion	1.797412
F-statistic	34.02857	Durbin-Watson statistic	2.012835
Prob(F-statistic)	0.000000	Wald F-statistic	25.93166
Prob(Wald F-statistic)	0.000000		

Key to variables in Table 7.4:

TOBINSQ	Tobin's Q
DERTOTALWINSB	Total amount of derivatives reported in the financial statements
LNTOTASS	Natural logarithm of total assets
DIVYIELD	Dividend yield
RD/SALES	Ratio of research and development costs divided by sales
FOR/SALES	Ratio of foreign sales divided by sales
ROA	Return on assets
CR	Current ratio
LEVDA	Leverage calculated as the ratio of debt to assets
DUM2006	Year dummy variable
HEALTHCAREDUM	Sector dummy variable

Source: Own compilation

The pooled OLS regression model was robust in meeting the assumptions necessary for the analysis of the data. Diagnostic tests were conducted for the presence of endogeneity, multi-collinearity, heteroskedasticity, autocorrelation and normality to ensure the robustness of the regression results. Outliers in the original data sample were excluded by winsorizing the data at the 5% and 95% percentiles. Since none of the tolerance values were below 0.1 and none of the VIF values were above 10, the assumption of no multicollinearity was met. The Durbin-Watson statistics of 2 fell within the expected range of 1.5 to 2.5, thus indicating that the assumption of no serious autocorrelation was also met. The absence of heteroskedasticity was confirmed by conducting the Breusch-Pagan test. Normality of the residuals can be assumed (although the Jarque-Bera test indicated that the assumption was not met, it was known that the test and the skewness and kurtosis values would only be used to provide a reasonable justification if the assumption was met/not met). The adjusted R-squared was 52% and the F-statistic was 34.03, $p<0.01$, indicating the overall goodness-of-fit of the model.

The results from the second multiple linear regression model, which used a continuous variable for the total (ZAR) amount of derivatives disclosed in the financial statements of the sample of JSE-listed companies, was positive, but not at a statistically significant level (1.4, $p = 0.22$). This potentially contradicted the findings from the first linear regression model, which used a binary explanatory variable for the (ZAR) amount of derivatives disclosed (1 if an amount was disclosed and 0 if none was disclosed) and which found that the decision to hedge was value relevant. This can imply that investors do not value companies higher for using more derivatives, but rather that they reward firms with a value premium simply for undertaking a risk management strategy such as using derivatives.

The data sample used in the regression models presented in Table 7.4 included all firm-year observations. The R-squared and adjusted R-squared represent the goodness-of-fit of the regression models, showing how much of the variation in the dependent variable was explained by each model. Low R-squared in regression equations is not uncommon in the social sciences (Wooldridge, 2012), especially for cross-sectional analyses.

The Durbin-Watson statistic indicates possible autocorrelation (a value close to 2 indicates that the model is not auto-correlated; if the value is below (above) 2, the model is positively (negatively) auto-correlated). The Durbin-Watson statistic of 1.19 indicated slight positive autocorrelation, but this autocorrelation problem is not significant.

Endogeneity and reverse causality between hedging and Tobin's Q can be a problem in the estimation models. A positive relation between Tobin's Q and derivatives use could indicate that companies with higher Tobin's Q are more likely to hedge, as Tobin's Q could reflect a company's greater investment opportunities for future growth. The current study addresses this problem in a number of ways. The first hypothesis and its sub-hypotheses explicitly dealt with the determinants of derivatives use (as discussed in detail in Chapter 6). The results from this estimation indicated that the instruments used were valid.

The explanatory power of the pooled OLS regression models was satisfactorily high for the value relevance of derivatives disclosure model (Equation 5.2), with an adjusted R-squared of 36% and 52% for each regression model respectively. Similar studies on the hedging practices of firms have found comparable values for power explanation and hence the set of variables used in the current study permits a strong explanation of Tobin's Q. The results for the control variables for the second regression model corresponded, for the most part, with the findings from the first regression model, reinforcing the robustness of both models. The signs of the coefficients of the control variables in the second regression model also confirmed the expected direction of the expected effects on firm value. Firm profitability (measured by ROA, 0.06, $p<0.01$) was a predictor of firm value, followed by geographic diversification (0.16, $p<0.01$) and firm liquidity (measured by the current ratio, -0.1, $p<0.01$), which as expected had a statistically significant negative relationship with firm value.

The second regression model for Equation 5.2 also indicated the year dummy variables for 2008 and 2009 to be statistically significant, with negative coefficients (-0.34, $p<0.01$ for 2008, and -0.2, $p=0.04$ for 2009). This again showed the negative effects of the financial crisis of 2008/2009 on firm value. The results of the time effects on the model are discussed in more detail in Section 7.3 and Section 8.2.

Some firm sectors were statistically significant, and there were differences in the signs of the coefficients. This indicates that different sectors of industries on the JSE had different effects on Tobin's Q: investors valued companies listed on the JSE differently depending on the sector in which they operate. Some sectors were statistically significant and negative, specifically the industrials sector (-0.24, p<0.01, -0.11, p=0.06) were significant in both models, which indicated that the performance of particular industries during the sample period was taken into account by investors.

None of the remaining control variables were statistically significant. The proxy variables for dividend policy and firm size were positive, but not statistically significant (0.07, p=0.23, 0.02, p=0.33). Firm value was independent of a company's capital structure (measured by its leverage ratio, 0.04, p=0.7) and its growth prospects (measured by the ratio of *RD/Sales*, 0.06, p=0.3). A detailed discussion of these results follows in the next section.

7.3 DISCUSSION: VALUE RELEVANCE OF DERIVATIVES DISCLOSURES

Derivatives use by sample JSE-listed companies had a statistically significant impact on how these firms were valued. The positive coefficient for the binary proxy variable for the total nominal (ZAR) amount of derivatives disclosed in the financial statements seemed to indicate that companies that used derivatives were valued at a premium to companies that did not hedge with derivatives. These findings contradict those of Ben Khediri (2010), who found that the independence of firm value from the firm's hedging decision and the discounted value of the extent of derivatives use for French firms contradicted the findings in most US studies. This could suggest major differences between French and US firms and how these firms are valued. Ben Khediri (2010) suggests that investors link derivatives use to non-value enhancing motives for French firms, which are characterized by a high concentration of ownership and weaker investor protection, and hence investors value this decision at a discount. Similarly Allayannis *et al.* (2011) indicate that derivatives use only adds value to firms with strong internal governance (strong shareholder and creditor rights, or in common law countries where the legal system is of English origin), and is insignificant for firms with weak internal governance and in countries with weak external governance. Similarly, the positive value effect for the hedging decision is further supported by the findings of studies in single countries such as those by Jankensgård (2015) in Sweden, Vivel Búa *et al.* (2015) in Spain, and Clark and Judge (2009) in the UK.

On the other hand, studies such as those by Jin and Jorion (2006) showed weak value effects between firms that hedge and firms who do not. Fauver and Naranjo (2010) reported a weak relationship between hedging and firm value, and a negative relationship between firms' use of derivatives and high agency and monitoring problems. Furthermore, Belghitar *et al.* (2013) found no association between firm value and derivatives use for a sample of French firms, and Nguyen and Faff (2007) noted a negative relationship between derivatives use and firm value.

7.3.1 Risk management practices by firms

Despite the contradictory results reported in the literature on whether or not disclosure of derivatives by companies is value relevant, it remains important to continue to investigate the effects of derivatives use and its disclosure by companies on firm value for several reasons. Firstly, corporate hedging in its purest sense exists to help companies to mitigate risk exposures and do so for the sole purpose of enhancing shareholder wealth. A negative relationship between derivatives use and firm value indicates a failure of the effective management of risk. Secondly, a weak relationship or no relationship between corporate hedging practices and firm value can be indicative of weak communication of a company's risk practices to investors and to the market as a whole. Most studies, including the current study, rely on the information conveyed in firms' financial statements, and so do investors. Knowledge about companies' hedging practices based on such sources thus depends on the quality of such information in effectively communicating both the extent of derivatives use and the degree of the risk exposure that is hedged (this is explored in detail in Section 8.3).

The quality of disclosure to some extent explains differences between the findings of different studies on the value relevance of derivatives use, because valuations depend on the derivatives amounts (in the applicable currencies) that are captured from the financial statements, or provided by data suppositories such as Thomson Reuters

Datastream, IRESS and others (as opposed to studies that rely on questionnaires, for example). Moreover, different countries have different disclosure requirements, and companies disclose information to different extents. Thus the findings from the current study, which shows that the decision to hedge was value relevant in South Africa for the sample period, can be contrasted to studies from other parts of the world, where the derivatives amounts used may to some extent be a subjective figure. In value relevance studies then, an important question is how well an investor is able to interpret the financial statements, and to what extent this interpretation influences investors' valuation of a firm.

As several previous researchers, for example, Bielmeier and Hansson Nansing (2013), have pointed out, comparing findings between different countries is not without limitations. Clearly, structural differences between economies, differences between corporate culture in companies in different countries and environments, and exposure to and integration with international financial markets all almost definitely have an impact on hedging practices in different companies in different countries. Comparing the value relevance of the derivatives hedging by JSE-listed firms to hedging practices in other parts of the world, one has to take into account these differences. However, regardless of where a company is listed, the core mandate of risk management remains protecting shareholder wealth. A company that is successful in its corporate risk management should thus be rewarded with a higher value.

The fact that the regression model for using the binary variable (1 or 0) for derivatives use (Equation 5.2) was statistically significant and positive shows that sample companies' decision to hedge was value relevant. In other words, investors valued a company higher if it disclosed a (ZAR) amount for the total (ZAR) amount of derivatives used in a particular financial year. Companies that did not disclose any (ZAR) amount for derivatives were indeed valued lower. This implies that there is a value premium associated with companies' hedging practices and companies that use derivatives are valued higher accordingly.

By contrast, the regression model using a continuous variable for derivatives use (Equation 5.2) did not display statistically significant support for the value relevance of the *extent* of hedging practices by firms. This may in part be attributed to how the variable for the size of derivatives use was constructed: the total (ZAR) amount of derivatives disclosed by JSE-listed firms was calculated by adding all the amounts disclosed in the financial statements of the entities, including the amounts disclosed as assets and liabilities. These amounts represent the total exposure companies had to derivative financial instruments, assuming that the companies disclosed all relevant amounts relating to derivatives exposure in the financial statements and that they did so according to the prescribed accounting standards and practices and for hedging purposes only (not as part of the firms' daily operations or for a profit-seeking motive).

Since companies take positions in derivatives markets, exposure to these instruments can either move in favour of the company or unfavourably, which means that the derivatives position has to be disclosed as either an asset or a liability. The implication of this for the current study (which seeks to establish whether such disclosure materially affects investors' valuation of a company) is that investors may interpret derivatives disclosed as assets as 'good', and derivatives disclosed as liabilities as 'bad', thus offsetting the potential value relevance effects of the derivatives that are disclosed.

The binary model showed that companies' decision to hedge was certainly value relevant. It is possible that investors rewarded companies with higher valuations if they were perceived to have done better in managing risk by disclosing more derivatives assets than derivatives liabilities. It opens a potential Pandora's box of implications for value relevance research if one starts comparing the value relevance effects of assets and liabilities, and it is beyond the scope of the current study to do so, but this does suggest an avenue for potential future research, because derivatives amounts are among the few accounting items that can be disclosed as either an asset or a liability. The core focus of the current study is to establish whether the total value of derivatives amounts disclosed in the financial statements of the sample of JSE-listed firms were value relevant for the sample period. The findings from the multiple linear regression models indicated that if companies disclosed an amount for derivatives, that amount was value relevant. In broader terms, investors rewarded firms listed on the JSE with a higher valuation if the firms used derivatives for corporate risk management.

7.3.2 The effects of derivatives disclosure on firm value

It is also possible that using different types of derivatives may have different effects on firm value. Bartram, Brown and Fehle (2003) found mixed results conditional on the type of risk and the underlying exposure – in their study, interest rate hedges were the only ones that were value enhancing. Companies can use a vast array of different derivatives instruments to hedge any number of underlying exposures, including but not limited to foreign exchange, interest rates and commodity prices. The current study investigates whether the total (ZAR) amount of derivatives disclosed in the financial statements of an entity is value relevant. Since the study found that the decision to hedge was value relevant, but that *size* of the total amount of derivatives exposure disclosed did not add to firm value, it is possible that different types of derivative instruments have different types of value enhancing abilities. In other words, investors could value companies differently depending on the exposures they hedged.

It is therefore possible that the derivatives instruments used to hedge different risk exposures have different value-adding properties (that there are differences in the value relevance of different types of hedge instruments). The current study investigates total derivatives use by companies. The results can therefore be compared to research that examined the hedging of other types of risk exposure. The hedging of foreign exchange exposure in particular seems to be a popular field of interest. Researchers such as Allayannis and Weston (2001), Pramborg (2004), Vivel Búa *et al.* (2015) and Belghitar *et al.* (2013) have focused on the value enhancing abilities of hedging foreign exchange exposures. Other researchers, such as Bartram *et al.* (2003), Ahmed, Azevedo and Guney (2014), and Walker *et al.* (2014) have looked at and compared the three main types of exposure, namely foreign exchange, interest rate and commodity prices. Still other researchers have looked at all the expsured or the total exposure that firms face (Ben Khediri, 2010; Choi, Mao & Upadhyay, 2013; Fauver & Naranjo, 2010). Bessler, Conlon and Huan (2019:226) provide an excellent summary of recent studies on firm hedging practices, and of which exposures were investigated by the different papers. The vast differences between the findings of these papers can be explained to some extent by the fact that these studies were done in various countries and over different sample periods.

Derivatives use and risk management practices are not static. Investors may value companies differently over different periods, depending on the particular exposures hedged at those times. It is important then for this particular study that the differences between the value relevance of the decision to hedge (as shown by the binary regression model) and the *extent* of derivatives use (as shown by the continuous model) could be explained by the fact that the different exposures hedged have different value-adding properties, and that investors could value firms differently depending on the type of exposure that was hedged. It is therefore possible that, because the current study considers the total derivatives exposure, it captures the value relevance of derivatives instruments that hedge any number of risk exposures, and that these risk exposures have conflicting effects on firm value. Investors could, for example, value derivatives that hedge foreign exchange exposures very highly, but could perceive derivatives used to hedge interest rates negatively.

Since the purpose of the current study is to establish whether the hedging motive is value relevant for JSE-listed firms, it is helpful that the regression model shows clearly that companies that disclosed derivatives were valued statistically significantly differently from companies that did not disclose derivatives amounts in their financial statements.

The results from the current study could support the findings of studies that indicate potential governance problems in South African firms, specifically in terms of corporate hedging strategy. The coefficient for derivatives use was positive for both regression models, suggesting that investors valued firms positively for using derivatives. However, the second regression model did not show statistical significance for derivatives use, implying that investors may have penalized companies for making too much use of derivatives, because investors did not trust their motives for using derivatives, or that derivatives were used by companies for hedging purposes. This result could show weak investor confidence in corporate governance structures and the accounting standards that prescribe derivatives use and disclosure for non-financial firms.

A further interesting implication from the results of the value relevance models is that they showed the statistical significance of the dummy periods employed to control for time effects in the regression models. The dummy variables displayed some statistical significance, specifically the years 2008 and 2009, coinciding with the global financial crisis, when derivatives instruments, although they were not necessarily the cause of the financial crisis, certainly exacerbated the consequences of the crisis.

Much has been written on the causes of the financial crisis and its effects on firms. For the purposes of this study, the effects of a financial crisis (and in particular the effect of the 2008/2009 financial crisis) were extremely consequential, given that the purpose of using derivatives is part of corporate risk management, to hedge the company against financial shocks and to mitigate the potential financial repercussions of adverse economic conditions and negative effects on its operations, cash flows and profits.

The effects of a crisis on firms are complex. On the one hand, firms are exposed to normal economic cycles, so their operations are vulnerable to various exogenous shocks which they have little control over. Companies can hedge (and use derivatives) to offset these shocks. On the other hand, a financial crisis subjects a company to more than the economic effects of a cyclical downturn: it also exposes to what extent risk management practices are successful.

Companies that use derivatives are exposed to fluctuations in the value of these instruments, caused by movements in the markets. This is the basis of the contract into which companies enter. Companies take a deliberate position in the derivatives market, often the opposite position of a pre-exiting exposure. Corporate hedging then becomes a zero-sum game: an increase in value from one position will offset the loss of value from the other position. A financial crisis such as the one in 2008/2009 exposed companies not just to the negative effects caused by an economic downturn, but also directly to excessive movements in derivatives positions. In addition, for banks in particular, there was also a knock-on effect for hybrid derivatives instruments. Some exotic derivatives instruments incorporated different underlying assets, for example, bonds, as well as other derivatives instruments that in turn were also based on different underlying assets. A default on any one of the underlying assets caused all the financial derivative instruments that incorporated this asset to default as well. Thus, in the crisis, companies were already facing some type of operational exposure (for example, interest rates), and then the derivatives that they used to protect themselves against exposure could in fact increase their exposure. In addition, the very fact that companies deliberately took a position in the derivatives market (for whichever purpose) already increased the companies' exposure to additional volatility. Only a skilled risk manager can exploit this increase in volatility to offset risk successfully. The negative coefficients of the year dummies for 2008 (-0.17, p= 0.05) and for 2009 (-0.31, p<0.01) clearly reflect the value-destroying effects of the 2008/2009 financial crisis. These findings offer additional evidence that the effects of the financial crisis on the value relevance of derivatives disclosures should be investigated in more detail.

The rationale for corporate hedging (and for using derivatives for such a purpose) lies in protecting a company from adverse economic conditions. If companies are better able to protect themselves against exogenous economic shocks, they should be valued more highly by investors. This idea is explored in the third hypothesis of the current study, which states that *the value relevance of derivatives disclosed in the financial statements of JSE-listed firms is statistically significantly different during specific economic periods.* The findings are discussed in Section 8.2.

It is possible that the suggested relations above could be caused by reverse causality, and that firms with a high Tobin's Q are more likely to hedge. Firms that are valued higher, for example, because of higher growth opportunities, may simply have an added incentive to hedge, as they pursue profitable investment opportunities. The results for tests for reverse causality are presented in Appendix A. As in the study by Allayannis and Weston (2001), it was found that hedging caused increases in Tobin's Q, but there was no evidence that the level of Tobin's Q influenced hedging behaviour.

7.3.3 Other drivers of firm value

A detailed discussion is presented in this section regarding the results on the effects of the control variables (various firm characteristics) on firm value, and to provide some insight into the interaction between the control variables and companies' use of derivatives. Furthermore, the regression models used to test *H2* were replicated in the sections 8.2 and 8.3 that follow and the same control variables were used in the regression models. A detailed discussion makes it unnecessary to present in-depth analysis of the control variables in each of the regression models presented in sections 8.2 and 8.3. Where discrepancies or interesting results for the control variables appear, they are discussed as needed.

Most of the signs of the coefficients of the control variables in the value relevance models confirmed the expected direction of the influence predicted in the literature. Based on the positive and statistically significant results from the multiple linear regression models, investors do value the sample firms listed on the JSE based on their profitability. This is in line with the findings of Allayannis and Weston (2001), Pramborg (2004), Jin and Jorion (2006) and Ben Khediri (2010). The proxy variable for profitability, *ROA*, was positive and highly statistically significant in both regression models (0.04, $p<0.01$, 0.06, $p<0.01$). Profitable firms are thus valued higher by the market.

Firms with more free cash flows are more likely to invest in projects with negative NPVs (Jensen, 1986) and hence are expected to have a lower Tobin's Q. This argument was also presented in previous research (Júnior & Laham, 2008; Nova, 2015; Pramborg, 2004), which suggests that excess liquidity motivates companies to invest in projects that have negative NPVs and therefore this liquidity does not add to shareholder value. The measure for liquidity, the current ratio, was negative and statistically significant in both models (-0.11, $p<0.01$, -0.1, $p<0.01$), showing that sample firms with higher liquidity were valued lower by investors. It could indicate that the market perceives companies with high liquidity as not actively pursuing enough profitable investment projects and not using their cash reserves well. Companies would do better to pay out a dividend to give shareholders an opportunity to pursue other investments that offer a higher return.

The independence of firm value from a firm's dividend policy has been reported by Ben Khediri (2010) and Pramborg (2004). The sign of the coefficient for the dividend yield could be negative, as has been found in some studies (Fauver & Naranjo, 2010), or positive (Jin & Jorion, 2006). The dividend yield can serve as a proxy for a firm's ability to access financial markets. If a firm has little access to financial markets and consequently has fewer agency costs, it is more likely to invest in projects with positive NPVs, resulting in an inverse relationship between dividend yield and Tobin's

Q. However, dividend pay-outs could also be indicative of good management, which is in turn positively correlated with firm value. In the current study, the coefficient for dividend policy was negative in the first regression model, indicating firms that paid a dividend were valued lower, but this relationship was not statistically significant. However the coefficient for the dividend proxy variable was positive in the second regression model: dividend yield was positively associated with Tobin's Q, although this relationship was also not statistically significant. These findings support the claim that the payment of dividends is interpreted as good management by JSE-listed firms and hence is rewarded with a higher valuation. The difference in the signs of the coefficients for the two models supported the literature, which has not achieved consensus on the value effect of a firm's dividend policy. It seems that it is rather the interplay between the different proxy variables that affect the sign of the proxy for dividend policy, supporting the independence of Tobin's Q from dividend policy.

Interestingly, the coefficient for firm size was negative and statistically significant in the first regression model, indicating that larger firms are characterized by a lower Tobin's Q. This result is in line with earlier findings by Allayannis and Weston (2001) and Pramborg (2004). However, the sign of the coefficient was reversed in the second regression model and was not statistically significant. Smaller firms listed on the JSE seem to be valued higher by investors. It could be that smaller firms are perceived to have fewer investment opportunities, and therefore are more likely to pursue only the most profitable projects, a proposition which is supported by the statistically significant results and negative relationship between liquidity and firm value. The higher value placed on smaller, less liquid firms could be indicative of the fact that those companies are better able to mitigate underinvestment costs: companies with fewer investment opportunities only pursue the most profitable projects with the highest NPVs, which is reflected in their higher valuation in the market.

7.4 SUMMARY AND CONCLUSION

This chapter has investigated the value relevance of derivatives disclosure for JSE-listed firms for the sample period from 2005 to 2017, using derivatives disclosure as indicative of hedging. The results from the multiple linear regression models indicate that a company's decision to hedge was indeed value relevant. The chapter also considered whether the (ZAR) amount disclosed made a difference. It seemed that investors perceived the value of firms to be higher if they disclosed an amount for the derivatives used in their financial statements.

The regression results also show that including a dummy period had a significant effect on firm value, specifically the financial crisis of 2008/2009. The effect of these different periods on the value relevance of the disclosure of derivatives is explored in more detail in the next chapter.

CHAPTER 8:
RESULTS AND DISCUSSION:
VALUE RELEVANCE OF DERIVATIVES DISCLOSURE IN DIFFERENT ECONOMIC PERIODS AND OF DISCLOSURE QUALITY, AND ROBUSTNESS TEST RESULTS

8.1 INTRODUCTION

The previous chapter investigated the value relevance of derivatives disclosures. This chapter discusses how the statistical models adopted to assess the value relevance of derivatives disclosures for a sample of JSE-listed firms were adjusted to investigate in more detail the effects of the financial crisis of 2008/2009 on the value relevance of derivatives disclosures for a sample of JSE-listed firms. This relates to the third hypothesis: *The value relevance of derivatives disclosed in the financial statements of JSE-listed firms is statistically significantly different during specific economic periods*. The results relating to *H2* are presented in Section 8.2.

Section 8.3 is devoted to the effect of the quality of disclosure on the value relevance of derivatives disclosures, relating to the final hypothesis, *H4*, which states that *the value relevance of derivatives disclosures for JSE-listed firms is statistically significantly different for different levels of quality of disclosure of information in the financial statements of these entities.*

This chapter also discusses the findings of the robustness tests to assess the reliability of the results of the regression models.

8.2 VALUE RELEVANCE OF DERIVATIVES DISCLOSURE IN DIFFERENT ECONOMIC PERIODS

This section reports on the value relevance of corporate hedging practices under the effects of specific periods and shocks to the financial markets as reflected in derivatives disclosure in different economic periods. As already discussed in Chapters 3 and 4, companies' core rationale for using derivatives is to hedge themselves against the unexpected consequences of adverse economic conditions. The 2008/2009 financial crisis offers a unique opportunity to study whether the disclosure of derivatives was value relevant prior to the crisis (pre-crisis, 2005 to 2007), during it (during-the-crisis, 2008 and 2009) and after it (post-crisis, 2010 to 2017). A three-period model was used to study these effects.

The study also used a two-period model to compare the value relevance of derivatives disclosure in two periods: before the financial crisis and after the financial crisis. These periods are referred to as before-shock (2005 to 2010) and after-shock (2011 to 2017) to account for the sudden impact of the financial crisis, and also to differentiate the two-period model from the three-period model.

The multiple linear regression models already discussed in Chapter 7 were again used, creating dummy variables for two of the three separate periods, namely one dummy variable for the during-the-crisis period and another for the post-crisis period. Then, a third dummy variable was created for the after-shock period, using the before-shock period as a reference category. Moreover, the regression models again used two proxy derivatives variables: a binary and a continuous variable. The findings from these four models supported the results from Model 2 (*H2*), which indicated that the disclosure of derivatives was value relevant. These regression results and a discussion of the findings relating to the third hypothesis are presented below.

8.2.1 Results: Value relevance of derivatives disclosure in different economic periods

8.2.1.1 Value relevance of derivatives disclosure: three-period model

As indicated in Section 8.2, the three-period model was constructed by splitting the sample period for the sample firms into three separate economic periods: the pre-crisis period (2005 to 2007), the during-the-crisis period (2008 and 2009), and the post-crisis period (2010 to 2017). The purpose of this was to establish the effects of the financial crisis of 2008/2009 on investor behaviour in valuing firms.

The aim of value relevance research is to examine the ability of the information disclosed in the financial statements to capture and summarize firm value (how well disclosed accounting amounts in the financial statements reflect information that investors and analysts actually use in valuing a firm) (Barth *et al.*, 2001). Hence, the value relevance of disclosure relating to hedging by means of derivatives may vary between different economic periods – if it does, it would reflect investors' opinions about the successfulness of companies' risk management practices. If it is assumed that firms use derivatives mainly for hedging purposes, then the financial crisis of 2008/2009 offers an opportunity to investigate whether companies were indeed able to mitigate the adverse consequences of the financial crisis by this practice.

8.2.1.2 Value relevance of derivatives disclosure: three-period model with derivatives as a dichotomous variable

The multiple linear regression model was employed to test the value relevance of derivatives disclosure as a binary variable, including variables representing the different economic periods, namely a pre-crisis, during-the-crisis and post-crisis period. A dummy variable was created for each of these periods. The model includes the same proxies for the set of control variables that can have an effect on firm value as used in the models already used to test *H2*, cited again here for the reader's convenience:

$$Firm\ value = \alpha + \Sigma SECTOR + \beta_1 DERTOTAL\_BIN + \beta_2 LNTOTASS + \beta_3 CR + \beta_4 LEVDA + \beta_5 ROA + \beta_6 RD/SALES + \beta_7 FOR/SALES + \beta_8 DIVYIELD + \beta_9 DUMPERIOD + \varepsilon_i \quad (5.3)$$

where

Dependent value	=	Firm value proxied by Tobin's Q
α	=	intercept
ΣSECTOR	=	different sectors in which the firms in the sample operate
DEROTAL_BIN / DERTOTALWINSB	=	Hedging/derivatives. Dichotomous of 1/(0) if the company uses derivatives/(does not use derivatives) and/or logarithm of the total derivatives amount disclosed in the financial statements as a continuous variable
LNTOTASS	=	Firm size = logarithm of total assets
CR	=	Liquidity = current ratio
LEVDA	=	Leverage ratio of total debt divided by total assets

ROA	=	Profitability = ratio of EBIT divided by total assets (ROA)
RD/SALES	=	Growth prospects = ratio of R&D expenses divided by total sales
FOR/SALES	=	Geographic diversification =ratio of foreign sales divided by total sales
DIVYIELD	=	Dividends = dichotomous variable of 1/(0) if company paid/(did not pay) dividends during the year
DUMPERIOD	=	Time dummy = Specific periods were controlled for by using dummy variables
ε_i	=	residual term

The results are presented in Table 8.1, overleaf.

Table 8.1: Value relevance of disclosed derivatives (ZAR) amount (as a dichotomous variable in the three-period model)

Dependent Variable: *TOBINSQ*
Method: Least Squares
Date: 06/02/20 Time: 11:05
Sample (adjusted): 2 2535
Included observations: 2070 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.595600	0.231557	11.20932	0.0000
DERTOTAL_BIN	0.131351	0.035200	3.731581	0.0002
ROA	0.037392	0.002670	14.00491	0.0000
DIVYIELD	-0.057545	0.036433	-1.579471	0.1144
RD/SALES	-0.001808	0.037711	-0.047943	0.9618
FOR/SALES	0.300667	0.037405	8.038149	0.0000
CR	-0.110265	0.019953	-5.526347	0.0000
LEVDA	0.006810	0.075424	0.090285	0.9281
LNTOTASS	-0.070821	0.014523	-4.876427	0.0000
DUMPERIOD2	-0.430137	0.053394	-8.055856	0.0000
DUMPERIOD3	-0.218643	0.046627	-4.689151	0.0000
TELEDUM	-0.010126	0.096031	-0.105445	0.9160
TECHDUM	-0.039094	0.077800	-0.502498	0.6154
CONSGOODSDUM	-0.057330	0.060767	-0.943453	0.3456
CONSSERVDUM	0.457293	0.068052	6.719736	0.0000
INDUSTRIALSDUM	-0.264890	0.050538	-5.241378	0.0000
HEALTHCAREDUM	0.365915	0.090829	4.028633	0.0001

R-squared	0.350574	Mean dependent var	1.583004
Adjusted R-squared	0.345513	S.D. dependent var	0.827679
S.E. of regression	0.669595	Akaike info criterion	2.043892
Sum squared resid	920.4785	Schwarz criterion	2.090172
Log likelihood	-2098.428	Hannan-Quinn criterion	2.060856
F-statistic	69.26590	Durbin-Watson statistic	2.041051
Prob(F-statistic)	0.000000	Wald F-statistic	66.75963
Prob(Wald F-statistic)	0.000000		

Key to variables in Table 8.1:

DERTOTAL_BIN	Dummy variable of 1/(0) if derivatives amount is/(not) reported
TOBINSQ	Tobin's Q
LNTOTASS	Natural logarithm of total assets
DIVYIELD	Dividend yield
RD/SALES	Ratio of research and development costs divided by sales
FOR/SALESWINS	Ratio of foreign sales divided by sales
ROA	Return on assets
CR	Current ratio
LEV/DE	Leverage calculated as the ratio of debt to equity
DUMPERIOD2	Dummy variable for specific period

Source: Own compilation

Regarding the assumption and the fit of the model, the pooled OLS regression model is robust in meeting the assumptions necessary for the analysis of the data. Diagnostic tests for the presence of endogeneity, multi-collinearity, heteroskedasticity, autocorrelation and normality were conducted to ensure the robustness of the regression results. Outliers in the original data sample were excluded by winsorizing the data at the 5% and 95% percentiles. Since none of the tolerance values were below 0.1 and none of the VIF values were above 10, the assumption of no multicollinearity was met. The Durbin-Watson statistic of 2 fell within the expected range of 1.5 to 2.5, thus indicating that the assumption of no serious autocorrelation was also met. The absence of heteroskedasticity was confirmed by the Breusch-Pagan test. Normality of the residuals could be assumed, although the Jarque-Bera test indicated that the assumption was not met, because it is known that the test and the skewness and kurtosis values would be used only to provide a reasonable justification if the assumption was met/not met. The adjusted R-squared of 35% and the F-statistic of 69.27, $p<0.01$ indicated the goodness-of-fit of the model.

The results from the multiple linear regression model indicated that the disclosure of derivatives in the financial statements of the sample of JSE-listed firms had a very strong positive statistically significant impact on firm value (0.13, $p<0.01$) in both the during-the-crisis period and the post-crisis period, compared to the pre-crisis period. Furthermore, the dummy periods themselves had a strong negative and statistically significant relationship with firm value (*DUMPERIOD2*: -0.43, $p<0.01$, *DUMPERIOD3*: -0.22, $p<0.01$). The dummies for both the during-the-crisis period and the post-crisis period, compared to the pre-crisis period, had strong negative effects on firm value. The during-the-crisis period, *DUMPERIOD2*, had double the negative effect of the post-crisis period, *DUMPERIOD3*, if the coefficient results of -0.43 for *DUMPERIOD2* are compared to -0.22 for *DUMPERIOD3*. Furthermore, the results from this regression model supported the findings from the regression model presented in Section 7.2.3, in that the binary variable used to proxy for derivatives disclosure was value relevant (0.12, $p<0.01$). The coefficients results for the regression model in this section that represent three periods were slightly higher (0.13, $p<0.01$) than those for the model that represents individual year effects (0.12, $p<0.01$). This potentially indicates that the effects of the 2008/2009 financial crisis did have an impact on the value relevance of derivatives disclosure and that the timing of disclosure in value relevance research is important.

8.2.1.3 Value relevance of derivatives disclosure: three-period model with derivatives as the continuous variable

A second regression model was employed that uses a continuous variable to proxy for the total (ZAR) amount of derivatives disclosed in the financial statements of the sample of JSE-listed firms during three different economic periods that made up the full sample period. The continuous variable was the total (ZAR) amount for derivatives disclosed in the financial statements of the entities in the sample, and it was calculated as the total amount of derivatives disclosed as assets added to the total amount of derivatives disclosed as liabilities. This proxy variable represents companies' total exposure to financial derivatives instruments during the three periods. The results from this regression model are presented in Table 8.2, overleaf.

Table 8.2: Value relevance of disclosed derivatives (ZAR) amount (as continuous variable in the three-period model)

Dependent Variable: *TOBINSQ*
Method: Least Squares
Date: 06/02/20 Time: 10:41
Sample (adjusted): 17 2532
Included observations: 736 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.874099	0.316657	2.760399	0.0059
DERTOTALWINSB	1.12E-07	1.10E-07	1.020724	0.3077
ROA	0.058749	0.004820	12.18822	0.0000
DIVYIELD	0.067367	0.062953	1.070112	0.2849
RD/SALES	0.046327	0.056035	0.826739	0.4087
FOR/SALES	0.159588	0.047063	3.390961	0.0007
CR	-0.100977	0.037498	-2.692881	0.0072
LEVDA	0.051025	0.092853	0.549519	0.5828
LNTOTASS	0.021327	0.019518	1.092687	0.2749
DUMPERIOD2	-0.437425	0.092604	-4.723589	0.0000
DUMPERIOD3	-0.180203	0.085357	-2.111166	0.0351
HEALTHCAREDUM	0.396352	0.120550	3.287860	0.0011
INDUSTRIALSDUM	-0.135626	0.064983	-2.087089	0.0372
TELEDUM	-0.138613	0.129075	-1.073893	0.2832
TECHDUM	0.031142	0.132536	0.234968	0.8143
CONSGOODSDUM	0.001051	0.083180	0.012640	0.9899
CONSSERVDUM	0.577796	0.136610	4.229521	0.0000

R-squared	0.526103	Mean dependent var	1.630614
Adjusted R-squared	0.515558	S.D. dependent var	0.817717
S.E. of regression	0.569146	Akaike info criterion	1.733468
Sum squared resid	232.9038	Schwarz criterion	1.839747
Log likelihood	-620.9163	Hannan-Quinn criterion	1.774456
F-statistic	49.88802	Durbin-Watson statistic	2.000095
Prob(F-statistic)	0.000000	Wald F-statistic	34.90176
Prob(Wald F-statistic)	0.000000		

Key to variables in Table 8.2:

TOBINSQ	Tobin's Q
DERTOTALWINSB	The total amount of derivatives reported in the financial statements
LNTOTASS	Natural logarithm of total assets
DIVYIELD	Dividend yield
RD/SALES	Ratio of research and development costs divided by sales
FOR/SALES	Ratio of foreign sales divided by sales
ROA	Return on assets
CR	Current ratio
LEVDA	Leverage calculated as the ratio of debt to assets
DUMPERIOD2	Year dummy variable
HEALTHCAREDUM	Sector dummy variable

Source: Own compilation

The adjusted R-squared of 52% and F-statistic of 49.89, p<0.01 showed the fit of the model. The adjusted R-squared was in line with results from similar studies, and showed that the model had good predictive capabilities. The pooled OLS regression model was robust in meeting the assumptions necessary for the data analysis. Diagnostic tests for the presence of endogeneity, multi-collinearity, heteroskedasticity, autocorrelation and normality were also conducted to ensure the robustness of the regression results. Outliers in the original data sample were excluded by winsorizing the data at the 5% and 95% percentiles. Since none of the tolerance values were below 0.1 and none of the VIF values were above 10, the assumption of no multicollinearity was met. The Durbin-Watson statistic of 2 fell within the expected range of 1.5 to 2.5, indicating that the assumption of no serious autocorrelation was met. The absence of heteroskedasticity was confirmed by applying the Breusch-Pagan test. Normality of the residuals could be assumed, as discussed in Section 8.2.1.2.

Similar to results from the regression model presented in Section 7.2, which also used a continuous variable for derivatives (ZAR) amount, the result for this proxy variable was not statistically significant (1.12, p=0.3). This indicates again that investors and analysts deemed the decision to hedge more important in determining firm value than the extent to which companies hedge. Disclosure in the dummy periods were again statistically significant indicators of firm value (*DUMPERIOD2*: -0.44, p<0.01, *DUMPERIOD3*: -0.18, p=0.04). Disclosure during the dummy period *DUMPERIOD2* (the during-the-crisis period), compared to the pre-crisis period, had a fairly high impact on firm value. Disclosure in the post-crisis period, compared to the pre-crisis period, was also a statistically significant indicator, but with a negative beta coefficient, which implies that the (ZAR) amounts disclosed became more value relevant after the financial crisis.

The value relevance models presented in Section 7.2 for *H2* showed that the disclosure of derivatives was value relevant if a binary proxy variable was used in the regression models, indicating that firms' decision to hedge was value relevant, whereas the same regression models using a continuous variable for the extent to which companies used derivatives was not statistically significant. The results from the additional regression models that split the year dummy variables into three groups, namely the pre-crisis, during-the-crisis and post-crisis periods, supported the results for *H2*, because the disclosure of derivatives remained value relevant when including the effects of the financial crisis and the effects of investors' perceptions of the importance of corporate hedging (proxied by the (ZAR) amount of derivatives used by companies). It can thus be inferred that corporate hedging became more important and statistically significant when exogenous shocks to the financial markets were experienced or anticipated.

Inspection of the coefficient results for the control variables included in the three-period regression models confirmed, for the most part, both the expected results and the results of the regression models for *H2*. The control variables in the multiple linear regression models presented in Tables 8.1 and 8.2 also offered some pertinent results. The signs of the coefficients of the control variables in the model were in line with what was predicted. Profitability, measured by *ROA*, was a statistically strong predictor of firm value in both models (0.04, $p<0.01$; 0.06, $p<0.01$), as more profitable firms were valued higher.

The current ratio as a proxy for firm liquidity was negative, as expected, and it was statistically significant (-0.11, $p<0.01$;-0.1, $p<0.01$). Investors valued firms with less excess cash or free cash flow higher, arguably because firms with lower cash reserves are expected to invest in the most profitable projects (those with a positive NPV) (Jensen, 1986).

The coefficients for foreign sales and dividends (0.3, $p<0.01$; 0.16, $p<0.01$) were positive and statistically significant. This indicates that the sample of JSE-listed firms that paid out a dividend and were geographically diversified, in other words, had more foreign operations were valued higher.

The remaining control variables, namely leverage (0.01, $p=0.93$; 0.05, $p=0.58$), dividend yield (-0.06, $p=0.11$; 0.07, $p=0.28$) and growth opportunities (0.002, $p= 0.96$; 0.05, $p=0.41$), were not statistically significant. There were again some industry effects, where some industries were statistically significant, such as consumer services (0.46, $p<0.01$; 0.58, $p<0.01$), industrials (0.26,$p<0.01$; -0.14, $p<0.05$) and the health sector (0.4, $p<0.01$; 0.4, $p<0.01$). The coefficient for firm size, namely the natural logarithm of total assets, was negative (-0.07, p<0.01) indicating that smaller firms were rewarded with a higher firm value, but this result was not statistically significant (0.02, p=0.27) for the continuous variable model. For a more detailed discussion of the effects of the control variables on firm value, please refer back to Section 7.3.3.

A detailed comparison between the results for the three-period model and the two-period model (which is discussed in the next three subsections, Sections 8.2.1.4 to 8.2.1.6) is given in Section 8.2.3.

8.2.1.4 The value relevance of derivatives disclosures: Two-period model before-shock and after-shock

This section discusses the results of the statistical analyses of the specific effects of the 2008/2009 financial crisis using the two-period model, which split the sample years into two periods, a before-shock period (2005 to 2010) and the after-shock period (2011 to 2017). The financial crisis of 2008/2009 was a sharp and sudden shock to international financial markets. Given the role that derivatives played in the financial crisis, it was deemed useful to analyse the effects of such a shock to the financial markets by comparing the value relevance of derivatives disclosure in these two periods.

The before-shock and after-shock period allowed a comparison of the value relevance of derivatives disclosure on financial and derivatives markets in different financial climates, and scrutiny of the effect that the crisis had on companies' use of derivatives, given the role derivatives played in exacerbating the effects of the financial crisis. The results from these multiple linear regression models are presented below in Tables 8.3 and 8.4. The regression again used two proxies for derivatives: a binary (see Section 8.2.1.5) and a continuous variable (see Section 8.2.1.6).

The time dummy variable split the data period almost into half into a before-shock from 2005 to 2010 and a after-shock period from 2011 to 2017. The year 2010 was included as part of the before-shock period in this model to allow for firms' adjusting to the effects of the financial crisis.

8.2.1.5 The value relevance of derivatives disclosures: Two-period model using disclosed derivatives (ZAR) amount as a dichotomous variable

The results for the multiple linear regression model for the two-period models are presented in Table 8.3. The first regression model used a binary derivatives value, a value of 1 was assigned if a company disclosed a derivatives amount, and 0 if not.

Table 8.3: The value relevance of disclosed derivatives (as the dichotomous variable) in the two-period model

Dependent Variable: *TOBINSQ*
Method: Least Squares
Date: 06/02/20 Time: 11:14
Sample (adjusted): 2 2535
Included observations: 2070 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.444132	0.234493	10.42306	0.0000
DERTOTAL_BIN	0.082187	0.034876	2.356550	0.0185
ROA	0.038433	0.002693	14.27143	0.0000
DIVYIELD	-0.050009	0.037304	-1.340584	0.1802
RD/SALES	0.018172	0.038449	0.472626	0.6365
FOR/SALES	0.318820	0.038314	8.321210	0.0000
CR	-0.120297	0.020239	-5.943770	0.0000
LEVDA	0.004381	0.078355	0.055911	0.9554
LNTOTASS	-0.075050	0.014976	-5.011311	0.0000
DUMPEIODB	0.036497	0.033219	1.098673	0.2720
TELEDUM	-0.037578	0.097309	-0.386171	0.6994
TECHDUM	-0.043266	0.079517	-0.544113	0.5864
CONSGOODSDUM	-0.063763	0.061483	-1.037084	0.2998
CONSSERVDUM	0.459520	0.069034	6.656415	0.0000
INDUSTRIALSDUM	-0.276393	0.051566	-5.359955	0.0000
HEALTHCAREDUM	0.350807	0.093665	3.745348	0.0002

R-squared	0.329268	Mean dependent var	1.583004
Adjusted R-squared	0.324370	S.D. dependent var	0.827679
S.E. of regression	0.680325	Akaike info criterion	2.075207
Sum squared resid	950.6775	Schwarz criterion	2.118765
Log likelihood	-2131.839	Hannan-Quinn criterion	2.091173
F-statistic	67.22170	Durbin-Watson statistic	1.987360
Prob(F-statistic)	0.000000	Wald F-statistic	62.28597
Prob(Wald F-statistic)	0.000000		

Key to variables in Table 8.3:

TOBINSQ	Tobin's Q
DERTOTAL_BIN	Dummy variable of 1/(0) if derivatives amount is/(not) reported
LNTOTASS	Natural logarithm of total assets
DIVYIELD	Dividend yield
RD/SALES	Ratio of research and development costs divided by sales
FOR/SALES	Ratio of foreign sales divided by sales
ROA	Return on assets
CR	Current ratio
LEVDA	Leverage calculated as the ratio of debt to assets
DUMPEIODB	Year dummy variable
HEALTHCAREDUM	Sector dummy variable

Source: Own compilation

Regarding the assumptions and fit of the model, the adjusted R-squared of 32% and F-statistic of 67.22 (p<0.01) show the goodness-of-fit of the model. The pooled OLS regression model was robust in meeting the assumptions necessary for the analysis of the data. Diagnostic tests for the presence of endogeneity, multi-collinearity, heteroskedasticity, autocorrelation and normality were also conducted to ensure the robustness of the regression results. Since none of the tolerance values were below 0.1 and none of the VIF values were above 10, the assumption of no multicollinearity was met. The Durbin-Watson statistic of 1.99 fell within the expected range of 1.5 to 2.5, indicating that the assumption of no serious autocorrelation was met. The absence of heteroskedasticity was confirmed by conducting the Breusch-Pagan test. Normality of the residuals could be assumed, as discussed in Section 8.2.1.2.

The binary derivatives variable that proxied for whether or not firms disclosed a derivatives amount was positive and statistically significant (0.08, p=0.02). This result confirmed the findings of the previous regression models, which all found that if an amount of derivatives was disclosed in the financial statement of a JSE-listed entity in the sample, it had a statistically significant impact on firm value as measured by Tobin’s Q. Furthermore, this regression model showed that the disclosure of derivatives remained value relevant despite the shock of the financial crisis on financial and derivatives markets. Disclosure in the after-shock period, compared to disclosure in the before-shock period, was not statistically significant (0.04, p=0.27). This is at odds with expectations. It is possible that other factors that contributed to firm value outweighed the effects of the period in this model. A detailed explanation of the results follows in the discussion of the findings of both the three-period and two-period model in Section 8.2.3

8.2.1.6 Value relevance according to the two-period model using (ZAR) amount disclosed derivatives as a continuous variable

The results from the regression model that employed a continuous derivatives variable are presented in Table 8.4, overleaf. These results again confirm the results from previous models, which found statistical significance for the binary derivatives variable, but not for the continuous variable.

Table 8.4: Value relevance of disclosed derivatives (ZAR) amount (as the continuous variable in the two-period model)

Dependent Variable: *TOBINSQ*
Method: Least Squares
Date: 06/02/20 Time: 11:17
Sample (adjusted): 17 2532
Included observations: 736 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.607299	0.315876	1.922588	0.0549
DERTOTALWINSB	1.08E-07	1.10E-07	0.983456	0.3257
ROA	0.059685	0.004832	12.35318	0.0000
DIVYIELD	0.062376	0.064374	0.968968	0.3329
RD/SALES	0.053461	0.056961	0.938559	0.3483
FOR/SALES	0.158260	0.048446	3.266725	0.0011
CR	-0.108284	0.038357	-2.823056	0.0049
LEVDA	0.036682	0.097279	0.377084	0.7062
LNTOTASS	0.021639	0.019695	1.098720	0.2723
DUMPEIODB	0.108159	0.047091	2.296813	0.0219
TELEDUM	-0.147131	0.132636	-1.109286	0.2677
TECHDUM	0.046188	0.135346	0.341262	0.7330
CONSGOODSDUM	-0.004198	0.084543	-0.049649	0.9604
CONSSERVDUM	0.544693	0.137973	3.947831	0.0001
INDUSTRIALSDUM	-0.141185	0.068572	-2.058927	0.0399
HEALTHCAREDUM	0.391012	0.121434	3.219950	0.0013

R-squared	0.510172	Mean dependent var	1.630614
Adjusted R-squared	0.499967	S.D. dependent var	0.817717
S.E. of regression	0.578232	Akaike info criterion	1.763816
Sum squared resid	240.7336	Schwarz criterion	1.863843
Log likelihood	-633.0844	Hannan-Quinn criterion	1.802393
F-statistic	49.99354	Durbin-Watson statistic	1.936044
Prob(F-statistic)	0.000000	Wald F-statistic	33.24906
Prob(Wald F-statistic)	0.000000		

Key to variables in Table 8.4:

TOBINSQ	Tobin's Q
DERTOTALWINSB	Total amount of derivatives reported in the financial statements
LNTOTASS	Natural logarithm of total assets
DIVYIELD	Dividend yield
RD/SALES	Ratio of research and development costs divided by sales
FOR/SALES	Ratio of foreign sales divided by sales
ROA	Return on assets
CR	Current ratio
LEVDA	Leverage calculated as the ratio of debt to assets
DUMPEIODB	Year dummy variable
HEALTHCAREDUM	Sector dummy variable

Source: Own compilation

Regarding the assumptions and fit of the model, the adjusted R-squared of 50% and F-statistic of 49.99 (p<0.01) showed the goodness-of-fit of the model. The pooled OLS regression model was robust in meeting the assumptions necessary for the analysis of the data. Diagnostic tests for the presence of endogeneity, multi-collinearity, heteroskedasticity, autocorrelation and normality were also conducted to ensure the robustness of the regression results. Since none of the tolerance values were below 0.1 and none of the VIF values were above 10, the assumption of no multicollinearity was met. The Durbin-Watson statistic of 1.94 fell within the expected range of 1.5 to 2.5, indicating that the assumption of no serious autocorrelation was met. The absence of heteroskedasticity was confirmed by the Breusch-Pagan test. Normality of the residuals could be assumed, as discussed in Section 8.2.1.2.

The results for the multiple linear regression model showed that the disclosure of derivatives was positively related to firm value, but not at a statistically significant level (1.1, p=0.33), whereas the regression coefficients for the year periods of the after-shock period, compared to the before-shock period, was positive at a statistically significant level (0.11, p=0.02).

Based on the two-period model for which the results are presented in Table 8.4, the evidence suggests that corporate hedging (binary variable) was rewarded by investors with a higher firm value. The coefficient for the hedging proxy, the (ZAR) amount of total derivatives disclosure, was extremely small – it was positive, but not at a statistically significant level (p=0.33). This finding suggests that derivatives use was valued higher by investors depending on the period in which the firms used them. Clearly, derivatives use was valued higher by investors in the after-shock period. A detailed discussion of the results follows in Section 8.2.3 where the findings of the three-period models and two-period models are compared and discussed.

The results from Equation 5.3 of the time hypothesis presented in Tables 8.3 and 8.4, and the results for the control variables, are similar to those of Equation 5.3 presented in Tables 8.1 and 8.2, which was reassuring. The coefficients for the proxy variables for profitability (0.04, p<0.01; 0.06, p<0.01), geographic diversification (0.32, p<0.01; 0.16, p<0.01), were positive and statistically significant, whereas firm liquidity (-0.12, p<0.01; -0.12, p<0.01) were negative and statistically significant. The other control variables, including firm size (0.02, p=0.27; -0.08, p<0.01), leverage (0.05; p=0.58; 0.004, p=0.96) and growth prospects (0.05, p=0.41; 0.02, p=0.64) were not statistically significant.

8.2.2 Results: Partial correlation analysis

A partial correlation analysis was conducted to provide insight into the effect that specific periods had on the value relevance of derivatives disclosure. Partial correlation is the correlation between an independent variable and a dependent variable after controlling for the influence of other variables on both the independent and the dependent variable. For partial correlation, only the influence of the control variables on the independent variable is taken into account. The results from the partial correlations for the three-period model are presented in Table 8.5, and those for the two-period model are presented in Table 8.6.

Table 8.5: Partial correlations: Three-period model (binary derivatives variable)

Model		Sig.	Correlations		
			Zero-order	Partial	Part
	DERTOTAL_BIN	0.000	0.042	0.080	0.065
	DUMPERIOD2	0.000	-0.077	-0.180	-0.147
	DUMPERIOD3	0.000	-0.111	-0.117	-0.095

Key to variables in Table 8.5:
DERTOTAL_BIN Dummy variable of 1 or 0 if derivatives amount is or is not reported
DERTOTALWINSB Total amount of derivatives reported in the financial statements
DUMPERIOD2 Year dummy variable
Source: Own compilation

Table 8.6: Partial correlations: Three-period model (continuous derivatives variable)

Model		Sig.	Correlations		
			Zero-order	Partial	Part
	DUMPERIOD2	0.000	-0.075	-0.179	-0.125
	DUMPERIOD3	0.025	-0.024	-0.083	-0.058
	DERTOTALWINSB	0.196	0.042	0.048	0.033

Key to variables in Table 8.6:
DERTOTAL_BIN Dummy variable of 1 or 0 if derivatives amount is or is not reported
DERTOTALWINSB Total amount of derivatives reported in the financial statements
DUMPERIOD2 Year dummy variable
Source: Own compilation

The partial and part correlation for *DUMPERIOD3* was almost double that of the derivatives value variable (continuous), providing further evidence regarding the statistical significance of the period dummy versus the derivatives variable, and highlighting the role played by the specific periods in respect of Tobin's Q. In addition to the partial correlation analysis and the descriptive statistics of the sample presented in Section 6.2, additional descriptive statistics for firm value and the derivatives disclosed in the financial statements during the periods used were calculated. These results are presented in Table 8.7.

Table 8.7: Descriptive statistics for the three-period model for Tobin's Q and derivatives

		Tobin's Q	Derivatives Total (R)
2005 to 2007	Mean	1.95	160 591
	N	389	74
	Std. Deviation	0.83	314 631
2008 to 2009	Mean	1.4	181 306
	N	320	133
	Std. Deviation	0.7	330 330
2010 to 2017	Mean	1.5	147 681
	N	1 402	573
	Std. Deviation	0.83	290 268

Source: Own compilation

The descriptive statistics show a sharp increase in the (ZAR) amount of derivatives disclosed in the during-the-crisis period (with a mean of R181 306) in comparison to the pre-crisis period (with a mean of R160 591) and the post-crisis period (with a mean of R147 681). There was also a marked decrease in the mean values of derivatives disclosed between the pre-crisis and post-crisis periods. The sharp increase in the during-the-crisis period can possibly be ascribed to a large increase in the (ZAR) amount of derivatives disclosed when the sudden market shock of the financial crisis resulted in a sharp increase in derivatives exposure. In other words, the financial crisis may have caused the (ZAR) amount of derivatives contracts to increase when the underlying values of the contracts moved suddenly. Derivatives contracts are valued as the difference between the spot and exercise price, so when the spot and exercise date move further away from each other, the value of the contract increases. The descriptive statistics also showed a decrease in firm value in the during-the-crisis period, indicative of the economic downturn in this period.

Table 8.8: Partial correlations: Two-period model (dichotomous derivatives variable)

Model	Correlations		
	Zero-order	Partial	Part
DERTOTALWINSB	0.042	0.046	0.032
DUMPEIODB	-0.009	0.085	0.059

Key to variables in Table 8.8::
DERTOTAL_BIN Dummy variable of 1 or 0 if derivatives amount is, or is not reported
DERTOTALWINSB Total amount of derivatives reported in the financial statements
DUMPEIODB Year dummy variable
Source: Own compilation

Table 8.9: Partial correlations: Two-period model (continuous derivatives variable)

Model	Correlations		
	Zero-order	Partial	Part
DUMPEIODB	-0.076	0.025	0.021
DERTOTAL_BIN	0.042	0.050	0.041

Key to variables in Table 8.9:
DERTOTAL_BIN Dummy variable of 1 or 0 if derivatives amount is, or is not reported
DERTOTALWINSB Total amount of derivatives reported in the financial statements
DUMPEIODB Year dummy variable
Source: Own compilation

The partial and part correlation for the period dummy was almost double that of the derivatives value variable (continuous), providing further evidence regarding the statistical significance of the period dummy versus the derivatives variable. These results also highlight the role that the specific periods played because of how they affected Tobin's Q.

Table 8.10: Descriptive statistics for the two-period model for Tobin's Q and derivatives

		Tobin's Q	Derivatives Total (R)
2005 to 2010	Mean	1.67	172 069
	N	875	273
	Std. Deviation	0.81	320 931
2011 to 2017	Mean	1.53	145 253
	N	1 236	507
	Std. Deviation	0.84	287 439

Source: Own compilation

The mean value for Tobin's Q showed a small decline in the after-shock period. This reflects the decrease in the firm value of JSE-listed firms in the period after the financial crisis. South Africa was characterized by low economic growth throughout the after-shock period, as reflected in the lower Tobin's Q for the firms in the sample.

The partial correlation analyses for both the three-period models and the two-period models indicated that different economic periods have a statistically significant influence on firm value, even if one assumes that the other control variables are constant. The descriptive values further confirmed that there was a trend in both the derivatives and the firm value variables in the specific periods studied. These findings confirmed the usefulness of the three-period model, separating the sample years into the pre-crisis (2005 to 2007), during-the-crisis (2008 to 2009) and post-crisis (2010 to 2017) periods to test the value relevance of derivatives disclosure. The data sample years were also separated into two-period models where the sample years were separated into two periods: a before-shock period (2005 to 2010) and an after-shock period (2011 to 2017).

The purpose of employing the three-period and two-period models was to better ascertain the effect that an exogenous market shock such as the financial crisis of 2008/2009 may have on the ability of companies' hedging policy to protect firm value during adverse economic periods. If the disclosure of derivatives was value relevant, it meant that derivatives use by companies was valued positively by investors and it can then be said that hedging adds value. If firm value is positively related to derivatives disclosure during times of economic crisis, then it can be inferred that companies' hedging policies are effective in protecting firm value. The results from the pooled OLS regression analyses for the value relevance of derivatives disclosure in the different economic periods have been set out in Sections 8.2.1.1 to 8.2.1.3 (the three-period models) and Sections 8.2.1.4 to 8.2.1.6 (the two-period models). A detailed discussion comparing the results from both the three-period and two-period models follows in Section 8.2.3.

8.2.3 Discussion: Value relevance of derivatives disclosure in different economic periods

The literature contains conflicting results on the question of whether or not corporate hedging is more important during periods of economic crisis. Bartram *et al.* (2011) claim that hedging definitely increases during crisis periods, using the 2001 economic decline as their point of reference. More recent research by Ahmed *et al.* (2014) found no evidence that companies significantly changed corporate hedging behaviour due to the 2008-2009 financial crisis. Nova (2015) found major variations in derivatives use during the period 2008 to 2009 for the largest 350 non-financial FTSE-350 Index listed firms, from a sample period of 2005 to 2013. The current study supports the findings of Ahmed *et al.* (2014) and Nova (2015), in that the specific time span of the sample period chosen influences whether or not the results show that derivatives use by companies is value relevant.

The regression models in the current study controlling for derivatives use during different economic periods, specifically the pre-crisis, during-the-crisis and post-crisis periods, indicated that the value relevance of derivatives was statistically different during the different economic periods. This finding has several implications for value relevance research, which looks at whether information contained in the financial statements causes companies to be valued differently. This study focuses on whether the disclosure of derivatives in the financial statements has a material effect on a company's valuation, measured by Tobin's Q, using a sample period when a single accounting standard prescribing the disclosure of derivatives use was in force. The findings from the current study suggest that it is not just a question of whether information in the financial statements has an effect on the valuation of a company – the timing of such disclosure also matters.

Another implication of the finding is that, when one looks at the value relevance of particular accounting items, one also has to take into account the broader economic environment in which such valuations take place. Derivatives are used for corporate hedging: firms try to mitigate the effects of adverse economic conditions by using derivatives. The results from the regression analyses that test *H2* suggest that investors do *not* take into account whether companies use derivatives when they value a firm. However, this changes once the time dummy variable is introduced. The evidence suggests that investors do value companies differently when they take into account whether or not the firms hedge, and they take it into account more in a post-crisis period. Assuming that companies use derivatives only for hedging purposes and not to speculate for profit-seeking, derivatives use is a proxy for the hedging practices – the risk management practices. Derivatives use by companies and its disclosure is then more value relevant in a post-crisis period. The results of the current study do indeed show that derivatives disclosure had a statistically significantly stronger impact on firm value, measured by Tobin's Q. The implication of this is that investors and analysts valued companies higher if they disclosed a derivatives amount and in the post-crisis world. Hence it can be inferred that since 2010, investors and analysts have valued companies' corporate hedging (reflected in their derivatives use) to a greater extent, rewarding companies that pursue active hedging practices with a higher firm value.

A further implication of the results in this study is that the value relevance of particular accounting items should be read in context, not just in the context of the different accounting standards that prescribe the disclosure of those accounting items, but also in the context of the timing when such accounting standards were in effect. The contribution of this study lies in the insight it provides into value relevance of derivatives disclosure under a particular accounting standard (*IAS 39*), which was in effect for the sample period (2005-2017), offering a unique opportunity to study the value relevance of the particular standard during significantly different economic periods.

A new accounting standard to disclose derivatives instruments was introduced in 2018, amongst other things, to simplify the requirements relating to the disclosure of derivatives and to make it easier for stakeholders to understand a company's derivatives disclosures. If future researchers want to compare the value relevance of derivatives disclosure that falls across these different accounting standards, they will have to take into account which accounting standards were in effect in which different economic periods. The amount of value relevance attached to these accounting items may well also fluctuate because of fluctuations in the economic cycle. Here again the disclosure of derivatives can add valuable insight into how corporate hedging by companies is perceived and valued.

The change in accounting standards in 2018 preceded the 2020 market crash related to the COVID-19 pandemic. Comparing the value relevance of derivatives disclosure under two different accounting standards that are both in effect in excessively volatile economic periods can in future provide answers regarding whether corporate hedging is valued differently because of differences between disclosure requirements, but also regarding whether corporate hedging matters in the real sense in protecting firm (and shareholder) value during times of economic uncertainty.

The next section investigates in more detail the effect that the *quality* of disclosure had on the value relevance of derivatives disclosure for JSE-listed firms.

8.3 VALUE RELEVANCE OF THE QUALITY OF DERIVATIVES DISCLOSURE

The final hypothesis of the current study, *H4*, posits that *the value relevance of derivatives disclosures for JSE-listed firms is statistically significantly different for different levels of quality of disclosure of information in the financial statements of these entities.* The study therefore investigates in detail the effect of the quality of disclosure on the value relevance of derivatives disclosure. Since value relevance research is concerned with whether or not companies are valued differently depending on particular information contained in the financial statements, the *manner* in which the information is presented could have a material effect on the value relevance of such information. Hence, the current study used a quality of disclosure index (QDI) to assess whether or not the quality of disclosure had a statistically significant impact on the value relevance of derivatives disclosure.

H4 is an extension of *H2* and *H3,* for which the results have already been presented. *H2* relates to the value relevance of derivatives disclosures by JSE-listed firms. The testing of *H3* relied on the same statistical models, but investigated in more detail the value relevance effects of derivatives disclosure during different, specific economic periods. The model used to test *H4* is another extension of the basic value relevance model presented for the testing of *H2*, except that an additional independent variable was introduced to represent the quality of disclosure, proxied by a QDI. The QDI is similar to those used in studies by Hassan *et al*. (2006), Hassan and Mohd-Saleh (2010) and Jankensgård *et al*. (2014). The QDI was created by means of a content analysis of the financial statements and notes to the financial statements of the sample of JSE-listed entities that specifically pertained to derivatives disclosures, and scoring the quality and completeness of the disclosures according to the QDI (see Section 5.5.4).

8.3.1 Results: Value relevance of derivatives disclosure quality

The results of the regression analyses to test *H4* are presented in Tables 8.11 and 8.12. The regression model used the same value relevance models as those used to test for *H2* and *H3*. Derivatives were again classified as a continuous variable representing the total (ZAR) amount of derivatives disclosed in the financial statements, or as a binary variable representing the decision to hedge. The same control variables from the models used to test *H2* that can influence firm value were included, as well as variables to control for sector and year effects. The models to test *H4* thus differ from those used to explore *H2* in the inclusion of an additional variable, the QDI that measured the quality of disclosure information in the financial statements. QDI_1 represented fair disclosure, QDI_2 represented good disclosure (compared to fair disclosure) and QDI_3 represented excellent disclosure (compared to fair disclosure). Depending on their QDI scores, firms were categorized into three categories; QDI1, QDI2 and QDI3 allocated in terms of whether quality of disclosure represented fair disclosure, good disclosure or excellent disclosure. The regression model used is the following, repeated here for the convenience of the reader:

$$Firm\ value = \alpha + \Sigma SECTOR + \beta_1 DERTOTAL\_BIN + \beta_2 LNTOTASS + \beta_3 CR + \beta_4 LEVDA + \beta_5 ROA + \beta_6 RD/SALES + \beta_7 FOR/SALES + \beta_8 DIVYIELD + \beta_9 QDI + \varepsilon_i \quad (5.4)$$

where

Dependent value	=	Firm value proxied by Tobin's Q
α	=	intercept
ΣSECTOR	=	different sectors in which the firms in the sample operate
DEROTAL_BIN / DERTOTALWINSB	=	Hedging/derivatives. Dichotomous of 1/(0) if the company uses derivatives/(does not use derivatives) and/or

		logarithm of the total derivatives amount disclosed in the financial statements as a continuous variable
LNTOTASS	=	Firm size = logarithm of total assets
CR	=	Liquidity = current ratio
LEVDA	=	Leverage ratio of total debt divided by total assets
ROA	=	Profitability = ratio of EBIT divided by total assets (ROA)
RD/SALES	=	Growth prospects = ratio of R&D expenses divided by total sales
FOR/SALES	=	Geographic diversification =ratio of foreign sales divided by total sales
DIVYIELD	=	Dividends = dichotomous variable of 1/(0) if company paid/(did not pay) dividends during the year
QDI	=	proxy variable to control for the quality of derivatives disclosure
ε	=	residual term

The results from this regression are presented in Tables 8.11 and 8.12.

Table 8.11: Value relevance of derivatives disclosure depending on quality of disclosure

Dependent Variable: *TOBINSQ*
Method: Least Squares
Date: 06/04/20 Time: 00:00
Sample (adjusted): 17 2532
Included observations: 736 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.520526	0.321008	1.621536	0.1053
DERTOTALWINSB	1.69E-07	1.07E-07	1.580171	0.1145
LNTOTASS	0.036410	0.020618	1.765934	0.0778
DIVYIELD	0.064733	0.062366	1.037939	0.2997
RD/SALES	0.035954	0.056361	0.637927	0.5237
FOR/SALES	0.161747	0.047978	3.371292	0.0008
ROA	0.060152	0.004887	12.30792	0.0000
LEVDA	0.089834	0.094125	0.954410	0.3402
CR	-0.091519	0.038018	-2.407256	0.0163
DUM2006	0.121587	0.141574	0.858821	0.3907
DUM2007	0.168581	0.115427	1.460507	0.1446
DUM2008	-0.374618	0.096471	-3.883224	0.0001
DUM2009	-0.233012	0.093366	-2.495674	0.0128
DUM2010	-0.065137	0.093986	-0.693047	0.4885
DUM2011	-0.112632	0.087180	-1.291950	0.1968
DUM2013	0.115729	0.089949	1.286610	0.1987
DUM2014	0.103120	0.104338	0.988326	0.3233

DUM2015	-0.055497	0.094203	-0.589121	0.5560
DUM2016	-0.155486	0.088078	-1.765326	0.0779
DUM2017	-0.040908	0.093492	-0.437557	0.6618
DUMQD2	-0.131746	0.050027	-2.633513	0.0086
DUMQD3	-0.147922	0.064023	-2.310456	0.0211
TECHDUM	0.018671	0.129865	0.143770	0.8857
TELEDUM	-0.151086	0.129186	-1.169528	0.2426
CONSSERVDUM	0.585337	0.133403	4.387745	0.0000
CONSGOODSDUM	0.025775	0.081896	0.314729	0.7531
INDUSTRIALSDUM	-0.141409	0.064577	-2.189769	0.0289
HEALTHCAREDUM	0.339154	0.124721	2.719314	0.0067

R-squared	0.540627	Mean dependent var	1.630614
Adjusted R-squared	0.523108	S.D. dependent var	0.817717
S.E. of regression	0.564693	Akaike info criterion	1.732233
Sum squared resid	225.7660	Schwarz criterion	1.907280
Log likelihood	-609.4618	Hannan-Quinn criterion	1.799742
F-statistic	30.86039	Durbin-Watson statistic	2.064515
Prob(F-statistic)	0.000000	Wald F-statistic	25.26485
Prob(Wald F-statistic)	0.000000		

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	2.821442	Prob. F(27,708)	0.0000
Obs*R-squared	71.49859	Prob. Chi-Square(27)	0.0000
Scaled explained SS	157.7164	Prob. Chi-Square(27)	0.0000

Key to variables in Table 8.11:

TOBINSQ	Tobin's Q
DERTOTALWINSB	Total amount of derivatives reported in the financial statements
LNTOTASS	Natural logarithm of total assets
DIVYIELD	Dividend yield
RD/SALES	Ratio of research and development costs divided by sales
FOR/SALES	Ratio of foreign sales divided by sales
ROA	Return on assets
CR	Current ratio
LEVDA	Leverage calculated as the ratio of debt to assets
DUM2006	Year dummy variable
HEALTHCAREDUM	Sector dummy variable
DUMQD2	Dummy variable to measure quality of disclosure

Source: Own compilation

The pooled OLS regression model was robust in meeting the assumptions necessary for the analysis of the data. Diagnostic tests for the presence of endogeneity, multi-collinearity, heteroskedasticity, autocorrelation and normality were also conducted to ensure the robustness of the regression results. Outliers in the original data sample were excluded by winsorizing the data at the 5% and 95% percentiles. Since none of the tolerance values were below 0.1 and none of the VIF values were above 10, the assumption of no multicollinearity was met. The Durbin-Watson statistic of 2 fell within the expected range of 1.5 to 2.5, thus indicating that the assumption of no serious autocorrelation was met. The absence of heteroskedasticity was confirmed by the

Breusch-Pagan test. Normality of the residuals was assumed. The adjusted R-squared 52% and the F-statistic of 30.86 (p<0.01) showed the fit of the model.

The results from the multiple linear regression analysis using derivatives as a continuous variable indicated the total (ZAR) amount of derivatives disclosed was not value relevant (1.7, p=0.11), but that the *quality* of disclosure did have a statistically significant negative effect on firm value (*DUMQD2*: -0.13, p<0.01; *DUMQD3*: -0.15, p=0.02). The results from the regression model indicated that companies that had good and excellent quality of disclosure compared to companies with only fair quality of disclosure tended to have a lower firm value. Thus, the higher the completeness and adherence to the accounting standard requirements (in other words, the higher the quality of disclosure), the lower the firm value, measured by Tobin's Q. These findings are set out in Table 8.12.

In the same analyses, of the control variables, firm profitability, liquidity, size, and foreign operations seemed to be the best indicators of firm value, confirming the findings from the regression model used to test *H2* (see Section 7.2).

Table 8.12: Value relevance of different levels of quality of disclosure (dichotomous model)

Dependent Variable: *TOBINSQ*
Method: Least Squares
Date: 06/04/20 Time: 00:03
Sample (adjusted): 2 2535
Included observations: 2070 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.431435	0.235535	10.32301	0.0000
DERTOTAL_BIN	0.098248	0.041466	2.369350	0.0179
LNTOTASS	-0.074298	0.014973	-4.962151	0.0000
DIVYIELD	-0.045055	0.036374	-1.238664	0.2156
RD/SALES	0.015175	0.037916	0.400231	0.6890
FOR/SALES	0.299721	0.036843	8.134992	0.0000
ROA	0.037091	0.002659	13.95070	0.0000
LEVDA	0.009876	0.075316	0.131124	0.8957
CR	-0.110383	0.019875	-5.553827	0.0000
DUM2006	0.238267	0.081205	2.934140	0.0034
DUM2007	0.332548	0.072724	4.572724	0.0000
DUM2008	-0.146844	0.066403	-2.211398	0.0271
DUM2009	-0.293565	0.061858	-4.745784	0.0000
DUM2010	-0.142161	0.064731	-2.196185	0.0282
DUM2011	-0.063099	0.063155	-0.999126	0.3179
DUM2013	0.051537	0.064176	0.803047	0.4220
DUM2014	0.085311	0.067309	1.267449	0.2051
DUM2015	0.026646	0.066199	0.402520	0.6873

DUM2016	-0.033008	0.063099	-0.523111	0.6010
DUM2017	-0.000773	0.065627	-0.011778	0.9906
DUMQD2	0.042820	0.052907	0.809341	0.4184
DUMQD3	0.036362	0.062885	0.578242	0.5632
TECHDUM	-0.038288	0.076542	-0.500219	0.6170
TELEDUM	-0.007618	0.096907	-0.078611	0.9373
CONSSERVDUM	0.458643	0.066616	6.884880	0.0000
CONSGOODSDUM	-0.060962	0.061177	-0.996488	0.3191
INDUSTRIALSDUM	-0.264605	0.050121	-5.279337	0.0000
HEALTHCAREDUM	0.368443	0.091119	4.043554	0.0001

R-squared	0.360580	Mean dependent var	1.583004
Adjusted R-squared	0.352125	S.D. dependent var	0.827679
S.E. of regression	0.666204	Akaike info criterion	2.038993
Sum squared resid	906.2965	Schwarz criterion	2.115219
Log likelihood	-2082.358	Hannan-Quinn criterion	2.066933
F-statistic	42.64887	Durbin-Watson statistic	2.073905
Prob(F-statistic)	0.000000	Wald F-statistic	42.29659
Prob(Wald F-statistic)	0.000000		

Key to variables in Table 8.12:

TOBINSQ	Tobin's Q
DERTOTAL_BIN	Dummy variable of 1/(0) if derivatives amount is/(not) reported
LNTOTASS	Natural logarithm of total assets
DIVYIELD	Dividend yield
RD/SALES	Ratio of research and development costs divided by sales
FOR/SALES	Ratio of foreign sales divided by sales
ROA	Return on assets
CR	Current ratio
LEVDA	Leverage calculated as the ratio of debt to assets
DUM2006	Year dummy variable
HEALTHCAREDUM	Sector dummy variable
DUMQD2	Dummy variable to measure quality of disclosure

Source: Own compilation

Regarding the model fit and assumptions, the pooled OLS regression model was robust in meeting the assumptions necessary for the analysis of the data. Diagnostic tests for the presence of endogeneity, multi-collinearity, heteroskedasticity, autocorrelation and normality were also conducted to ensure the robustness of the regression results. Outliers in the original data sample were excluded by winsorizing the data at the 5% and 95% percentiles. Since none of the tolerance values were below 0.1 and none of the VIF values were above 10, the assumption of no multicollinearity was met. The Durbin-Watson statistic (2.1) fell within the expected range of 1.5 to 2.5, thus indicating that the assumption of no serious autocorrelation was met. The absence of heteroskedasticity was confirmed by the Breusch-Pagan test. Normality of the residuals could be assumed. The adjusted R-squared was 35% and the F-statistic was 42.65 ($p<0.01$), showing the goodness-of-fit of the model.

The second multiple regression model employed to test *H4* used a binary variable as a proxy for the decision to hedge. The results from this regression model again confirmed that the hedging decision was value relevant. The binary derivatives variable was positive and statistically significant (0.1, p=0.02), indicating that firms that used derivatives tended to be valued higher than firms that did not use derivatives. This finding was in line with the findings from the models employed to test *H2* and *H3*, which found the binary derivatives variable to be a statistically strong predictor of firm value. The dummy variables that measured the quality of disclosure were, however, not statistically significant and positive (*DUMQD2*: 0.04, p=0.42, *DUMQD3*: 0.04, p=0.56), contradicting the findings from the previous model that found the quality of disclosure value relevant at a statistically significant level, but negative.

8.3.2 Discussion: Value relevance of derivatives disclosure quality

Few previous researchers have included a quality measure in value relevance models, notable exceptions being Hassan and Mohd-Saleh (2010) and Jankensgård *et al.* (2014). Other researchers such as Hassan *et al.* (2006) and Chang *et al.* (2016) explored risk and derivatives disclosures.

It is possible that the accounting standard itself was responsible for the negative association between quality of disclosure and firm value. A relevant study in this regard was conducted by Steffen (2019), who investigated whether a change in derivatives and hedging disclosure requirements affected investors' uncertainty. Steffen (2019) used six uncertainty proxies, including bid-ask spreads, return volatility, analyst forecast accuracy, analyst forecast dispersion, and measures of total and common analyst uncertainty, to find that a change in derivatives and hedging disclosure requirements under *SFAS no. 161* for US firms that adopted *SFAS no. 161* decreased investors' uncertainty. This indicates that the adoption of *SFAS no. 161* improved derivatives and hedging disclosures and led to better understanding among investors of disclosed derivatives and hedging information.

Various researchers have pointed to the complexity of derivatives disclosure requirements (Campbell, 2013; Chang *et al.*, 2016; Kawaller, 2004; Ryan, 2012). The complexity and difficulty in disclosing derivatives could have implications for the value relevance of derivatives disclosures by firms in several ways. Firstly, firms might eschew using derivatives altogether, or may avoid some types of derivatives instruments in favour of other types of hedging available to firms, simply due to the difficulty in disclosing derivatives information (Belghitar *et al.*, 2013). It is possible some firms, especially smaller, less profitable firms with less access to expertise in risk management practices, may forgo the opportunity to use derivatives because they do not have the internal capabilities to report such practices in the manner prescribed by the accounting standards. *IFRS 9* has replaced *IAS 39* for the reporting of financial instruments for JSE-listed firms to attempt to address the difficulties of reporting financial instruments inherent in *IAS 39*. Future research can investigate the effectiveness of *IFRS 9* in addressing the complexity of derivatives disclosure.

Moreover, investors, analysts and other users of financial statements may well struggle to interpret the information contained in derivatives disclosure, even though companies disclose pertinent information in a relevant manner (Chang *et al.*, 2016). Even experts can struggle to interpret a firm's derivatives activity accurately and correctly, and they often misjudge the earnings implications of firms' derivatives activities. The accounting standards prescribe the relevant information that must be included in the financial statements of an entity, but the prescribed manner in which the standards require the information may then have the opposite effect of the purpose of such disclosure. In other words, the sheer complexity of derivatives disclosure has the opposite effect to informing analysts and investors of a company's derivatives activities. The results from the current study's regression models seem to support this argument: although investors view hedging practices by firms as value relevant, the extent and quality of disclosure of such practices is viewed negatively. This can be interpreted as a negative reaction by investors and analysts to the difficulty and complexity of derivatives disclosures.

The findings for *H4* imply that the interpretation of the information prescribed by the accounting standards can have a significant impact on the value relevance of disclosure. Some accounting items disclosed may become more value relevant if the disclosures of such accounting items are interpreted more easily. If the accounting standards prescribe simpler methods and manners of disclosure, the understandability of the disclosure of an accounting item presented in the financial statements could be factored into the value relevance of that accounting item. Hence, it may be important to include a measure of this 'understandability' as a control variable in regression models that seek to establish the value relevance of a particular disclosed accounting item, as the current study has done.

The current study used a QDI to score firms' derivatives disclosure, a well-established practice reported in previous studies by Hassan (2004), Hassan and Mohd-Saleh (2010) and Jankensgård *et al.* (2014). The QDI assumes that the better the quality of information, the more useful that information. It is possible, however, that there is a disconnect between the *quality* of disclosure and the *usefulness* in information. It is possible that to understand better what the value relevance of a disclosed accounting item is, such as the derivatives disclosed by JSE-listed companies, a different control measure should be included in studies that aim to measure more accurately how useful analysts found the information contained in particular financial statements. The current study assumed that a higher score for the QDI reflected higher informational content, but it is possible that investors and analysts did not interpret the information given accurately, as was reported in a study by Chang *et al.* (2016). Inclusion of a different control variable in value relevance models may better reflect the analysts' perception of the usefulness of the information contained in financial statements.

In essence, given that value relevance research investigates whether or not companies are valued differently depending on information in the financial statements of corporate entities, it is important for value relevance research that investors and analysts are able to analyse the disclosed information accurately, and actually use it to make informed decisions. The findings of the current study suggest that investors and analysts do not reward a higher level of the quality of disclosure and instead view additional informational content as a hindrance to their assessment of firm value.

The negative relationship between the QDI, the value relevance of derivatives disclosure and firm value can also be explained in terms of how well the QDI used in the current study captured the informational content in derivatives disclosure. The QDI certainly captured the differences in the levels of quality disclosure. Although the relationship between firm value and the level of the quality of derivatives disclosure was found to be negative, rather than the expected positive value, the findings of the regression models do indicate that the level of quality of informational content is an important factor to consider in value relevance research.

It is possible that there is a distinction between *quality* of disclosure and the *usefulness* of such information. Value relevance research is not necessarily concerned with the usefulness of financial statements (Barth *et al.*, 2001), so the term usefulness can be misleading: value relevance research does concern itself with how well particular disclosed accounting amounts reflect information that is in fact used by investors in valuing the firm's equity value, so it is important for value relevance research that such information is not only accessible to investors, but also interpretable, in other words, useful.

The QDI used in this study attempts to give an accurate representation of the level of informational content in derivatives disclosures. A higher level of quality was assumed to be associated with a higher level of informational content, and hence greater usefulness to investors and analysts using financial statements. However, accounting standards, particularly the accounting standards that prescribe the requirements for derivatives disclosure, are notorious for their complexity, increasing the difficulty of preparing the financial reports and the difficulty that investors and analysts have with understanding and interpreting the information. Accounting standards are therefore continuously adjusted and updated, not only to be better able to reflect an entity's financial performance and position, but also to be more useful to the users of financial statements. The accounting standards for derivatives for JSE-listed firms have changed from *IAS 39* to *IFRS 9*.

It is therefore possible that the QDI captured accurately how closely firms adhered to the accounting standards requirements, but that investors did not view that information as prescribed by the accounting standard as particularly important or value relevant. It is also possible that the QDI was not able to capture accurately the difficulty with which investors interpret the information contained in the financial statements. Financial statements might closely resemble what they are supposed to disclose according to the standard, and have all the pertinent information, but may not be able to convey that information in a useful manner.

It becomes important then that value relevance research should include some type of qualitative proxies to ascertain whether information disclosed in the financial statements is value relevant or not. But it is possible that investors do not necessarily read or are able to read and understand, or read with comprehension, the information contained in the financial statements. Different measures of the informational content can be explored that include different measures of the usefulness of the information in the financial statements, rather than just how well such information was disclosed.

Much financial research relies on information contained in the financial statements of companies. Financial statements are used as a communication tool which entities use to provide information to users of financial statements on various aspects of the company's financial position and performance. Often, the only access investors or analysts have to information on a firm's activities is through the financial statements. In the current study, it was assumed that all of a company's derivatives activities are disclosed in the financial statements and in the absence of any other communication tool (such as questionnaires as used by some previous researchers), investors and analysts do not have any other method of attaining such useful information.

Thus it becomes important that accounting standards and disclosure of information in the financial statements of entities is not just accurate, but useful as well. Value relevance research bridges the gap between disclosure of information and usefulness of information. If an accounting item is said to be value relevant, then investors value a company differently, depending on the disclosure of such an item in the financial statements and its accompanying notes. Thus the manner in which information appears in the financial statements becomes extremely important for value relevance research, both for preparers of financial statements (who have to decide what information should be included) and for users of financial statements (who have to interpret the information in the financial statements).

It is a hugely complex task and researchers should be careful not to get bogged down in the semantics of language complexity that obfuscate the purpose of assessing the informational content of financial reports and the accompanying notes. This study employed a QDI similar to those proposed by Hassan and Mohd-Saleh (2010) and Jankensgård *et al.* (2014) to introduce a measure of control for the different levels of informational content provided in the financial statements in the value relevance models to assess whether derivatives disclosures had an impact on firm value for JSE-listed firms. This concept offers an entire field of separate research that investigates the link between the disclosure quality, readability, complexity, usefulness, and utility of financial reporting practices. For example, the term accounting complexity can be described as the difficulty experienced by preparers of financial reports in applying generally accepted accounting principles in US GAAP to communicate the economic substance of a transaction or event, and the overall financial position and results of a company. Two sources of accounting complexity are identified: the standards, which are difficult to understand and apply, and the volume and diversity of accounting standards (Hoitash & Hoitash, 2018).

Financial reporting quality is a vast field of research and multiple different measures of accounting reporting complexity exist. Complexity is sometimes divided into operating complexity, where measures such as the number of geographic and business sectors and the existence of foreign operations proxy for the complexity in models of financial reporting quality. The current study accounted for operating complexity by including foreign operations and the sector in which the entity operates, both of which are often used as measures of complexity. A second complexity category is the linguistic complexity of financial reports, which can be measured by using the Gunning fog index (Gunning, 1952) or the length of 10-K filings (a comprehensive report filed annually by publicly-traded companies in the US about their financial performance, required by the SEC) to represent readability. The Gunning fog index is a readability test for English writing. The index estimates the number of years of formal education a person needs to understand the text on the first reading. Linguistic complexity can capture the readability of financial reports to explore the association between linguistic complexity and the consumption of reports by investors and analysts. A third measure proposed by Hoitash and Hoitash (2018) to measure accounting reporting complexity is to count the accounting items disclosed in eXtensible Business Reporting Language (XBRL) 10-K filings, since firms in the US have to translate notes and financial statements in their 10-K filings into XBRL. The measure proposed by Hoitash and Hoitash (2018) is based on the number of accounting concepts (for example, raw materials, inventories and revenue) disclosed in 10-K filings; the preparation complexity of financial reports increases with the number of disclosed accounting concepts.

An important implication for value relevance research is that it is important to gain a better understanding of the relationship between these seemingly disparate concepts that try to explain *what* should be included in the financial statements and *how* such information *is interpreted*. Perhaps the answer lies in establishing the link between the requirements that must be met by the preparers of the financial statements and the expectations of the users of such information. For future value relevance research, different control measures can be investigated that capture more precisely both the quality of the information disclosed and the ability of users of financial statements to interpret such information accurately.

8.4 ROBUSTNESS ANALYSES

Robustness analysis is important to ensure the reliability of the results of regression models. Random sample permutation tests were therefore conducted to ascertain the robustness of the statistical models employed to analyse the four hypotheses. These tests were conducted on random samples of 50% of the original sample. Then ten additional random permutation tests were conducted for each of the regression models executed for this study

For the first hypothesis, $H1_1$ to $H1_5$, the random permutation tests (see Appendix B1) displayed good results, as 80% of the random sample regression models confirmed the results of the statistical model, indicating the regression model to be robust. For the statistical models used to test for *H2*, the random permutation tests (see Appendix B2) again showed robust regression model results; 90% of the random permutation sample regression models confirmed the results of the original regression analyses.

Four statistical models were used to test *H3* (results are presented in Appendix B3). For the three-period models, the random permutation test confirmed the results of the regression models in the case of binary variable for derivatives, as 90% of the random permutation sample regression models confirmed the results. However, the model using a continuous variable only agreed with 40% of the results. This implies that further research is required to confirm the outcome of the regression models in this particular case. The two-period model again confirmed the robustness for the binary model, with 80% of the random permutation sample regression models confirming the regression results. For the continuous model, 70% of the random sample regression models confirmed the results of the regression model.

The random permutation tests for *H4* did not indicate statistical robustness, because only 30% of the random sample regression models confirmed the results of the regression model. An instrumental variable approach was therefore used in addition to the random permutation tests to assess the robustness of the regression models for *H4*. This approach uses an instrumental variable to control for confounding and measurement error in observational studies. An additional variable for leverage, measured as the total debt to equity ratio, was introduced in the regression model. The results from the instrumental variable approach do confirm the robustness of the original regression models.

8.5 SUMMARY AND CONCLUSION

Section 8.2 and its subsections investigated in detail the effects that a big exogenous economic shock has on the value relevance of derivatives disclosure. The financial crisis of 2008/2009 had a significant economic impact on international financial markets, including emerging market economies such as South Africa. If companies are assumed to use derivatives to protect themselves against adverse economic conditions, such as those caused by the financial crisis, then the statistical models presented in this study have provided evidence that investors and analysts take into consideration the disclosure of firms' use of derivatives in the financial statements when they determine the value of these companies.

This study employed a three-period model to consider the pre-crisis period, the during-the-crisis period and the post-crisis period, as well as a two-period model to consider the before-shock and the after-shock period, to determine whether companies were valued differently if they disclosed derivatives in these individual periods. The results showed that the (ZAR) amounts of derivatives disclosed was value relevant for specific periods, and that the periods themselves had an impact on firm valuation.

With regard to *H4*, value relevance research is concerned with whether or not the disclosure of particular information in a firm's financial statements or the notes to these financial statements is value relevant, in other words, whether the company is valued differently depending on the information contained in the financial statements. Based on the literature, it was expected that the quality of disclosure should have a statistically significant impact on the value relevance of derivatives disclosure. However, the negative statistically significant results from the OLS multiple linear regression models indicate a negative relationship between derivatives disclosure quality and firm value. This implies that investors penalized the sample companies with a lower firm value (measured by Tobin's Q) for providing more information and more details in the derivatives notes to the financial statements.

The findings from these regression results thus confirm *H4* in that the quality of disclosure was indeed a statistically significant important indicator of the value relevance of derivatives disclosures, but surprisingly, this relationship was negative, rather than the expected positive relationship between higher quality and higher firm value. It is possible that more details in the financial reports exposed companies' use of derivatives to greater scrutiny, and then companies were penalized for it doubly, either by well-informed users of financial statements who may regard extensive use of derivatives in a negative light, or by users of financial statements who are ill-equipped to interpret the information in the disclosures correctly. In line with previous research, notably by Allayannis and Weston (2001), Hagelin (2003) and Júnior and Laham (2008), the results of the current study indicated that the adoption of a hedging policy increased firm value. These results were robust when control variables that are also known drivers of firm value were included.

The analysis of the value relevance of derivatives disclosure was further extended to determine whether the financial crisis of 2008/2009 had an impact on the value relevance of such disclosure. The results showed that the financial crisis did indeed have a statistically significant effect on firm value, and the value relevance of derivatives disclosure was statistically significantly different before, during and after the crisis.

Finally, the study of the value relevance of derivatives disclosures was further extended by including an additional measure to control for different levels of quality of derivatives disclosure. The results suggest that the quality of disclosure does influence the value relevance of derivatives disclosure, but somewhat surprisingly that firm value decreased when the quality of disclosure was higher. This finding may possibly be ascribed to the complexity of accounting standards' requirements regarding derivatives disclosure.

Random sample permutation tests were conducted to ascertain the robustness of the statistical models employed to analyse the four hypotheses. The robustness tests displayed good results, indicating the statistical validity of the results.

CHAPTER 9:
CONCLUSIONS AND RECOMMENDATIONS

9.1 INTRODUCTION

This study investigates derivatives use, as well as the value relevance of the disclosure of derivative financial instruments by non-financial companies listed on the JSE. More specifically, the study considered, firstly, whether firms listed on the JSE used derivative instruments to hedge in line with rationales for corporate hedging proposed in the finance literature. Next, the study examined whether the disclosure of companies' use of derivatives in the financial statements was value relevant. Then, the study investigated whether the value relevance of derivatives disclosure was significantly influenced by different economic periods (specifically, the global economic crisis of 2008/2009) and/or the (ZAR) amounts disclosed made a difference. Finally, the study looked at whether or not the quality of disclosure in the financial statements, based on a QDI, influenced the value relevance of derivatives disclosure.

This chapter summarizes the main findings of the study, making some recommendations based on the findings, acknowledges the limitations of the study and makes suggestions for future research before presenting some concluding remarks.

9.2 SUMMARY OF THE MAIN FINDINGS

This study examined corporate use of derivatives, including the value relevance of derivatives disclosure. Value relevance research tries to establish whether companies are valued differently depending on whether and how particular information is disclosed in the financial statements of entities. Thus, if one considers derivatives use a proxy for corporate hedging (as this study does), then the question is really whether or not corporate hedging has an impact on firm value. Hence, the current study looked at whether or not information pertaining to derivatives use (as a form of hedging) contained in the financial statements was value relevant. More specifically, the current study investigated whether companies on the JSE were valued differently depending on their disclosure of derivatives (as a proxy for their corporate risk management practices). To put this differently: do investors value companies differently when they look at their corporate hedging practices, and is corporate risk management a value adding exercise for companies? It is a small, yet crucial implication: the first hypothesis relates to motives for corporate hedging, considering derivatives as a proxy for corporate hedging. These results are discussed in section 9.2.1.

The second part of this study examined the value relevance of derivatives disclosure. This part of the study was separated into three hypotheses that all related to whether the disclosure of derivatives in the financial statements had an effect on firm value for JSE-listed companies from 2005 to 2017. The second hypothesis examined in this thesis related directly to the value relevance of derivatives disclosures by JSE-listed firms from 2005 to 2017 (see Section 9.2.2). The testing of the third and fourth hypotheses included additional measures for specific aspects that could influence the value relevance of derivatives disclosures. To test the third hypothesis year dummies were included to look at whether an exogenous market shock, the financial crisis of 2008/2009, influenced companies' use of derivatives. To test the fourth and final hypothesis of the current study, a measure of the quality of derivatives disclosure was included. It is possible the different levels of informational content available in the financial statements had an effect on the value relevance of such disclosure. The findings and recommendations for *H3* and *H4* are discussed in Sections 9.2.3 and 9.2.4 respectively.

9.2.1 Findings and recommendations: Determinants of corporate hedging

The first hypothesis (divided into five sub-hypotheses, $H1_1$ to $H1_5$) related to the rationales for the corporate hedging practices that non-financial firms listed on the JSE in the sample period, 2005 to 2017, engaged in. The hypotheses were formulated as follows (repeated here for the convenience of the reader):

> $H1_1$: *JSE-listed firms use derivatives to hedge financial risk exposure in order to reduce possible financial distress costs and the risk of bankruptcy.*
>
> $H1_2$: *JSE-listed firms use derivatives to reduce underinvestment costs.*
>
> $H1_3$: *JSE-listed firms use derivatives to reduce information asymmetry costs between shareholders and managers.*

$H1_4$: JSE-listed firms use derivatives to hedge financial risk exposure in response to tax incentives to minimize expected tax liability.

$H1_5$: JSE-listed firms use derivatives to hedge financial risk exposures and/or because of other operating characteristics.

Specifically, the study investigated whether derivatives use as a corporate risk management strategy by the sample companies conformed to the reasons proposed by the literature. In a world of perfect markets, as theorised by Modigliani and Miller (1958), companies would have no incentive to hedge. But due to the real-world risk of financial distress costs and bankruptcy, underinvestment costs, managerial risk aversion and convexity in corporate taxes, companies do use derivatives to hedge their pre-existing risk exposures. The literature argues that they do so in an attempt to smooth volatility in earnings and reduce the risk of bankruptcy, decrease the risk and costs associated with financial distress and avoid the costs of underinvestment. Furthermore, given the existence of information asymmetries, managers of firms can use derivatives to reduce the variability of company cash flows, thereby lowering the noise in the dividend stream of firms, in which they have a vested interest. Firms can also increase post-tax firm value by reducing the volatility of pre-tax income by means of derivatives use. Finally, as tested in relation to $H1_5$, some firms are more likely to use derivatives due to key pre-existing operating firm characteristics, including firm size and the level of foreign operations.

Two panel regression models were used to assess the determinants of corporate hedging practices by JSE-listed firms: a binomial logistic regression model and a multiple variable regression model. The binary logistic regression model estimated which factors influenced the likelihood that a sample company would use derivatives. The multiple linear regression model estimated whether an increase in a proposed determinant had a linear effect on the (ZAR) amount of derivatives used by an entity. The multiple linear regression model was found to be useful to confirm the expected signs of the coefficients of the regression models, but did not necessarily answer the research question of which factors determined the likelihood that firms would use derivatives. The binary logistic regression model was therefore used to address this research question.

The findings from the binary logistic regression model indicated that firm size, firm leverage, growth prospects and managerial risk aversion were the strongest rationales for corporate hedging with derivatives for this sample of JSE-listed firms from 2005 to 2017. Larger firms which had greater growth prospects and a higher amount of debt as part of their capital structure, and where directors had a higher stake in the business were more likely to use derivatives.

Minimizing the risk of financial distress cost and reducing underinvestment costs had the most marginal effect on the likelihood that the sample firms would hedge using derivatives. Proxies used in the models to measure the likelihood of financial distress included the leverage ratio and the dividend yield, both of which were found by the binomial logistic regression model to be statistically significant indicators of the likelihood that a company would use derivatives. This result was further supported by the negative coefficient of the liquidity ratio, albeit not at a statistically significant level. Larger firms were expected to experience lower financial distress costs, as firm size was a statistically significant predictor of the likelihood that a firm would hedge.

South Africa is considered an emerging market economy. However, the JSE is considered a sophisticated exchange, because it is similar, in many ways, to securities and stock exchanges in more developed economies. It is thus possible that similar findings for this sample of JSE-listed firms and the findings in studies on firms listed on stock exchanges in developed countries confirm certain rationales for corporate hedging. Similar findings would also indicate that the maturity and efficiency of the stock exchange and derivatives markets plays an important part in whether the rationale for corporate hedging applies to emerging markets, rather than the classification of whether on economy is considered emerging or not.

Dissimilar findings for corporate hedging rationales in different countries may point to differences between the economic structures and corporate cultures in the countries under review. It is possible that the level of advancement of the national stock exchange could play a part in whether or not companies use derivatives to hedge, since almost certainly companies in countries that have a more developed derivatives market are more likely to use derivatives. Companies that operate in emerging market economies without well-developed financial markets might be more dependent on other types of corporate hedging. Thus, if one compares different companies' motives for using derivatives, one has to keep in mind how well developed a particular country's financial markets are. It is therefore possible that the findings from some studies that examine corporate hedging practices may conform more closely to the traditional rationales for corporate hedging, especially findings from countries that are considered 'developed' and have highly efficient financial markets and easy access to such markets.

The ratio of R&D costs as a proxy for growth opportunities was found to be statistically significant. Growth prospects were used as a proxy for underinvestment costs. Companies with more investment opportunities are more likely to experience a conflict of interest between shareholders and bondholders, and managers may opt to forego investment in profitable projects if the gains from the investments are more likely to flow to bondholders than to shareholders. The findings from the current study indicated that the existence of greater investment opportunities and the need to reduce underinvestment costs was a powerful motivator for the sample firms listed on the JSE to use derivatives. The reason for this may be that these companies have a greater incentive to protect their future cash flows, profits and financial sustainability.

The findings of this study contribute to the growing literature and studies on hedging from an emerging market perspective. Conflicting evidence from studies in developed economies on the well-established theories of the determinants of corporate hedging provides fertile ground for comparing and juxtaposing findings. Growing evidence from emerging market economies can only further this debate. Findings from meta-analytical studies such as those by Geyer-Klingeberg *et al.* (2018) and Arnold *et al.* (2014) suggest that the determinants of corporate hedging in different countries are influenced by various country-specific macro-economic factors, as well as the inherent micro-economic factors of corporate culture. The current study suggests that one also has to consider companies' use of derivatives in the context of the level of development of the financial markets in which they operate, as well as the development, efficiency and accessibility of derivatives markets.

The results from this study suggest potentially productive recommendations for various stakeholders in financial markets regarding the impact of derivatives use on other corporate financing decisions, and on firm value and risk. These suggestions are discussed in detail below. Research on derivatives from the perspective of an emerging market economy is beneficial to stakeholders in the South African market who need to assess why companies use derivatives. It is crucial for various stakeholders, such as firms' credit suppliers, and the owners of and investors in South African listed companies to understand the motivation for companies to use derivatives. This study provides evidence that the well-established rationales for corporate hedging are indeed applicable to South African firms, allowing stakeholders in South Africa to assess the risk management practices by JSE-listed firms better.

It is recommended that investors in particular take into account the findings of the current study when they analyse companies' investment opportunities. Since the results from the study show that JSE-listed firms do hedge to decrease the risks of financial distress costs and to reduce the risk of bankruptcy, derivatives use can give a good indication of a firm's ability to protect investors' investments. The results suggest that investors should be able to assess their investment risk based on corporate hedging rationales: larger firms with more debt, better growth prospects and higher profitability are more likely to use derivatives and thus are more likely to hedge.

It was beyond the scope of the current study to include other proxies of corporate hedging, such as foreign debt, pass-through and operational hedges, because the focus of the study was to examine specifically derivatives use by companies listed on the JSE. As discussed in detail in the literature review, many previous studies on the motives for corporate hedging employed derivatives disclosure as a proxy for corporate hedging. The findings from this study are very much in line with those of previous studies (Ben Khediri, 2010; Jankensgård *et al.*, 2014; Rossi, 2013) that did so, confirming that derivatives use is a good proxy of corporate hedging practices for JSE-listed firms. This implies that although stakeholders could look at other methods of hedging available, a company's derivatives use is the most useful indicator of a firm's hedging practices.

Traditional theory from Modigliani and Miller (1958) and Smith and Stulz (1985) argues that there would be no incentive to hedge in perfect markets, and this is why research has investigated the question of why companies do, in fact, hedge. Once it has been established that companies do use derivatives (whether or not they subscribe to the motives for corporate hedging discussed in detail in the literature review – broadly summarized as bankruptcy and financial distress costs, agency conflict between shareholders and providers of external financing, information asymmetry between managers and owners of the company, and tax reasons), the next step is logically to determine whether they are successful in their hedging practices. It is illogical to assume that companies would forego hedging practices simply because investors do not reward them by adding value for corporate risk management. It then becomes a question of whether companies are able to communicate and convey essential information effectively regarding the steps the company has taken to protect itself against adverse economic conditions, so that investors can incorporate such information more inclusively and effectively when valuing the firm.

In summary, the results of the testing of the first hypothesis with its five sub-hypotheses suggests to stakeholders that JSE-listed firms hedge with derivatives in response to well established rationales for corporate hedging. Hence, stakeholders such as investors and credit providers may safely interpret derivatives use as part of a company's hedging practices, and the success of these hedging practices can be interpreted in terms of a firm's performance, relating to its profitability, share price and market value.

9.2.2 Findings and recommendations: Value relevance of derivatives disclosure

The second hypothesis of this thesis states that *the disclosure of derivatives in the financial statements of JSE-listed firms is value relevant.* This hypothesis was tested to examine the value relevance of derivatives disclosures by JSE-listed firms for the period from 2005 to 2017. The study employed two separate multiple linear regression models that included different measures of derivatives disclosure.

The first multiple linear regression model included a binary dummy variable for companies' derivatives disclosure. This variable can be interpreted as firms' hedging decision, and disclosure was indeed found to be statistically significant. In other words, JSE-listed firms' decision to use derivatives to hedge was considered by investors to be value relevant.

The second multiple linear regression model included a continuous variable that measured the total (ZAR) amount of derivatives disclosed in the financial statements of JSE-listed firms from 2005 to 2017. This measure can be interpreted as the total extent to which companies listed on the JSE were exposed to derivatives instruments and its value relevance was found not to be statistically significant.

The findings regarding *H2* contribute to the ongoing debate on the value relevance of derivatives disclosures in several ways. Firstly, the study focused on a sample of firms in an emerging market economy, whereas most of the prior research studied the value relevance of derivatives disclosure in developed economies. Since many emerging market economies have similar disclosure requirements, the findings of the current study should be easier to compare with the findings from other developing countries, but the sophistication of the JSE also makes these results comparable to those of prior studies conducted in developed countries. Nevertheless, it may not always be possible or applicable to compare findings between different countries, for example, results from the US, which is subject to US GAAP's requirements for derivatives disclosure in financial reports. Studies from emerging market economies can also contribute to a discussion on the value relevance of derivatives disclosure compared to findings from other emerging market economies to determine country-specific factors that could influence the way in which companies' derivatives use is perceived by the market.

Secondly, different financial instruments may be value relevant in different ways. Firms can use of a wide variety of financial instruments to hedge any number of risks. These risk exposures include, but are not limited to, credit risk, exchange rate risk and commodity price risk. Different derivative instruments used to hedge these risks may be valued differently by investors. The results from the current study suggest that if companies disclosed a derivatives amount in their financial statements, then this amount was value relevant and had a positive relationship with firm value, measured by Tobin's Q. This implies that companies were rewarded with a value premium for engaging in risk management practices (a disclosed derivatives amount was positively and statistically significantly associated with a higher Tobin's Q). However, the extent to which companies used derivatives (if a continuous variable was analysed in the regression models) was positively related to value relevance, but not at a statistically significant level. This finding could be ascribed to the different effects of the different instruments used to hedge different underlying risk exposures. Thus, it is recommended that analysts and investors be cautious in interpreting the risk management practices of firms, since not all instruments used to hedge risk exposures are necessarily similarly value relevant. The type of instrument used by companies can in fact have opposing effects on the value relevance of derivatives disclosure; Nguyen and Faff (2010) report that firms are valued at a discount for their use of swaps, while there is no discount for the use of options by these firms. JSE-listed firms can also use different types of derivative instruments, including forwards, futures, options and swaps, so users of financial statements should take care in interpreting companies' use of derivatives, not only in considering the type of risk exposure being hedged, but also the specific instrument used to hedge the particular risk, since the market could view individual instruments differently.

Thirdly, the current study also looked at the total (ZAR) amount of disclosed derivatives, which was calculated by adding the total line items for derivatives disclosed together, which included derivatives disclosed as assets and those disclosed as liabilities. This total amount was a good reflection of the total derivatives exposure by the companies in the sample. However, it is possible that investors and analysts view the disclosure of assets and liabilities differently, and it is therefore possible that derivatives disclosed as assets can have a different value relevance effect from derivatives disclosed as liabilities. Analysts and investors should thus take care in interpreting the difference between derivatives disclosed as assets and derivatives disclosed as liabilities. The market might perceive derivative instruments disclosed as liabilities as negative, although this might not be the case and could reflect only a short-term adverse moment in a derivatives position. Similarly, analysts and investors should be cautious of potential timing effects in relation to financial year-end transactions. Derivatives disclosed as assets and liabilities could be subject to sharp movements in value if the financial year-end of companies overlaps with a market shock that could cause a sharp decline or spike in value. This implies that investors and analysts should consider the value of the derivatives positions taking into account market movements, since timing matters as was shown in more detail in relation to the third hypothesis (see Section 9.2.3).

Finally, the sample in this study consisted of non-financial firms listed on the JSE in South Africa. The JSE is the world's 19th largest stock exchange by market capitalization and South Africa is considered to be an emerging market economy, making the JSE one of the largest stock exchanges in an emerging market. Investors, analysts and other market participants need to compare and contrast the findings from this study on the value relevance of derivatives disclosure from an emerging market economy's perspective to the results from other research from emerging market economies, as well as findings from research in developed countries. Since many emerging market economies have similar derivatives disclosure requirements under *IFRS 9*, differences in the value relevance of derivatives disclosure can possibly be ascribed to existing country-specific factors that could influence the hedging practices of firms in different countries. It is possible that the development of financial markets plays a crucial role in companies' ability and access to derivatives as part of their risk management practices; given that the JSE is one of the largest stock exchanges in the world, it offers opportunities for JSE-listed firms to pursue active hedging programmes that may not be possible in other emerging market economies.

9.2.3 Findings and recommendations: Value relevance of derivatives disclosure during different economic periods

The third hypothesis, *H3*, of the current study states that *the value relevance of derivatives disclosed in the financial statements of JSE-listed firms is statistically significantly different during specific economic periods.* The study therefore examined the effect of a specific shock to the economic cycle on the value relevance of derivatives disclosure in the financial statements of JSE-listed companies from 2005 to 2017, as reflected in the effect on firm value, measured by Tobin's Q. Additional year dummy periods were included in the models to control for the effects of a sudden change in the macro-economic cycle due to the market crash of 2008/2009.

A three-period model was employed focusing on a pre-crisis period (2005 to 2007), a during-the-crisis period (2008 and 2009), and a post-crisis period (2010 to 2017). In addition, the effect of this exogenous financial shock on the value relevance of companies' derivatives disclosures was tested by means of a two-period model, focusing on a before-shock period (2005 to 2010) and an after-shock period (2011 to 2017). The results show that the different economic periods had a statistically significant influence on firm value, and that the decision to disclose derivatives was statistically significant during these different economic periods.

The financial crisis of 2008/2009 was intrinsically linked to companies' use of derivatives, since companies use financial derivatives to hedge against adverse economic conditions and mitigate the effects of market volatility, to hedge against a variety of risk exposures such as credit risk, exchange rate risk and commodity price risk exposure. These risk exposures are influenced by fluctuations in the economic cycles. A downturn increases companies' exposure to rising interest rates, excess exchange rate volatility and changes in commodity prices. By introducing a measure to control for an exogenous shock to the economic cycle, such as dummy periods to control for the financial crisis, this study was better able to judge the effectiveness of companies' corporate hedging practices in protecting firm value during adverse economic conditions.

In addition to investigating the effects of the financial crisis on the effectiveness of corporate hedging practices, the introduction of specific year dummy periods to control for the financial crisis allowed this study to compare the value relevance of derivatives under different economic circumstances. Since derivative instruments themselves played a big part in exacerbating the effects of the financial crisis, it was useful to compare the value relevance of derivatives disclosures between a period before and after the financial crisis to compare whether investors viewed companies' use of derivatives differently under crisis conditions, as indeed they did.

9.2.4 Findings and recommendations: Value relevance of derivatives disclosure quality

The regression models used to test the final hypothesis, *H4*, which states that *the value relevance of derivatives disclosures for JSE-listed firms is statistically significantly different for different levels of quality of disclosure of information in the financial statements of these entities,* included a variable to control for the quality of derivatives disclosure.

The current study followed relevant recent finance research by including a measure of the level of quality of disclosure of disclosed derivatives in the form of a QDI. The QDI measured how well a company managed to disclose the information in terms of the requirement of the applicable accounting standard, *IAS 39*, and the informational content within the disclosed derivatives in the financial statements and the notes to the financial statement. The hypothesis that the quality of disclosure does influence the value relevance of such disclosure was accepted, although the relationship was found to be negative, rather than the expected positive relationship between quality of disclosure and value relevance. The findings from this regression analysis seem to contradict the assumption that higher quality of disclosure should lead investors and analysts to deem the disclosed accounting items more value relevant.

The negative relationship found between the level of the quality of derivatives disclosure and firm value raises some pertinent issues for discussion. Firstly, accounting standards, and in particular accounting standards concerned with the disclosure of derivatives, have been criticized for their complexity, for both the preparers of financial reports, and the users interpreting such disclosed information.

The findings from the current study, secondly, suggest that using derivatives was value relevant, even controlling for different levels of quality of disclosure. Companies were valued higher and more positively if they disclosed a derivatives amount (in terms of the models using a binary variable for whether or not firms hedge). The findings regarding *H4* seem to suggest, however, that investors and analysts are critical of the complexity of the disclosure requirements prescribed by the accounting standards; hence the negative relationship between the proxies for the level of quality of derivatives disclosure and firm value.

The users of financial statements need to be able to interpret how the quality of information influences the value relevance of the disclosure. The findings from the current study suggest that companies are penalized for adding to the quantity and quality of detail in the notes to the financial statements. Different accounting standards prescribe different disclosure requirements. Those for the disclosure of derivatives instruments are thought to be complex and difficult to interpret. Investors, analysts and other market participants should thus take care in interpreting the effectiveness of a company's hedging programme, since it could be difficult to assess derivatives positions considering the complexity of the accounting standards.

An important distinction that users of financial data should consider is the relationship between the quality of disclosure and the amount of utility or usefulness derived from the information in the financial statements. The current study assumed that the quality of disclosure, measured by means of content analysis and a QDI, would be a good indicator of the usefulness of the information. Other measures of usefulness such as a readability score can be used by market participants to assess the usefulness of information in the financial statements.

It is further recommended that users of financial statements understand the link between the kinds of information required by the accounting standards, the accessibility of information from the financial statements, the quality of disclosure and the usefulness of such information. Information that has to be disclosed according to a particular accounting standard may not be deemed value relevant because it is too complex to understand, and companies could therefore be penalized for including additional information even though they are required to add certain details in terms of the accounting standards. It is therefore possible that the manner in which they disclose that information becomes more important, either in the quality of such disclosure or in the amount of use a user of the financial statements derives from it.

The accounting standard under which companies had to disclose information in the current study, *IAS 39*, was notorious for its complexity and the difficulty involved in preparing the financial statements and in interpreting the information. *IAS 39* has since been replaced by *IFRS 9* as a requirement for JSE-listed companies. The users of financial statements should be cautious in comparing the quality of disclosure under these different accounting standards, and in comparing the effects of the quality of disclosure on the value relevance under the two accounting standards. Hopefully, *IFRS 9* will be successful in increasing the accessibility and usefulness of information in derivatives disclosures.

Finally, it is recommended that investors and analysts take note that the quality of derivatives disclosures can vary across countries. Different countries have different disclosure requirements and care should be taken when comparing the quality of disclosure of companies listed on the JSE, to the quality of disclosure in other emerging market economies, as well as developed economies. Differences in the quality of disclosure could also exist between different companies. It is thus possible that the quality of information contained in the financial statements could go some way toward explaining differences between the value relevance of derivatives disclosure in these different settings.

9.3 LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

This section discusses the limitations of the current study. The study relied on some assumptions which limited the scope of the study. Some of the limitations discussed here offer valuable opportunities for future research, as discussed at the end of the section.

It is important to note that the current study assumed that the (ZAR) amount of total derivatives disclosure was a proxy for derivatives use. It is possible and even likely that the determinants of derivatives use would vary for different types of risks being hedged. Different risks can be influenced by different factors (Allayannis & Ofek, 2001; Haushalter, 2000; Marsden & Prevost, 2005) and future research can investigate whether there is a difference in the determinants of foreign exchange, interest rate and commodities hedging.

It must be reiterated that there are other forms of corporate hedging, such as pass-through, operational hedges and the use of foreign debt. The current study explicitly investigated derivatives use by companies, using the (ZAR) amount of derivatives disclosed in the financial statements of an entity as a proxy for both whether or not a firm used derivatives to hedge, and the extent to which a company used derivatives.

The study also made use of Tobin's Q as a proxy for firm value. Future research might look towards other proxies for firm value such as the market value of equity or share price to assess the effects of derivatives disclosures on such values.

Finally, it was assumed all the firms in the sample used derivatives only for hedging purposes. By contrast, companies in the financial sector of the stock exchange, for example, actively use derivatives as part of their daily operations in pursuing financial gain from transactions, and therefore firms in the financial sector were excluded from the sample. It is possible that firms in other sectors also use derivatives for speculative purposes for a profit motive, but further research would be required to be able to distinguish between hedgers and speculators.

It was assumed that all derivatives used by companies were disclosed in the financial statements of those companies. In that sense, value relevance is dependent on the quality of the information presented in firms' financial statements. This study included a control measure for the level of quality of informational content, but it is possible that the information in the published financial statements of entities did not necessarily reflect the total amount of derivatives used by companies, and did not indicate for what purpose derivatives were used.

It would be worthwhile for future researchers to investigate the value relevance of derivatives disclosure under the requirements of the new accounting standard, *IFRS 9*, which came into effect on 1 January 2018. The disclosure requirements for derivatives have long been criticized for their complexity, from the perspectives of the preparers of financial reports and of the users who need to understand companies' derivatives positions. It would thus be useful to test whether *IFRS 9* is better able than *IAS 39* to communicate companies' use of derivatives and exposure to financial derivative instruments, and whether this has an effect on the value relevance of such disclosure.

The global financial markets suffered a massive shock again in 2020 due to the effects of the COVID-19 pandemic. It would be extremely interesting to compare, in future, the effects of the financial crisis of 2008/2009 under *IAS 39* to those of the crisis of 2020 under *IFRS 9*. The aim would be to see whether companies were better able to use derivatives to protect firm value a decade after the financial crisis of 2008/2009, and whether *IFRS 9* is more capable to capture companies' derivatives use during this crisis period and more effectively communicate companies' derivatives positions to investors than *IAS 39* was. Future studies can also include additional interaction terms in the regression models that investigate time effects on the value relevance of derivatives disclosures to better indicate the sensitivity of changes to firm value in relation to derivatives use.

The current study used a QDI to assess the quality of information contained in the financial statements of the sample of JSE-listed firms. The QDI has to rely on what information the accounting standard views as important, and how an entity is required to convey that information. If the underlying accounting standard itself is criticized for not being particularly user-friendly, this could have a knock-on effect on the QDI and the value relevance of the disclosed item.

9.4 CONCLUDING REMARKS

This study investigated derivatives use by non-financial firms listed on the JSE from 2005 to 2017. Two aspects of companies' use of derivatives were investigated, namely whether derivatives use by JSE-listed firms was in line with the rationales for corporate hedging suggested in the finance literature and whether the disclosure of derivative financial instruments in the financial statements of these entities was value relevant. The results from this study suggest firm size, growth prospects, leverage and managerial risk aversion are important determinants of JSE-listed firms' hedging decisions. This is an important contribution to the financial literature because South Africa is regarded as an emerging market economy, but its financial markets have many similar characteristics to those of more developed economies. This implies that access to financial markets and a well-developed derivatives market plays an important role in companies' decision to use derivatives to hedge.

Furthermore, the results from this study suggest that the disclosure of firms' use of derivatives in the financial statements is value relevant; companies listed on the JSE were associated with a higher Tobin's Q if they disclosed a derivatives amount. The findings suggest that corporate hedging with derivatives adds value to firms. This has important implications for firms, especially for companies that pursue corporate hedging and financial risk management practices. The results indicate that effective use of derivatives as part of a broader risk management strategy can add value to firms and protect firm value during adverse economic conditions. This was also illustrated in the results relating to the third hypothesis tested in this study, namely that the value relevance of derivatives disclosure is influenced differently during different economic periods. This study found that different economic periods had a statistically significant impact on firm value and that derivatives use during these different economic periods had a statistically significant impact on firm value. The use of derivatives by companies should become more important during times of economic uncertainty, and such use of derivatives should focus on protecting firm value during adverse economic conditions.

Finally, this study investigated whether the quality of disclosure influences the value relevance of derivatives disclosures. This study found that the level of quality of derivative disclosure negatively impacted the value relevance of derivatives disclosures, and that firms were punished with a lower value where they provided a higher level of quality of derivatives disclosure. This has important implications for both the setting of accounting standards and future research on the value relevance of derivatives and its disclosure. The disclosure requirements for derivatives are notoriously difficult, and this was reflected in the findings of the current study, because more detailed and higher levels of quality of disclosure were negatively associated with the value relevance of derivatives disclosure.

The exponential growth of the derivatives market in the last decade has made research on derivatives instruments and companies' use of derivatives extremely important, and it should remain at the forefront of future finance research. Firms and financial systems worldwide are becoming increasingly connected, and derivatives instruments offer a unique opportunity for even small firms to become big players on a global stage. This holds both positive and negative implications for companies. Firms face increasingly dangerous and complex risks, not least those seen with the financial crisis of 2008/2009 and the impact of global events such as the COVID19 pandemic of 2020. Conversely, firms have more and better opportunities than ever to access financial markets and the potential to hedge themselves in newer, more sophisticated and effective ways. Derivatives are both terrifying and beautiful: at worst, they have the potential to destroy entire financial systems, but at best, they offer almost unlimited opportunities in their applications, and only further research can show us derivatives' full potential in all their terrifying beauty.

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APPENDIX A:

TESTS FOR RANDOM OR FIXED EFFECTS

Table A.1: Descriptive statistics: Unwinsorized data (dependent variable)

		DerCA	DerNCA	DerCL	DerNCL	DerTotal
Mean		108514.76	107700.311	186198.9499	364807.0714	324197.3844
95% Confidence Interval for Mean	Lower Bound	70151.42	74702.32913	69716.74214	234239.8804	204253.9442
	Upper Bound	146878.11	140698.2934	302681.1577	495374.2625	444140.8246
5% Trimmed Mean		35763.07	72824.77594	32372.7892	195029.1315	105865.1817
Median		11000.00	26000	11416	69000	27344
Variance		204808286446.118	42113316813	2.03648E+12	8.59054E+11	2.9233E+12
Std. Deviation		452557.495	205215.2938	1427054.065	926851.6985	1709765.682
Minimum		1	75	2	25	1
Maximum		5386000	1453000	18770000	7433000	23389000
Range		5385999	1452925	18769998	7432975	23388999
Interquartile Range		45003	114385	44556	204675	113737
Skewness		8.021	3.776	11.44927822	4.774147952	11.0450619
Kurtosis		73.703	17.568	136.2934594	26.48260465	133.1157685

Table A.2: Linear model to test for fixed effects

Dependent Variable: *DERTOTALWINSB*
Method: Panel Least Squares
Date: 04/16/20 Time: 13:21
Sample: 2005 2017
Periods included: 13
Cross-sections included: 102
Total panel (unbalanced) observations: 663

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1104614.	127817.9	-8.642091	0.0000
ROAWINSB	-1788.141	1705.465	-1.048477	0.2948
CRWINS	-3954.506	13677.67	-0.289121	0.7726
LNTOBINSQ	2616.999	24847.24	0.105324	0.9162
LNTOTASS	85283.74	7352.482	11.59931	0.0000
DIVYIELDWINS_BIN	-45889.07	28060.55	-1.635359	0.1025
RDSALESWINS_BIN	-8204.389	21897.79	-0.374668	0.7080
FORSALESWINS_BIN	-34370.48	23087.06	-1.488734	0.1370
DIRSHARETOTWINS	-0.189635	0.224758	-0.843730	0.3991
INTCOVERWINSB	-3.113936	5.229270	-0.595482	0.5517
LEVDAWINS	-8247.685	55086.59	-0.149722	0.8810
ACTLDV	-34738.66	20125.22	-1.726126	0.0848

Root MSE	239831.5	R-squared	0.238487
Mean dependent var	137496.3	Adjusted R-squared	0.225620
S.D. dependent var	275039.7	S.E. of regression	242031.8
Akaike info criterion	27.64946	Sum squared resid	3.81E+13
Schwarz criterion	27.73085	Log likelihood	-9153.796
Hannan-Quinn criterion	27.68100	F-statistic	18.53430
Durbin-Watson statistic	0.580323	Prob(F-statistic)	0.000000

Key to variables in Table A.2:

DERTOTALWINSB	Total amount of derivatives reported in the financial statements
LNTOBINSQ	Natural logarithm of Tobin's Q
LNTOTASS	Natural logarithm of total assets
DIVYIELDWINS_BIN	Dividend yield
RDSALESWINS_BIN	Ratio of research and development costs divided by sales
FORSALESWINSWINS_BIN	Ratio of foreign sales divided by sales
ROAWINSB	Return on assets
CRWINS	Current ratio
LEV/DA	Leverage calculated as the ratio of debt to assets
DIRTOTSHARESWINS	Total number of directors' shares
INTCOVERWINSB	Interest coverage ratio
ACTLDV	Dummy variable of 1/(0) if accumulated computed tax loss is/(not) reported

Table A.3: Hausman test for fixed or random effects for Hypothesis 1

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	31.339502	11	0.0010

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
ROAWINSB	2107.213828	1298.831886	303121.743997	0.1420
CRWINS	-7145.001825	-10129.991863	130555345.232939	0.7939
LNTOBINSQ	-50413.814372	-40461.002069	256588883.977999	0.5344
LNTOTASS	28070.072995	62795.639660	208313288.291471	0.0161
DIVYIELDWINS_BIN	10892.034585	-1037.133416	123993852.440296	0.2840
RDSALESWINS_BIN	-22404.618899	-10191.031422	196691668.140078	0.3838
FORSALESWINS_BIN	30890.006685	4646.189884	114344347.313574	0.0141
DIRSHARETOTWINS	0.278020	-0.012311	0.050321	0.1956
INTCOVERWINSB	-3.495154	-2.384295	5.035146	0.6206
LEVDAWINS	399304.522100	163049.903755	3408310482.985090	0.0001
ACTLDV	-14563.385315	-15327.116781	93504695.503954	0.9370

Key to variables in Table A.3:

DERTOTALWINSB	Total amount of derivatives reported in the financial statements
LNTOBINSQ	Natural logarithm of Tobin's Q
LNTOTASS	Natural logarithm of total assets
DIVYIELDWINS_BIN	Dividend yield
RDSALESWINS_BIN	Ratio of research and development costs divided by sales
FORSALESWINSWINS_BIN	Ratio of foreign sales divided by sales
ROAWINSB	Return on assets
CRWINS	Current ratio
LEV/DA	Leverage calculated as the ratio of debt to assets
DIRTOTSHARESWINS	Total number of directors' shares
INTCOVERWINSB	Interest coverage ratio
ACTLDV	Dummy variable of 1/(0) if accumulated computed tax loss is/(not) reported

APPENDIX B:

RANDOM SAMPLE PERMUTATION TESTS

Table B.1: Random sample permutation tests Hypothesis 1_binary

Dependent Variable: *DERTOTAL_BIN*
Method: ML - Binary Logit (Newton-Raphson / Marquardt steps)
Date: 06/25/20 Time: 09:54
Sample: 2005 2017
Included observations: 882
Convergence achieved after 5 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-11.57693	1.065827	-10.86193	0.0000
DIVYIELDWINS_BIN	0.563562	0.230563	2.444281	0.0145
FORSALESWINS_BIN	0.145987	0.196366	0.743444	0.4572
RDSALESWINS_BIN	0.335391	0.200402	1.673590	0.0942
CRWINS	0.038165	0.101798	0.374905	0.7077
LNTOBINSQ	0.059364	0.220307	0.269460	0.7876
LNTOTASS	0.576967	0.061644	9.359663	0.0000
ACTLDV	-0.103311	0.175484	-0.588717	0.5561
ROAWINSB	-0.028959	0.014128	-2.049804	0.0404
INTCOVERWINSB	2.51E-06	4.81E-05	0.052191	0.9584
DIRTOTSHARE_2G	1.423973	0.370233	3.846159	0.0001
LEVDEWINSB	0.011363	0.001882	6.037363	0.0000

McFadden R-squared	0.242399	Mean dependent var	0.377551
S.D. dependent var	0.485049	S.E. of regression	0.409975
Akaike info criterion	1.031567	Sum squared resid	146.2294
Schwarz criterion	1.096631	Log likelihood	-442.9209
Hannan-Quinn criterion	1.056446	Deviance	885.8418
Restr. deviance	1169.272	Restr. log likelihood	-584.6359
LR statistic	283.4300	Avg. log likelihood	-0.502178
Prob(LR statistic)	0.000000		

Obs with Dep=0	549	Total obs	882
Obs with Dep=1	333		

Dependent Variable: *DERTOTAL_BIN*
Method: ML - Binary Logit (Newton-Raphson / Marquardt steps)
Date: 06/25/20 Time: 09:58
Sample: 2005 2017
Included observations: 884
Convergence achieved after 5 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-10.37445	1.045965	-9.918549	0.0000
DIVYIELDWINS_BIN	0.314013	0.246830	1.272182	0.2033
FORSALESWINS_BIN	0.209940	0.199434	1.052679	0.2925
RDSALESWINS_BIN	0.574863	0.199348	2.883722	0.0039
CRWINS	-0.176336	0.106775	-1.651464	0.0986
LNTOBINSQ	-0.047658	0.220294	-0.216337	0.8287
LNTOTASS	0.575851	0.062668	9.188937	0.0000
ACTLDV	-0.043222	0.174270	-0.248018	0.8041
ROAWINSB	-0.002079	0.015078	-0.137910	0.8903

INTCOVERWINSB	-5.13E-05	4.57E-05	-1.122016	0.2619
DIRTOTSHARE_2G	0.787520	0.351123	2.242862	0.0249
LEVDEWINSB	0.006382	0.001654	3.858983	0.0001

McFadden R-squared	0.245231	Mean dependent var	0.389140
S.D. dependent var	0.487831	S.E. of regression	0.410391
Akaike info criterion	1.036067	Sum squared resid	146.8626
Schwarz criterion	1.101015	Log likelihood	-445.9417
Hannan-Quinn criterion	1.060899	Deviance	891.8834
Restr. deviance	1181.664	Restr. log likelihood	-590.8320
LR statistic	289.7805	Avg. log likelihood	-0.504459
Prob(LR statistic)	0.000000		

Obs with Dep=0	540	Total obs	884
Obs with Dep=1	344		

Dependent Variable: *DERTOTAL_BIN*
Method: ML - Binary Logit (Newton-Raphson / Marquardt steps)
Date: 06/25/20 Time: 10:05
Sample: 2005 2017
Included observations: 836
Convergence achieved after 5 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-10.77936	1.046573	-10.29968	0.0000
DIVYIELDWINS_BIN	0.267140	0.233722	1.142980	0.2530
RDSALESWINS_BIN	0.682151	0.216871	3.145422	0.0017
FORSALESWINS_BIN	-0.063738	0.210373	-0.302976	0.7619
CRWINS	-0.025230	0.108257	-0.233057	0.8157
LNTOTASS	0.581228	0.062492	9.300803	0.0000
LNTOBINSQ	0.234302	0.204628	1.145015	0.2522
DIRTOTSHARE_2G	1.049459	0.344228	3.048729	0.0023
ACTLDV	0.149629	0.176085	0.849754	0.3955
INTCOVERWINSB	-4.70E-05	4.80E-05	-0.979435	0.3274
LEVDEWINSB	0.006883	0.001754	3.925229	0.0001
ROAWINSB	-0.019515	0.013957	-1.398184	0.1621

McFadden R-squared	0.234473	Mean dependent var	0.387560
S.D. dependent var	0.487485	S.E. of regression	0.414791
Akaike info criterion	1.050907	Sum squared resid	141.7705
Schwarz criterion	1.118782	Log likelihood	-427.2793
Hannan-Quinn criterion	1.076928	Deviance	854.5586
Restr. deviance	1116.301	Restr. log likelihood	-558.1504
LR statistic	261.7422	Avg. log likelihood	-0.511100
Prob(LR statistic)	0.000000		

Obs with Dep=0	512	Total obs	836
Obs with Dep=1	324		

Dependent Variable: *DERTOTAL_BIN*
Method: Panel Least Squares
Date: 06/25/20 Time: 10:11
Sample: 2005 2017
Periods included: 13
Cross-sections included: 174
Total panel (unbalanced) observations: 901

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.045173	0.135292	-7.725307	0.0000
DIVYIELDWINS_BIN	0.060151	0.037172	1.618182	0.1060
RDSALESWINS_BIN	0.098194	0.036448	2.694085	0.0072
FORSALESWINS_BIN	0.081449	0.035763	2.277427	0.0230
CRWINS	0.001349	0.016814	0.080230	0.9361
ACTLDV	0.013691	0.028795	0.475475	0.6346
LEVDEWINSB	0.001302	0.000268	4.854000	0.0000
ROAWINSB	-0.001352	0.002051	-0.659338	0.5098
LNTOBINSQ	0.019684	0.028002	0.702944	0.4823
LNTOTASS	0.074250	0.008533	8.701247	0.0000
DIRTOTSHARE_2G	0.165127	0.055184	2.992299	0.0028
INTCOVERWINSB	-1.96E-05	7.40E-06	-2.644708	0.0083

Root MSE	0.415161	R-squared	0.250533
Mean dependent var	0.358491	Adjusted R-squared	0.241259
S.D. dependent var	0.479824	S.E. of regression	0.417954
Akaike info criterion	1.106337	Sum squared resid	155.2952
Schwarz criterion	1.170313	Log likelihood	-486.4048
Hannan-Quinn criterion	1.130775	F-statistic	27.01602
Durbin-Watson statistic	0.765798	Prob(F-statistic)	0.000000

Dependent Variable: *DERTOTAL_BIN*
Method: Panel Least Squares
Date: 06/25/20 Time: 12:36
Sample: 2005 2017
Periods included: 13
Cross-sections included: 170
Total panel (unbalanced) observations: 865

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.159790	0.143918	-8.058713	0.0000
DIVYIELDWINS_BIN	0.063596	0.038153	1.666864	0.0959
RDSALESWINS_BIN	0.131158	0.037564	3.491592	0.0005
FORSALESWINS_BIN	0.053502	0.037289	1.434780	0.1517
CRWINS	-0.000945	0.016926	-0.055811	0.9555
ACTLDV	0.036058	0.029803	1.209878	0.2267
LEVDEWINSB	0.000882	0.000292	3.019106	0.0026
ROAWINSB	-0.003634	0.002147	-1.692379	0.0909
LNTOBINSQ	0.029745	0.031310	0.950012	0.3424
LNTOTASS	0.089089	0.009218	9.665067	0.0000
DIRTOTSHARE_2G	0.073443	0.058205	1.261810	0.2074
INTCOVERWINSB	-3.34E-06	7.75E-06	-0.431534	0.6662

Root MSE	0.418838	R-squared	0.249297
Mean dependent var	0.372254	Adjusted R-squared	0.239616
S.D. dependent var	0.483685	S.E. of regression	0.421774
Akaike info criterion	1.125080	Sum squared resid	151.7427
Schwarz criterion	1.191152	Log likelihood	-474.5970
Hannan-Quinn criterion	1.150368	F-statistic	25.75162
Durbin-Watson statistic	0.892808	Prob(F-statistic)	0.000000

Dependent Variable: *DERTOTAL_BIN*
Method: ML - Binary Logit (Newton-Raphson / Marquardt steps)
Date: 06/25/20 Time: 19:28
Sample: 2005 2017
Included observations: 884
Convergence achieved after 6 iterations

Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-11.41041	1.086219	-10.50471	0.0000
DIVYIELDWINS_BIN	0.494826	0.241731	2.047014	0.0407
RDSALESWINS_BIN	0.679891	0.201367	3.376382	0.0007
FORSALESWINS_BIN	0.157955	0.199713	0.790910	0.4290
CRWINS	-0.211973	0.104713	-2.024311	0.0429
ACTLDV	-0.216305	0.175323	-1.233751	0.2173
LEVDEWINSB	0.005864	0.001760	3.332380	0.0009
ROAWINSB	-0.025311	0.015765	-1.605523	0.1084
LNTOBINSQ	0.160385	0.229664	0.698349	0.4850
LNTOTASS	0.601763	0.064203	9.372807	0.0000
DIRTOTSHARE_2G	1.508253	0.363388	4.150529	0.0000
INTCOVERWINSB	1.52E-05	4.63E-05	0.327409	0.7434

McFadden R-squared	0.255627	Mean dependent var	0.367647
S.D. dependent var	0.482438	S.E. of regression	0.403449
Akaike info criterion	1.006285	Sum squared resid	141.9367
Schwarz criterion	1.071233	Log likelihood	-432.7781
Hannan-Quinn criterion	1.031117	Deviance	865.5562
Restr. deviance	1162.799	Restr. log likelihood	-581.3993
LR statistic	297.2424	Avg. log likelihood	-0.489568
Prob(LR statistic)	0.000000		

Obs with Dep=0	559	Total obs	884
Obs with Dep=1	325		

Dependent Variable: *DERTOTAL_BIN*
Method: ML - Binary Logit (Newton-Raphson / Marquardt steps)
Date: 06/25/20 Time: 19:50
Sample: 2005 2017
Included observations: 878
Convergence achieved after 5 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-9.653440	1.016891	-9.493093	0.0000
DIVYIELDWINS_BIN	0.129677	0.224009	0.578893	0.5627
RDSALESWINS_BIN	0.687789	0.209112	3.289093	0.0010
FORSALESWINS_BIN	0.425570	0.195315	2.178891	0.0293
CRWINS	-0.249863	0.108186	-2.309565	0.0209
ACTLDV	-0.036337	0.172415	-0.210755	0.8331
LEVDEWINSB	0.006658	0.001790	3.718863	0.0002
ROAWINSB	-0.010460	0.015053	-0.694913	0.4871
LNTOBINSQ	-0.242532	0.223368	-1.085793	0.2776
LNTOTASS	0.530995	0.060868	8.723746	0.0000
DIRTOTSHARE_2G	1.027842	0.358986	2.863184	0.0042
INTCOVERWINSB	-4.74E-05	4.90E-05	-0.967372	0.3334

McFadden R-squared	0.236762	Mean dependent var	0.379271
S.D. dependent var	0.485482	S.E. of regression	0.411118
Akaike info criterion	1.040466	Sum squared resid	146.3693
Schwarz criterion	1.105764	Log likelihood	-444.7647
Hannan-Quinn criterion	1.065440	Deviance	889.5294
Restr. deviance	1165.468	Restr. log likelihood	-582.7340
LR statistic	275.9386	Avg. log likelihood	-0.506566
Prob(LR statistic)	0.000000		

Obs with Dep=0	545	Total obs	878

Obs with Dep=1	333

Dependent Variable: *DERTOTAL_BIN*
Method: ML - Binary Logit (Newton-Raphson / Marquardt steps)
Date: 06/25/20 Time: 20:02
Sample: 2005 2017
Included observations: 903
Convergence achieved after 5 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-10.72851	1.032038	-10.39546	0.0000
DIVYIELDWINS_BIN	0.166864	0.229719	0.726381	0.4676
RDSALESWINS_BIN	0.615346	0.203798	3.019389	0.0025
FORSALESWINS_BIN	0.024353	0.197974	0.123012	0.9021
CRWINS	-0.171620	0.108072	-1.588017	0.1123
ACTLDV	-0.136723	0.174229	-0.784727	0.4326
LEVDEWINSB	0.004272	0.001736	2.461385	0.0138
ROAWINSB	-0.028809	0.014261	-2.020128	0.0434
LNTOBINSQ	0.198195	0.196455	1.008857	0.3130
LNTOTASS	0.606328	0.062919	9.636664	0.0000
DIRTOTSHARE_2G	1.294632	0.354106	3.656060	0.0003
INTCOVERWINSB	-8.18E-05	5.02E-05	-1.628138	0.1035

McFadden R-squared	0.233986	Mean dependent var	0.380952
S.D. dependent var	0.485890	S.E. of regression	0.414453
Akaike info criterion	1.044654	Sum squared resid	153.0485
Schwarz criterion	1.108518	Log likelihood	-459.6613
Hannan-Quinn criterion	1.069046	Deviance	919.3227
Restr. deviance	1200.138	Restr. log likelihood	-600.0692
LR statistic	280.8157	Avg. log likelihood	-0.509038
Prob(LR statistic)	0.000000		

Obs with Dep=0	559	Total obs	903
Obs with Dep=1	344		

Dependent Variable: *DERTOTAL_BIN*
Method: ML - Binary Logit (Newton-Raphson / Marquardt steps)
Date: 06/25/20 Time: 20:09
Sample: 2005 2017
Included observations: 851
Convergence achieved after 5 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-10.19839	1.052364	-9.690933	0.0000
DIVYIELDWINS_BIN	0.311398	0.232564	1.338978	0.1806
RDSALESWINS_BIN	0.597464	0.201057	2.971621	0.0030
FORSALESWINS_BIN	0.193616	0.193591	1.000133	0.3172
CRWINS	-0.243997	0.107006	-2.280219	0.0226
ACTLDV	0.022218	0.174293	0.127477	0.8986
LEVDEWINSB	0.005309	0.001773	2.993988	0.0028
ROAWINSB	-0.015087	0.015053	-1.002235	0.3162
LNTOBINSQ	0.031153	0.220697	0.141159	0.8877
LNTOTASS	0.550061	0.062788	8.760569	0.0000
DIRTOTSHARE_2G	1.241629	0.353442	3.512961	0.0004
INTCOVERWINSB	-5.08E-05	5.02E-05	-1.011885	0.3116

McFadden R-squared	0.225647	Mean dependent var	0.371328
S.D. dependent var	0.483444	S.E. of regression	0.414904
Akaike info criterion	1.049819	Sum squared resid	144.4298
Schwarz criterion	1.116748	Log likelihood	-434.6980
Hannan-Quinn criterion	1.075455	Deviance	869.3960
Restr. deviance	1122.739	Restr. log likelihood	-561.3695
LR statistic	253.3430	Avg. log likelihood	-0.510808
Prob(LR statistic)	0.000000		
Obs with Dep=0	535	Total obs	851
Obs with Dep=1	316		

Dependent Variable: *DERTOTAL_BIN*
Method: ML - Binary Logit (Newton-Raphson / Marquardt steps)
Date: 06/25/20 Time: 20:14
Sample: 2005 2017
Included observations: 901
Convergence achieved after 4 iterations
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-10.23124	1.014142	-10.08856	0.0000
DIVYIELDWINS_BIN	0.229158	0.225650	1.015546	0.3098
RDSALESWINS_BIN	0.681868	0.199101	3.424730	0.0006
FORSALESWINS_BIN	0.097396	0.194098	0.501789	0.6158
CRWINS	-0.055335	0.100769	-0.549123	0.5829
ACTLDV	-0.093150	0.170303	-0.546966	0.5844
LEVDEWINSB	0.005620	0.001801	3.120383	0.0018
ROAWINSB	-0.007184	0.014001	-0.513103	0.6079
LNTOBINSQ	-0.001571	0.209167	-0.007511	0.9940
LNTOTASS	0.556217	0.060444	9.202117	0.0000
DIRTOTSHARE_2G	0.884376	0.348466	2.537910	0.0112
INTCOVERWINSB	-6.29E-05	5.00E-05	-1.257704	0.2085

McFadden R-squared	0.220992	Mean dependent var	0.360710
S.D. dependent var	0.480473	S.E. of regression	0.415127
Akaike info criterion	1.045309	Sum squared resid	153.2018
Schwarz criterion	1.109284	Log likelihood	-458.9116
Hannan-Quinn criterion	1.069747	Deviance	917.8232
Restr. deviance	1178.194	Restr. log likelihood	-589.0970
LR statistic	260.3709	Avg. log likelihood	-0.509336
Prob(LR statistic)	0.000000		
Obs with Dep=0	576	Total obs	901
Obs with Dep=1	325		

Key to variables in Table B1:

DERTOTAL_BIN	Dummy variable of 1/(0) if derivatives amount is/(not) reported
LNTOBINSQ	Natural logarithm of Tobin's Q
LNTOTASS	Natural logarithm of total assets
DIVYIELDWINS_BIN	Dividend yield
RDSALESWINS_BIN	Ratio of research and development costs divided by sales
FORSALESWINSWINS_BIN	Ratio of foreign sales divided by sales
ROAWINSB	Return on assets
CRWINS	Current ratio
LEV/DEWINS	Leverage calculated as the ratio of debt to equity
DIRTOTSHARESWINS_2G	Total number of directors' shares
INTCOVERWINSB	Interest coverage ratio
ACTLDV	Dummy variable of 1/(0) if accumulated computed tax loss is/(not) reported

Table B.2: Random sample permutation tests Hypothesis 2_binary

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 13:14
Sample (adjusted): 2 1266
Included observations: 1044 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.361955	0.351558	6.718528	0.0000
DERTOTAL_BIN	0.112504	0.051643	2.178490	0.0296
DIVYIELDWINS_BIN	-0.047112	0.050967	-0.924373	0.3555
RDSALESWINS_BIN	0.029208	0.052340	0.558036	0.5769
FORSALESWINS_BIN	0.304347	0.054673	5.566700	0.0000
CRWINS	-0.133087	0.025144	-5.293077	0.0000
ROAWINSB	0.038472	0.003774	10.19390	0.0000
LNTOTASS	-0.068193	0.020479	-3.329847	0.0009
LEVDAWINS	-0.039969	0.106881	-0.373957	0.7085
DUM2006	0.159302	0.146533	1.087142	0.2772
DUM2007	0.292959	0.141437	2.071306	0.0386
DUM2008	-0.212728	0.129378	-1.644234	0.1004
DUM2009	-0.283148	0.128245	-2.207872	0.0275
DUM2010	-0.167866	0.128430	-1.307065	0.1915
DUM2011	-0.086143	0.130335	-0.660932	0.5088
DUM2012	-0.031483	0.129507	-0.243096	0.8080
DUM2013	-0.030138	0.126800	-0.237677	0.8122
DUM2014	0.053455	0.126920	0.421169	0.6737
DUM2015	-0.015535	0.137304	-0.113140	0.9099
DUM2016	-0.052217	0.127433	-0.409763	0.6821
DUM2017	-0.017902	0.127873	-0.139996	0.8887
HEALTHCAREDUM	0.454293	0.132357	3.432333	0.0006
INDUSTRIALSDUM	-0.162940	0.066157	-2.462945	0.0139
CONSGOODSDUM	0.009892	0.080417	0.123008	0.9021
CONSSERVDUM	0.453361	0.096855	4.680812	0.0000
OILGASDUM	0.825289	0.533296	1.547527	0.1220
TECHDUM	0.064925	0.106198	0.611354	0.5411

R-squared	0.373453	Mean dependent var	1.596465
Adjusted R-squared	0.357436	S.D. dependent var	0.831076
S.E. of regression	0.666191	Akaike info criterion	2.051042
Sum squared resid	451.3557	Schwarz criterion	2.179080
Log likelihood	-1043.644	Hannan-Quinn criterion	2.099604
F-statistic	23.31474	Durbin-Watson statistic	2.085091
Prob(F-statistic)	0.000000	Wald F-statistic	24.11123
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 13:20
Sample (adjusted): 2 1210
Included observations: 981 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.315316	0.363494	6.369616	0.0000
DERTOTAL_BIN	0.169204	0.053740	3.148545	0.0017
DIVYIELDWINS_BIN	-0.074986	0.055068	-1.361705	0.1736

RDSALESWINS_BIN	0.053062	0.056787	0.934403	0.3503
FORSALESWINS_BIN	0.330045	0.059466	5.550168	0.0000
CRWINS	-0.106006	0.032616	-3.250103	0.0012
ROAWINSB	0.039916	0.003959	10.08294	0.0000
LNTOTASS	-0.070877	0.022843	-3.102806	0.0020
LEVDAWINS	0.051732	0.109324	0.473194	0.6362
DUM2006	0.197531	0.123153	1.603948	0.1091
DUM2007	0.355695	0.128344	2.771422	0.0057
DUM2008	-0.204255	0.107463	-1.900697	0.0576
DUM2009	-0.346926	0.105145	-3.299500	0.0010
DUM2010	-0.178708	0.113561	-1.573676	0.1159
DUM2011	-0.023210	0.113094	-0.205230	0.8374
DUM2012	-0.113637	0.116454	-0.975810	0.3294
DUM2013	0.021809	0.118239	0.184447	0.8537
DUM2014	0.005556	0.114193	0.048657	0.9612
DUM2015	0.003043	0.117221	0.025959	0.9793
DUM2016	-0.041944	0.113066	-0.370974	0.7107
DUM2017	-0.028275	0.118025	-0.239566	0.8107
HEALTHCAREDUM	0.386830	0.129964	2.976427	0.0030
INDUSTRIALSDUM	-0.263524	0.067120	-3.926137	0.0001
CONSGOODSDUM	-0.095896	0.085944	-1.115788	0.2648
CONSSERVDUM	0.440146	0.094913	4.637339	0.0000
OILGASDUM	0.948023	0.642300	1.475981	0.1403
TECHDUM	-0.008499	0.104991	-0.080947	0.9355

R-squared	0.395381	Mean dependent var	1.582119
Adjusted R-squared	0.378903	S.D. dependent var	0.841936
S.E. of regression	0.663527	Akaike info criterion	2.044644
Sum squared resid	420.0162	Schwarz criterion	2.179192
Log likelihood	-975.8977	Hannan-Quinn criterion	2.095829
F-statistic	23.99431	Durbin-Watson statistic	2.035332
Prob(F-statistic)	0.000000	Wald F-statistic	26.05190
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 13:23
Sample: 1 1292
Included observations: 1044
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.543680	0.352214	7.221977	0.0000
DERTOTAL_BIN	0.128891	0.050783	2.538048	0.0113
DIVYIELDWINS_BIN	-0.078010	0.053584	-1.455843	0.1457
RDSALESWINS_BIN	0.040819	0.056307	0.724934	0.4687
FORSALESWINS_BIN	0.317803	0.052121	6.097447	0.0000
CRWINS	-0.118535	0.028782	-4.118402	0.0000
ROAWINSB	0.038226	0.003759	10.16910	0.0000
LNTOTASS	-0.077320	0.020593	-3.754617	0.0002
LEVDAWINS	-0.055764	0.115982	-0.480800	0.6308
DUM2006	0.195097	0.142913	1.365139	0.1725
DUM2007	0.251313	0.132480	1.896990	0.0581
DUM2008	-0.240758	0.129054	-1.865551	0.0624
DUM2009	-0.323781	0.129094	-2.508096	0.0123
DUM2010	-0.247518	0.132730	-1.864825	0.0625
DUM2011	-0.133936	0.126434	-1.059338	0.2897
DUM2012	-0.078297	0.127550	-0.613850	0.5395
DUM2013	0.095272	0.134050	0.710718	0.4774
DUM2014	0.036035	0.132967	0.271009	0.7864

DUM2015	-0.002546	0.136644	-0.018632	0.9851
DUM2016	-0.102856	0.125482	-0.819689	0.4126
DUM2017	-0.006197	0.131117	-0.047262	0.9623
HEALTHCAREDUM	0.321848	0.112565	2.859223	0.0043
INDUSTRIALSDUM	-0.245290	0.069431	-3.532886	0.0004
CONSGOODSDUM	-0.040959	0.086964	-0.470984	0.6378
CONSSERVDUM	0.431711	0.097941	4.407873	0.0000
OILGASDUM	0.549393	0.372707	1.474062	0.1408
TECHDUM	0.028919	0.110586	0.261505	0.7938

R-squared	0.368979	Mean dependent var	1.601715
Adjusted R-squared	0.352847	S.D. dependent var	0.843889
S.E. of regression	0.678873	Akaike info criterion	2.088757
Sum squared resid	468.7036	Schwarz criterion	2.216795
Log likelihood	-1063.331	Hannan-Quinn criterion	2.137319
F-statistic	22.87209	Durbin-Watson statistic	1.985639
Prob(F-statistic)	0.000000	Wald F-statistic	27.66604
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 13:25
Sample: 1 1237
Included observations: 1009
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.287345	0.344295	6.643560	0.0000
DERTOTAL_BIN	0.132804	0.049124	2.703449	0.0070
DIVYIELDWINS_BIN	-0.062300	0.053304	-1.168770	0.2428
RDSALESWINS_BIN	0.029948	0.057365	0.522060	0.6017
FORSALESWINS_BIN	0.324512	0.058379	5.558756	0.0000
CRWINS	-0.103053	0.027726	-3.716787	0.0002
ROAWINSB	0.040197	0.003854	10.42920	0.0000
LNTOTASS	-0.072664	0.022680	-3.203823	0.0014
LEVDAWINS	-0.000758	0.096449	-0.007863	0.9937
DUM2006	0.290753	0.133101	2.184458	0.0292
DUM2007	0.433068	0.121636	3.560363	0.0004
DUM2008	0.023860	0.118771	0.200892	0.8408
DUM2009	-0.345288	0.096598	-3.574465	0.0004
DUM2010	-0.067592	0.103833	-0.650963	0.5152
DUM2011	0.036994	0.104928	0.352564	0.7245
DUM2012	0.016179	0.108931	0.148522	0.8820
DUM2013	0.147025	0.113063	1.300381	0.1938
DUM2014	0.109885	0.105577	1.040811	0.2982
DUM2015	0.232919	0.114713	2.030454	0.0426
DUM2016	0.046052	0.103524	0.444842	0.6565
DUM2017	0.046699	0.111350	0.419386	0.6750
HEALTHCAREDUM	0.252606	0.130854	1.930440	0.0538
INDUSTRIALSDUM	-0.254944	0.067977	-3.750471	0.0002
CONSGOODSDUM	-0.076802	0.082017	-0.936411	0.3493
CONSSERVDUM	0.433176	0.103456	4.187036	0.0000
OILGASDUM	0.275057	0.387395	0.710017	0.4779
TECHDUM	0.012644	0.111564	0.113335	0.9098

R-squared	0.389187	Mean dependent var	1.597520
Adjusted R-squared	0.373015	S.D. dependent var	0.843233
S.E. of regression	0.667692	Akaike info criterion	2.056415
Sum squared resid	437.7881	Schwarz criterion	2.187983
Log likelihood	-1010.462	Hannan-Quinn criterion	2.106398

F-statistic	24.06516	Durbin-Watson statistic	2.166277
Prob(F-statistic)	0.000000	Wald F-statistic	25.40381
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 13:27
Sample: 1 1277
Included observations: 1042
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.173963	0.357652	6.078430	0.0000
DERTOTAL_BIN	0.070783	0.048655	1.454773	0.1460
DIVYIELDWINS_BIN	-0.084929	0.049790	-1.705754	0.0884
RDSALESWINS_BIN	0.018387	0.054699	0.336142	0.7368
FORSALESWINS_BIN	0.324210	0.054463	5.952853	0.0000
CRWINS	-0.136261	0.025765	-5.288688	0.0000
ROAWINSB	0.042155	0.003741	11.26754	0.0000
LNTOTASS	-0.061648	0.020982	-2.938211	0.0034
LEVDAWINS	-0.111068	0.104787	-1.059940	0.2894
DUM2006	0.389524	0.131858	2.954124	0.0032
DUM2007	0.620003	0.117680	5.268532	0.0000
DUM2008	0.024132	0.120052	0.201017	0.8407
DUM2009	-0.165325	0.109257	-1.513168	0.1305
DUM2010	-0.073757	0.113427	-0.650260	0.5157
DUM2011	0.056845	0.114286	0.497390	0.6190
DUM2012	0.101971	0.113490	0.898500	0.3691
DUM2013	0.163367	0.112605	1.450795	0.1471
DUM2014	0.128738	0.115396	1.115613	0.2649
DUM2015	0.214670	0.119033	1.803452	0.0716
DUM2016	0.111337	0.116889	0.952501	0.3411
DUM2017	0.038005	0.114602	0.331624	0.7402
HEALTHCAREDUM	0.368152	0.132238	2.784004	0.0055
INDUSTRIALSDUM	-0.181468	0.062837	-2.887891	0.0040
CONSGOODSDUM	-0.071955	0.082178	-0.875606	0.3815
CONSSERVDUM	0.420409	0.092522	4.543907	0.0000
OILGASDUM	0.956161	0.715322	1.336685	0.1816
TECHDUM	0.023901	0.098261	0.243242	0.8079

R-squared	0.397131	Mean dependent var	1.596138
Adjusted R-squared	0.381688	S.D. dependent var	0.835424
S.E. of regression	0.656918	Akaike info criterion	2.023054
Sum squared resid	438.0140	Schwarz criterion	2.151288
Log likelihood	-1027.011	Hannan-Quinn criterion	2.071695
F-statistic	25.71597	Durbin-Watson statistic	2.062725
Prob(F-statistic)	0.000000	Wald F-statistic	25.89803
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 13:31
Sample: 1 1257
Included observations: 1038
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.

C	2.546683	0.344792	7.386146	0.0000
DERTOTAL_BIN	0.109737	0.049115	2.234300	0.0257
DIVYIELDWINS_BIN	-0.049101	0.050768	-0.967160	0.3337
RDSALESWINS_BIN	0.072232	0.053003	1.362781	0.1733
FORSALESWINS_BIN	0.343476	0.053193	6.457158	0.0000
CRWINS	-0.149151	0.026231	-5.686148	0.0000
ROAWINSB	0.041903	0.003749	11.17659	0.0000
LNTOTASS	-0.091686	0.020477	-4.477599	0.0000
LEVDAWINS	0.009523	0.106920	0.089070	0.9290
DUM2006	0.267128	0.121360	2.201125	0.0280
DUM2007	0.456907	0.109215	4.183563	0.0000
DUM2008	-0.088128	0.100564	-0.876342	0.3811
DUM2009	-0.156857	0.095104	-1.649322	0.0994
DUM2010	0.001217	0.105706	0.011510	0.9908
DUM2011	0.055978	0.102021	0.548691	0.5833
DUM2012	0.088461	0.102043	0.866898	0.3862
DUM2013	0.120415	0.103652	1.161722	0.2456
DUM2014	0.281971	0.107264	2.628758	0.0087
DUM2015	0.159723	0.106929	1.493737	0.1356
DUM2016	0.228850	0.109378	2.092283	0.0367
DUM2017	0.104731	0.101324	1.033626	0.3016
HEALTHCAREDUM	0.522315	0.131622	3.968286	0.0001
INDUSTRIALSDUM	-0.212721	0.064309	-3.307782	0.0010
CONSGOODSDUM	-0.073437	0.076037	-0.965810	0.3344
CONSSERVDUM	0.583527	0.089711	6.504523	0.0000
OILGASDUM	0.822156	0.462843	1.776316	0.0760
TECHDUM	-0.079583	0.096442	-0.825194	0.4095

R-squared	0.397052	Mean dependent var	1.599089
Adjusted R-squared	0.381546	S.D. dependent var	0.841070
S.E. of regression	0.661433	Akaike info criterion	2.036850
Sum squared resid	442.3055	Schwarz criterion	2.165478
Log likelihood	-1030.125	Hannan-Quinn criterion	2.085649
F-statistic	25.60624	Durbin-Watson statistic	2.152207
Prob(F-statistic)	0.000000	Wald F-statistic	26.07308
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 13:32
Sample: 1 1304
Included observations: 1050
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.706383	0.347697	7.783744	0.0000
DERTOTAL_BIN	0.180340	0.052398	3.441704	0.0006
DIVYIELDWINS_BIN	-0.002946	0.052540	-0.056074	0.9553
RDSALESWINS_BIN	0.049651	0.051558	0.963014	0.3358
FORSALESWINS_BIN	0.319516	0.055739	5.732363	0.0000
CRWINS	-0.124305	0.029144	-4.265216	0.0000
ROAWINSB	0.035504	0.003569	9.946746	0.0000
LNTOTASS	-0.088319	0.021256	-4.155026	0.0000
LEVDAWINS	-0.058549	0.114304	-0.512224	0.6086
DUM2006	0.212801	0.147860	1.439203	0.1504
DUM2007	0.273187	0.129800	2.104673	0.0356
DUM2008	-0.125252	0.134022	-0.934562	0.3502

DUM2009	-0.371428	0.120666	-3.078145	0.0021
DUM2010	-0.204775	0.128915	-1.588449	0.1125
DUM2011	-0.160953	0.127611	-1.261284	0.2075
DUM2012	-0.004705	0.131993	-0.035645	0.9716
DUM2013	-0.141531	0.128265	-1.103426	0.2701
DUM2014	-0.038179	0.134168	-0.284561	0.7760
DUM2015	0.012779	0.131678	0.097047	0.9227
DUM2016	-0.000210	0.132010	-0.001591	0.9987
DUM2017	-0.021199	0.133034	-0.159353	0.8734
HEALTHCAREDUM	0.449322	0.125313	3.585608	0.0004
INDUSTRIALSDUM	-0.291681	0.066448	-4.389642	0.0000
CONSGOODSDUM	-0.031685	0.088795	-0.356829	0.7213
CONSSERVDUM	0.381725	0.098374	3.880357	0.0001
OILGASDUM	1.195567	0.559530	2.136735	0.0329
TECHDUM	0.002343	0.107207	0.021857	0.9826

R-squared	0.354646	Mean dependent var	1.599607
Adjusted R-squared	0.338244	S.D. dependent var	0.851448
S.E. of regression	0.692640	Akaike info criterion	2.128764
Sum squared resid	490.7840	Schwarz criterion	2.256218
Log likelihood	-1090.601	Hannan-Quinn criterion	2.177091
F-statistic	21.62215	Durbin-Watson statistic	2.125323
Prob(F-statistic)	0.000000	Wald F-statistic	23.99161
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 13:35
Sample (adjusted): 2 1237
Included observations: 1010 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.527078	0.372782	6.778961	0.0000
DERTOTAL_BIN	0.174315	0.053714	3.245220	0.0012
DIVYIELDWINS_BIN	-0.013860	0.051866	-0.267220	0.7894
RDSALESWINS_BIN	-0.065208	0.053987	-1.207849	0.2274
FORSALESWINS_BIN	0.299188	0.053390	5.603804	0.0000
CRWINS	-0.139283	0.028315	-4.919098	0.0000
ROAWINSB	0.035915	0.004020	8.934448	0.0000
LNTOTASS	-0.071207	0.022101	-3.221937	0.0013
LEVDAWINS	-0.112042	0.104475	-1.072428	0.2838
DUM2006	0.257029	0.141018	1.822666	0.0687
DUM2007	0.307480	0.138783	2.215550	0.0270
DUM2008	-0.269751	0.129141	-2.088815	0.0370
DUM2009	-0.399941	0.129582	-3.086386	0.0021
DUM2010	-0.192038	0.134649	-1.426211	0.1541
DUM2011	-0.207169	0.124454	-1.664627	0.0963
DUM2012	-0.184307	0.129079	-1.427862	0.1536
DUM2013	-0.013086	0.125207	-0.104518	0.9168
DUM2014	-0.101524	0.129068	-0.786598	0.4317
DUM2015	-0.137122	0.137225	-0.999252	0.3179
DUM2016	-0.166549	0.130368	-1.277532	0.2017
DUM2017	-0.073435	0.134655	-0.545359	0.5856
HEALTHCAREDUM	0.440074	0.136113	3.233159	0.0013
INDUSTRIALSDUM	-0.213615	0.063211	-3.379377	0.0008
CONSGOODSDUM	-0.021514	0.083048	-0.259052	0.7956
CONSSERVDUM	0.454079	0.104250	4.355679	0.0000
OILGASDUM	0.178044	0.194058	0.917479	0.3591
TECHDUM	0.023393	0.110099	0.212470	0.8318

R-squared	0.372494	Mean dependent var	1.589003
Adjusted R-squared	0.355896	S.D. dependent var	0.827712
S.E. of regression	0.664289	Akaike info criterion	2.046171
Sum squared resid	433.7787	Schwarz criterion	2.177635
Log likelihood	-1006.316	Hannan-Quinn criterion.	2.096112
F-statistic	22.44301	Durbin-Watson statistic	2.121418
Prob(F-statistic)	0.000000	Wald F-statistic	24.84417
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 13:37
Sample (adjusted): 2 1247
Included observations: 1023 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.530218	0.335756	7.535890	0.0000
DERTOTAL_BIN	0.135404	0.049929	2.711935	0.0068
DIVYIELDWINS_BIN	-0.003266	0.050540	-0.064619	0.9485
RDSALESWINS_BIN	0.047924	0.055610	0.861790	0.3890
FORSALESWINS_BIN	0.300514	0.053150	5.654026	0.0000
CRWINS	-0.121823	0.028851	-4.222557	0.0000
ROAWINSB	0.037515	0.003762	9.972970	0.0000
LNTOTASS	-0.083593	0.021136	-3.955073	0.0001
LEVDAWINS	-0.011885	0.108888	-0.109150	0.9131
DUM2006	0.294511	0.127369	2.312258	0.0210
DUM2007	0.379199	0.115613	3.279904	0.0011
DUM2008	-0.137196	0.112211	-1.222661	0.2217
DUM2009	-0.344562	0.106503	-3.235236	0.0013
DUM2010	-0.166761	0.112647	-1.480393	0.1391
DUM2011	-0.048464	0.116836	-0.414802	0.6784
DUM2012	-0.017248	0.113960	-0.151347	0.8797
DUM2013	0.038543	0.113180	0.340546	0.7335
DUM2014	0.101807	0.120061	0.847962	0.3967
DUM2015	-0.001293	0.122981	-0.010514	0.9916
DUM2016	0.019296	0.116257	0.165980	0.8682
DUM2017	0.090386	0.120166	0.752173	0.4521
HEALTHCAREDUM	0.356751	0.138083	2.583597	0.0099
INDUSTRIALSDUM	-0.227650	0.064569	-3.525660	0.0004
CONSGOODSDUM	-0.021050	0.082080	-0.256462	0.7976
CONSSERVDUM	0.491432	0.094425	5.204489	0.0000
OILGASDUM	0.500899	0.420304	1.191753	0.2336
TECHDUM	-0.051972	0.105211	-0.493980	0.6214

R-squared	0.368778	Mean dependent var	1.595544
Adjusted R-squared	0.352300	S.D. dependent var	0.824678
S.E. of regression	0.663699	Akaike info criterion	2.044063
Sum squared resid	438.7346	Schwarz criterion	2.174193
Log likelihood	-1018.538	Hannan-Quinn criterion	2.093467
F-statistic	22.38046	Durbin-Watson statistic	2.097355
Prob(F-statistic)	0.000000	Wald F-statistic	22.47642
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 13:39

Sample (adjusted): 2 1283
Included observations: 1070 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.423993	0.334307	7.250797	0.0000
DERTOTAL_BIN	0.173947	0.050405	3.450960	0.0006
DIVYIELDWINS_BIN	-0.045415	0.050774	-0.894459	0.3713
RDSALESWINS_BIN	0.035874	0.055519	0.646161	0.5183
FORSALESWINS_BIN	0.313623	0.052326	5.993677	0.0000
CRWINS	-0.101788	0.028885	-3.523915	0.0004
ROAWINSB	0.037167	0.003842	9.673582	0.0000
LNTOTASS	-0.080809	0.020417	-3.958023	0.0001
LEVDAWINS	-0.038053	0.108117	-0.351964	0.7249
DUM2006	0.378101	0.134165	2.818184	0.0049
DUM2007	0.371302	0.122746	3.024955	0.0025
DUM2008	-0.102429	0.113354	-0.903624	0.3664
DUM2009	-0.222413	0.118826	-1.871752	0.0615
DUM2010	-0.182323	0.109611	-1.663367	0.0965
DUM2011	-0.025603	0.115228	-0.222198	0.8242
DUM2012	-0.078945	0.113714	-0.694235	0.4877
DUM2013	0.105519	0.120228	0.877661	0.3803
DUM2014	0.093718	0.122620	0.764296	0.4449
DUM2015	0.124620	0.122285	1.019089	0.3084
DUM2016	-0.009632	0.118980	-0.080954	0.9355
DUM2017	0.083186	0.124883	0.666108	0.5055
HEALTHCAREDUM	0.346422	0.123751	2.799337	0.0052
INDUSTRIALSDUM	-0.219636	0.062152	-3.533877	0.0004
CONSGOODSDUM	-0.037987	0.076899	-0.493987	0.6214
CONSSERVDUM	0.477835	0.098438	4.854165	0.0000
OILGASDUM	0.895384	0.504332	1.775387	0.0761
TECHDUM	0.012908	0.103709	0.124465	0.9010

R-squared	0.355096	Mean dependent var	1.591791
Adjusted R-squared	0.339019	S.D. dependent var	0.827348
S.E. of regression	0.672640	Akaike info criterion	2.069696
Sum squared resid	471.8995	Schwarz criterion	2.195244
Log likelihood	-1080.288	Hannan-Quinn criterion.	2.117256
F-statistic	22.08824	Durbin-Watson statistic	2.093410
Prob(F-statistic)	0.000000	Wald F-statistic	24.60301
Prob(Wald F-statistic)	0.000000		

Key to variables in Table B.2:

TOBINQWINS	Tobin's Q
DERTOTAL_BIN	Dummy variable of 1/(0) if derivatives amount is/(not) reported
LNTOTASS	Natural logarithm of total assets
DIVYIELDWINS_BIN	Dividend yield
RDSALESWINS_BIN	Ratio of research and development costs divided by sales
FORSALESWINS_BIN	Ratio of foreign sales divided by sales
ROAWINSB	Return on assets
CRWINS	Current ratio
LEVDAWINS	Leverage calculated as the ratio of debt to assets
DUM2006	Year dummy variable
HEALTHCAREDUM	Sector dummy variable

Table B.3: Random sample permutation tests Hypothesis 2_continuous

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 13:50
Sample (adjusted): 162 1260
Included observations: 383 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.491311	0.457186	1.074641	0.2833
DERTOTALWINSB	1.81E-07	1.54E-07	1.173043	0.2416
DIVYIELDWINS_BIN	0.025202	0.080689	0.312334	0.7550
RDSALESWINS_BIN	0.153673	0.073504	2.090680	0.0373
FORSALESWINS_BIN	0.144165	0.068237	2.112729	0.0353
ROAWINSB	0.066561	0.006697	9.938938	0.0000
LEVDAWINS	0.115367	0.124862	0.923954	0.3561
DUM2006	-0.191560	0.243735	-0.785937	0.4324
DUM2007	-0.110842	0.198377	-0.558740	0.5767
DUM2008	-0.565490	0.140271	-4.031415	0.0001
DUM2009	-0.346207	0.141630	-2.444446	0.0150
DUM2010	-0.199300	0.156268	-1.275376	0.2030
DUM2011	-0.341657	0.129669	-2.634836	0.0088
DUM2012	-0.193388	0.137938	-1.401998	0.1618
DUM2013	-0.081805	0.139989	-0.584370	0.5593
DUM2014	-0.036169	0.142494	-0.253826	0.7998
DUM2015	-0.179253	0.142416	-1.258661	0.2090
DUM2016	-0.338269	0.126212	-2.680157	0.0077
HEALTHCAREDUM	0.230574	0.162465	1.419223	0.1567
INDUSTRIALSDUM	0.014048	0.086811	0.161818	0.8715
CONSGOODSDUM	0.110163	0.103932	1.059953	0.2899
CONSSERVDUM	0.714742	0.161377	4.429015	0.0000
TECHDUM	0.135146	0.157140	0.860036	0.3903
LNTOTASS	0.036703	0.026699	1.374688	0.1701
CRWINS	-0.145569	0.042787	-3.402165	0.0007

R-squared	0.590401	Mean dependent var	1.651771
Adjusted R-squared	0.562942	S.D. dependent var	0.836882
S.E. of regression	0.553266	Akaike info criterion	1.717090
Sum squared resid	109.5849	Schwarz criterion	1.974794
Log likelihood	-303.8227	Hannan-Quinn criterion	1.819317
F-statistic	21.50111	Durbin-Watson statistic	1.890201
Prob(F-statistic)	0.000000	Wald F-statistic	18.58175
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 13:52
Sample (adjusted): 9 1203
Included observations: 354 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.287724	0.440226	2.925142	0.0037
DERTOTALWINSB	1.31E-07	1.57E-07	0.830873	0.4066
DIVYIELDWINS_BIN	-0.065556	0.103466	-0.633602	0.5268
RDSALESWINS_BIN	0.114031	0.095235	1.197361	0.2320
FORSALESWINS_BIN	0.170215	0.074714	2.278205	0.0234

ROAWINSB	0.057909	0.007337	7.892645	0.0000
LEVDAWINS	0.056948	0.124422	0.457703	0.6475
DUM2006	-0.062039	0.147558	-0.420441	0.6744
DUM2007	0.282303	0.210266	1.342597	0.1803
DUM2008	-0.392527	0.169283	-2.318762	0.0210
DUM2009	-0.349102	0.160718	-2.172137	0.0306
DUM2010	-0.141424	0.150066	-0.942410	0.3467
DUM2011	-0.099041	0.136078	-0.727821	0.4672
DUM2012	-0.117682	0.152368	-0.772356	0.4405
DUM2013	0.019218	0.139815	0.137452	0.8908
DUM2014	0.075266	0.184121	0.408784	0.6830
DUM2015	-0.004990	0.142687	-0.034974	0.9721
DUM2016	-0.200362	0.136901	-1.463560	0.1443
HEALTHCAREDUM	0.312163	0.175386	1.779858	0.0760
INDUSTRIALSDUM	-0.170161	0.091738	-1.854865	0.0645
CONSGOODSDUM	0.028223	0.117739	0.239708	0.8107
CONSSERVDUM	0.593818	0.216650	2.740908	0.0065
TECHDUM	-0.035004	0.191889	-0.182416	0.8554
LNTOTASS	-0.005764	0.026576	-0.216872	0.8284
CRWINS	-0.087321	0.075075	-1.163115	0.2456

R-squared	0.513032	Mean dependent var	1.642623
Adjusted R-squared	0.477509	S.D. dependent var	0.810640
S.E. of regression	0.585960	Akaike info criterion	1.836872
Sum squared resid	112.9617	Schwarz criterion	2.110127
Log likelihood	-300.1263	Hannan-Quinn criterion	1.945591
F-statistic	14.44207	Durbin-Watson statistic	1.960250
Prob(F-statistic)	0.000000	Wald F-statistic	13.09566
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 13:53
Sample (adjusted): 11 1285
Included observations: 353 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.825997	0.487117	1.695686	0.0909
DERTOTALWINSB	1.43E-07	1.64E-07	0.872720	0.3835
DIVYIELDWINS_BIN	0.021503	0.097351	0.220886	0.8253
RDSALESWINS_BIN	0.203267	0.083784	2.426076	0.0158
FORSALESWINS_BIN	0.196069	0.070596	2.777319	0.0058
ROAWINSB	0.069356	0.007067	9.814229	0.0000
LEVDAWINS	0.060075	0.129925	0.462378	0.6441
DUM2006	-0.247693	0.146820	-1.687054	0.0925
DUM2007	-0.183388	0.173873	-1.054722	0.2923
DUM2008	-0.532018	0.149757	-3.552529	0.0004
DUM2009	-0.287028	0.161974	-1.772064	0.0773
DUM2010	-0.277362	0.174232	-1.591909	0.1124
DUM2011	-0.270835	0.127930	-2.117054	0.0350
DUM2012	-0.121640	0.140988	-0.862768	0.3889
DUM2013	0.032187	0.130888	0.245915	0.8059
DUM2014	-0.092120	0.161564	-0.570178	0.5689
DUM2015	-0.243344	0.130461	-1.865265	0.0630
DUM2016	-0.184167	0.138369	-1.330985	0.1841
HEALTHCAREDUM	0.309371	0.135862	2.277094	0.0234
INDUSTRIALSDUM	-0.020410	0.090733	-0.224952	0.8222
CONSGOODSDUM	0.006527	0.109864	0.059407	0.9527
CONSSERVDUM	0.553658	0.173232	3.196050	0.0015

TECHDUM	0.135427	0.166412	0.813803	0.4163
LNTOTASS	0.012049	0.028941	0.416337	0.6774
CRWINS	-0.119252	0.044277	-2.693316	0.0074

R-squared	0.588630	Mean dependent var	1.645446
Adjusted R-squared	0.558530	S.D. dependent var	0.851054
S.E. of regression	0.565467	Akaike info criterion	1.765860
Sum squared resid	104.8791	Schwarz criterion	2.039689
Log likelihood	-286.6743	Hannan-Quinn criterion	1.874819
F-statistic	19.55569	Durbin-Watson statistic	1.866714
Prob(F-statistic)	0.000000	Wald F-statistic	15.89613
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 13:54
Sample (adjusted): 8 1237
Included observations: 354 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.772700	0.495888	1.558214	0.1201
DERTOTALWINSB	2.27E-07	1.83E-07	1.242950	0.2148
DIVYIELDWINS_BIN	0.088354	0.100595	0.878317	0.3804
RDSALESWINS_BIN	0.070411	0.076028	0.926124	0.3551
FORSALESWINS_BIN	0.240615	0.079112	3.041453	0.0025
ROAWINSB	0.060373	0.006888	8.764370	0.0000
LEVDAWINS	0.033379	0.159534	0.209227	0.8344
DUM2006	0.222458	0.255105	0.872027	0.3838
DUM2007	0.357117	0.186448	1.915376	0.0563
DUM2008	-0.321076	0.160155	-2.004780	0.0458
DUM2009	-0.295075	0.129181	-2.284208	0.0230
DUM2010	0.038424	0.139670	0.275104	0.7834
DUM2011	-0.076746	0.126947	-0.604553	0.5459
DUM2012	0.088524	0.124825	0.709185	0.4787
DUM2013	0.255760	0.126153	2.027379	0.0434
DUM2014	0.199004	0.147623	1.348055	0.1786
DUM2015	0.181362	0.139721	1.298032	0.1952
DUM2016	-0.062700	0.131905	-0.475339	0.6349
HEALTHCAREDUM	0.194617	0.190404	1.022123	0.3075
INDUSTRIALSDUM	-0.079582	0.095802	-0.830691	0.4068
CONSGOODSDUM	0.017860	0.109784	0.162680	0.8709
CONSSERVDUM	0.583557	0.185679	3.142827	0.0018
TECHDUM	0.106156	0.193381	0.548949	0.5834
LNTOTASS	0.005628	0.030284	0.185841	0.8527
CRWINS	-0.115629	0.042512	-2.719891	0.0069

R-squared	0.570928	Mean dependent var	1.669206
Adjusted R-squared	0.539628	S.D. dependent var	0.842069
S.E. of regression	0.571350	Akaike info criterion	1.786374
Sum squared resid	107.3990	Schwarz criterion	2.059629
Log likelihood	-291.1882	Hannan-Quinn criterion	1.895094
F-statistic	18.24044	Durbin-Watson statistic	2.307925
Prob(F-statistic)	0.000000	Wald F-statistic	14.84327
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 13:57
Sample (adjusted): 49 1275
Included observations: 375 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.497892	0.445559	1.117454	0.2646
DERTOTALWINSB	9.99E-08	1.62E-07	0.617321	0.5374
DIVYIELDWINS_BIN	0.090020	0.072348	1.244259	0.2142
RDSALESWINS_BIN	0.082043	0.081372	1.008247	0.3140
FORSALESWINS_BIN	0.182546	0.064916	2.812054	0.0052
ROAWINSB	0.063693	0.006198	10.27625	0.0000
LEVDAWINS	0.116533	0.116127	1.003499	0.3163
DUM2006	0.384154	0.210463	1.825277	0.0688
DUM2007	0.319392	0.156102	2.046049	0.0415
DUM2008	-0.244095	0.127676	-1.911838	0.0567
DUM2009	-0.088409	0.116965	-0.755855	0.4502
DUM2010	0.012569	0.133142	0.094401	0.9248
DUM2011	0.035560	0.120608	0.294837	0.7683
DUM2012	0.185089	0.123725	1.495964	0.1356
DUM2013	0.295986	0.120664	2.452983	0.0147
DUM2014	0.185299	0.114932	1.612258	0.1078
DUM2015	0.187462	0.127701	1.467970	0.1430
DUM2016	-0.114437	0.105789	-1.081746	0.2801
HEALTHCAREDUM	0.326983	0.158249	2.066259	0.0395
INDUSTRIALSDUM	-0.118676	0.084049	-1.411986	0.1588
CONSGOODSDUM	-0.034240	0.111252	-0.307770	0.7584
CONSSERVDUM	0.533256	0.150027	3.554406	0.0004
TECHDUM	-0.021703	0.153193	-0.141670	0.8874
LNTOTASS	0.017293	0.026861	0.643807	0.5201
CRWINS	-0.081788	0.038467	-2.126168	0.0342

R-squared	0.605022	Mean dependent var	1.612855
Adjusted R-squared	0.577938	S.D. dependent var	0.816007
S.E. of regression	0.530130	Akaike info criterion	1.632950
Sum squared resid	98.36312	Schwarz criterion	1.894745
Log likelihood	-281.1782	Hannan-Quinn criterion	1.736884
F-statistic	22.33857	Durbin-Watson statistic	1.762815
Prob(F-statistic)	0.000000	Wald F-statistic	16.11593
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 14:00
Sample (adjusted): 49 1247
Included observations: 359 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.122602	0.417730	0.293497	0.7693
DERTOTALWINSB	1.06E-07	1.29E-07	0.819201	0.4133
DIVYIELDWINS_BIN	0.038015	0.092816	0.409576	0.6824
RDSALESWINS_BIN	0.147817	0.071559	2.065670	0.0396
FORSALESWINS_BIN	0.168108	0.065340	2.572817	0.0105
ROAWINSB	0.074649	0.006178	12.08368	0.0000
LEVDAWINS	0.279177	0.121524	2.297303	0.0222

DUM2006	0.092141	0.184550	0.499274	0.6179
DUM2007	0.212750	0.157830	1.347968	0.1786
DUM2008	-0.440361	0.133602	-3.296065	0.0011
DUM2009	-0.137836	0.130888	-1.053084	0.2931
DUM2010	0.026928	0.125043	0.215352	0.8296
DUM2011	-0.173658	0.117380	-1.479456	0.1400
DUM2012	0.053889	0.117896	0.457084	0.6479
DUM2013	0.046431	0.120670	0.384781	0.7006
DUM2014	0.224414	0.135325	1.658328	0.0982
DUM2015	-0.046572	0.111893	-0.416223	0.6775
DUM2016	0.040372	0.120085	0.336193	0.7369
HEALTHCAREDUM	0.290218	0.214500	1.352998	0.1770
INDUSTRIALSDUM	-0.047317	0.073241	-0.646039	0.5187
CONSGOODSDUM	0.057828	0.101232	0.571238	0.5682
CONSSERVDUM	0.870013	0.158428	5.491519	0.0000
TECHDUM	-0.140737	0.165467	-0.850547	0.3956
LNTOTASS	0.033671	0.025311	1.330284	0.1843
CRWINS	-0.071515	0.042800	-1.670898	0.0957

R-squared	0.643845	Mean dependent var	1.669006
Adjusted R-squared	0.618253	S.D. dependent var	0.838970
S.E. of regression	0.518364	Akaike info criterion	1.590815
Sum squared resid	89.74606	Schwarz criterion	1.861241
Log likelihood	-260.5512	Hannan-Quinn criterion	1.698352
F-statistic	25.15806	Durbin-Watson statistic	1.942306
Prob(F-statistic)	0.000000	Wald F-statistic	25.16861
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 14:01
Sample (adjusted): 203 1297
Included observations: 364 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.000115	0.523883	1.909042	0.0571
DERTOTALWINSB	4.82E-07	1.57E-07	3.073803	0.0023
DIVYIELDWINS_BIN	0.061531	0.092411	0.665841	0.5060
RDSALESWINS_BIN	0.182380	0.076756	2.376093	0.0181
FORSALESWINS_BIN	0.128085	0.068617	1.866666	0.0628
ROAWINSB	0.061758	0.005531	11.16586	0.0000
LEVDAWINS	0.008525	0.146972	0.058005	0.9538
DUM2006	0.232269	0.257427	0.902273	0.3676
DUM2007	0.345829	0.166705	2.074492	0.0388
DUM2008	-0.446005	0.141954	-3.141909	0.0018
DUM2009	-0.265756	0.135458	-1.961908	0.0506
DUM2010	-0.124615	0.139659	-0.892279	0.3729
DUM2011	-0.303196	0.128165	-2.365677	0.0186
DUM2012	0.018421	0.131134	0.140474	0.8884
DUM2013	0.026565	0.128018	0.207508	0.8357
DUM2014	0.114396	0.135126	0.846586	0.3978
DUM2015	-0.094797	0.145801	-0.650179	0.5160
DUM2016	-0.129745	0.151209	-0.858052	0.3915
HEALTHCAREDUM	0.471584	0.195300	2.414661	0.0163
INDUSTRIALSDUM	-0.042763	0.085504	-0.500123	0.6173
CONSGOODSDUM	0.123880	0.110451	1.121584	0.2628
CONSSERVDUM	0.648458	0.191248	3.390669	0.0008
TECHDUM	0.038434	0.179663	0.213925	0.8307
LNTOTASS	0.001991	0.030610	0.065059	0.9482

CRWINS	-0.137220	0.044073	-3.113456	0.0020

R-squared	0.599008	Mean dependent var	1.642251
Adjusted R-squared	0.570619	S.D. dependent var	0.842710
S.E. of regression	0.552204	Akaike info criterion	1.716409
Sum squared resid	103.3709	Schwarz criterion	1.984071
Log likelihood	-287.3865	Hannan-Quinn criterion	1.822793
F-statistic	21.10015	Durbin-Watson statistic	1.826867
Prob(F-statistic)	0.000000	Wald F-statistic	17.45408
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 14:04
Sample (adjusted): 53 1230
Included observations: 351 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.676749	0.448010	1.510567	0.1319
DERTOTALWINSB	2.75E-07	1.56E-07	1.766579	0.0782
DIVYIELDWINS_BIN	0.160679	0.095170	1.688330	0.0923
RDSALESWINS_BIN	-0.030050	0.082617	-0.363726	0.7163
FORSALESWINS_BIN	0.151494	0.067539	2.243052	0.0256
ROAWINSB	0.061204	0.007414	8.254895	0.0000
LEVDAWINS	0.043764	0.140561	0.311350	0.7557
DUM2006	0.299609	0.245092	1.222433	0.2224
DUM2007	0.158703	0.183194	0.866309	0.3870
DUM2008	-0.393792	0.181972	-2.164030	0.0312
DUM2009	-0.241131	0.166134	-1.451427	0.1476
DUM2010	-0.072708	0.158045	-0.460049	0.6458
DUM2011	-0.145882	0.152403	-0.957215	0.3392
DUM2012	-0.177014	0.151610	-1.167562	0.2438
DUM2013	0.201993	0.161809	1.248337	0.2128
DUM2014	0.065897	0.183146	0.359807	0.7192
DUM2015	-0.085452	0.158983	-0.537491	0.5913
DUM2016	-0.359796	0.132478	-2.715894	0.0070
HEALTHCAREDUM	0.472114	0.162227	2.910216	0.0039
INDUSTRIALSDUM	-0.177557	0.087128	-2.037887	0.0424
CONSGOODSDUM	0.007912	0.114112	0.069332	0.9448
CONSSERVDUM	0.510527	0.213887	2.386900	0.0176
TECHDUM	0.089230	0.190003	0.469625	0.6389
LNTOTASS	0.020987	0.025459	0.824327	0.4104
CRWINS	-0.091047	0.067730	-1.344265	0.1798

R-squared	0.550828	Mean dependent var	1.644256
Adjusted R-squared	0.517760	S.D. dependent var	0.836568
S.E. of regression	0.580942	Akaike info criterion	1.820229
Sum squared resid	110.0229	Schwarz criterion	2.095214
Log likelihood	-294.4503	Hannan-Quinn criterion	1.929672
F-statistic	16.65752	Durbin-Watson statistic	1.729174
Prob(F-statistic)	0.000000	Wald F-statistic	16.39156
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 14:11
Sample (adjusted): 98 1242

Included observations: 364 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.683387	0.434841	1.571579	0.1170
DERTOTALWINSB	1.53E-07	1.42E-07	1.080882	0.2805
DIVYIELDWINS_BIN	0.120910	0.091700	1.318543	0.1882
RDSALESWINS_BIN	0.016799	0.082705	0.203117	0.8392
FORSALESWINS_BIN	0.120091	0.071716	1.674530	0.0949
ROAWINSB	0.055456	0.006819	8.132554	0.0000
LEVDAWINS	0.066514	0.145038	0.458600	0.6468
DUM2006	0.327118	0.201889	1.620291	0.1061
DUM2007	0.263695	0.168118	1.568507	0.1177
DUM2008	-0.386047	0.121633	-3.173876	0.0016
DUM2009	-0.238541	0.132958	-1.794101	0.0737
DUM2010	0.077217	0.138834	0.556184	0.5785
DUM2011	-0.119121	0.141220	-0.843515	0.3995
DUM2012	-0.021899	0.128464	-0.170468	0.8647
DUM2013	0.118577	0.129614	0.914846	0.3609
DUM2014	0.147077	0.166865	0.881414	0.3787
DUM2015	0.015861	0.152483	0.104018	0.9172
DUM2016	-0.139783	0.120838	-1.156786	0.2482
HEALTHCAREDUM	0.346044	0.170180	2.033400	0.0428
INDUSTRIALSDUM	-0.215858	0.083142	-2.596258	0.0098
CONSGOODSDUM	-0.011074	0.122102	-0.090691	0.9278
CONSSERVDUM	0.494154	0.206305	2.395262	0.0172
TECHDUM	0.077444	0.190476	0.406581	0.6846
LNTOTASS	0.020119	0.025757	0.781120	0.4353
CRWINS	-0.063788	0.056185	-1.135308	0.2570

R-squared	0.517263	Mean dependent var	1.638844
Adjusted R-squared	0.483087	S.D. dependent var	0.806280
S.E. of regression	0.579688	Akaike info criterion	1.813556
Sum squared resid	113.9170	Schwarz criterion	2.081217
Log likelihood	-305.0671	Hannan-Quinn criterion	1.919939
F-statistic	15.13526	Durbin-Watson statistic	1.936007
Prob(F-statistic)	0.000000	Wald F-statistic	13.66562
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 14:13
Sample (adjusted): 11 1282
Included observations: 387 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.114304	0.507681	2.194888	0.0288
DERTOTALWINSB	1.85E-07	1.56E-07	1.190921	0.2345
DIVYIELDWINS_BIN	0.067566	0.092262	0.732321	0.4644
RDSALESWINS_BIN	0.041229	0.078096	0.527927	0.5979
FORSALESWINS_BIN	0.222236	0.066033	3.365542	0.0008
ROAWINSB	0.059935	0.007656	7.828680	0.0000
LEVDAWINS	0.079817	0.120780	0.660840	0.5091
DUM2006	0.146460	0.205921	0.711245	0.4774
DUM2007	0.022115	0.203192	0.108836	0.9134
DUM2008	-0.280989	0.163642	-1.717098	0.0868
DUM2009	-0.172843	0.142497	-1.212962	0.2259

DUM2010	-0.134059	0.134353	-0.997806	0.3190
DUM2011	-0.160397	0.131336	-1.221268	0.2228
DUM2012	0.031532	0.142110	0.221884	0.8245
DUM2013	0.153764	0.125455	1.225654	0.2211
DUM2014	0.135572	0.193130	0.701975	0.4831
DUM2015	0.062330	0.139803	0.445844	0.6560
DUM2016	-0.137700	0.142535	-0.966079	0.3346
HEALTHCAREDUM	0.172337	0.145533	1.184174	0.2371
INDUSTRIALSDUM	-0.205856	0.085717	-2.401582	0.0168
CONSGOODSDUM	-0.025305	0.116919	-0.216430	0.8288
CONSSERVDUM	0.393223	0.213783	1.839350	0.0667
TECHDUM	0.099178	0.212527	0.466662	0.6410
LNTOTASS	-0.005714	0.029755	-0.192047	0.8478
CRWINS	-0.094803	0.058217	-1.628433	0.1043

R-squared	0.506276	Mean dependent var	1.634757
Adjusted R-squared	0.473543	S.D. dependent var	0.816717
S.E. of regression	0.592588	Akaike info criterion	1.853784
Sum squared resid	127.1202	Schwarz criterion	2.109496
Log likelihood	-333.7073	Hannan-Quinn criterion	1.955180
F-statistic	15.46681	Durbin-Watson statistic	2.030973
Prob(F-statistic)	0.000000	Wald F-statistic	12.38284
Prob(Wald F-statistic)	0.000000		

Key to variables in Table B.3

TOBINQWINS	Tobin's Q
DERTOTAL_BIN	Dummy variable of 1/(0) if derivatives amount is/(not) reported
LNTOTASS	Natural logarithm of total assets
DIVYIELDWINS_BIN	Dividend yield
RDSALESWINS_BIN	Ratio of research and development costs divided by sales
FORSALESWINS_BIN	Ratio of foreign sales divided by sales
ROAWINSB	Return on assets
CRWINS	Current ratio
LEVDAWINS	Leverage calculated as the ratio of debt to assets
DUM2006	Year dummy variable
HEALTHCAREDUM	Sector dummy variable

Table B.4: Random sample permutation tests Hypothesis 3_Three-period binary

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 14:19
Sample (adjusted): 2 1266
Included observations: 1044 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.554040	0.335232	7.618714	0.0000
DERTOTAL_BIN	0.118453	0.050813	2.331155	0.0199
ROAWINSB	0.037771	0.003790	9.965351	0.0000
DIVYIELDWINS_BIN	-0.075283	0.051661	-1.457252	0.1454
RDSALESWINS_BIN	0.014119	0.052901	0.266897	0.7896
FORSALESWINS_BIN	0.310317	0.054410	5.703346	0.0000
CRWINS	-0.131310	0.025651	-5.119132	0.0000
LEVDAWINS	-0.049094	0.104794	-0.468480	0.6395
LNTOTASS	-0.067785	0.020258	-3.346049	0.0008
DUMPERIOD2	-0.402876	0.079900	-5.042280	0.0000
DUMPERIOD3	-0.202202	0.068600	-2.947527	0.0033
TELEDUM	0.038566	0.132970	0.290037	0.7718
TECHDUM	0.049503	0.111552	0.443771	0.6573
CONSGOODSDUM	0.002821	0.084649	0.033331	0.9734
CONSSERVDUM	0.452989	0.098051	4.619948	0.0000
INDUSTRIALSDUM	-0.182891	0.072129	-2.535607	0.0114
HEALTHCAREDUM	0.443785	0.133982	3.312268	0.0010

R-squared	0.359249	Mean dependent var	1.596465
Adjusted R-squared	0.349267	S.D. dependent var	0.831076
S.E. of regression	0.670412	Akaike info criterion	2.054302
Sum squared resid	461.5880	Schwarz criterion	2.134919
Log likelihood	-1055.346	Hannan-Quinn criterion	2.084878
F-statistic	35.98800	Durbin-Watson statistic	2.066212
Prob(F-statistic)	0.000000	Wald F-statistic	33.97291
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 14:21
Sample (adjusted): 2 1210
Included observations: 981 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.556715	0.214369	11.92672	0.0000
DERTOTAL_BIN	0.170955	0.052600	3.250086	0.0012
ROAWINSB	0.038791	0.002748	14.11582	0.0000
DIVYIELDWINS_BIN	-0.076161	0.057260	-1.330089	0.1838
RDSALESWINS_BIN	0.031055	0.061811	0.502425	0.6155
FORSALESWINS_BIN	0.344248	0.055177	6.239034	0.0000
CRWINS	-0.103254	0.025383	-4.067887	0.0001
LEVDAWINS	0.042078	0.103468	0.406675	0.6843
LNTOTASS	-0.071148	0.014260	-4.989286	0.0000
DUMPERIOD2	-0.482269	0.076653	-6.291615	0.0000
DUMPERIOD3	-0.246378	0.059444	-4.144706	0.0000
TELEDUM	-0.095064	0.131843	-0.721040	0.4711
TECHDUM	-0.034629	0.091900	-0.376817	0.7064
CONSGOODSDUM	-0.124216	0.090305	-1.375519	0.1693
CONSSERVDUM	0.445010	0.088168	5.047301	0.0000

INDUSTRIALSDUM	-0.286402	0.064723	-4.425023	0.0000
HEALTHCAREDUM	0.359612	0.122260	2.941375	0.0033

R-squared	0.378350	Mean dependent var	1.582119
Adjusted R-squared	0.368032	S.D. dependent var	0.841936
S.E. of regression	0.669309	Akaike info criterion	2.052035
Sum squared resid	431.8473	Schwarz criterion	2.136750
Log likelihood	-989.5232	Hannan-Quinn criterion	2.084263
F-statistic	36.66942	Durbin-Watson statistic	2.000499
Prob(F-statistic)	0.000000		

Dependent Variable: *TOBINSQ*
Method: Least Squares
Date: 07/01/20 Time: 14:25
Sample: 1 1292
Included observations: 1044
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8.798410	2.697267	3.261972	0.0011
DERTOTAL_BIN	0.671585	0.248655	2.700870	0.0070
ROAWINSB	0.024407	0.019802	1.232537	0.2180
DIVYIELDWINS_BIN	-0.087058	0.250546	-0.347473	0.7283
RDSALESWINS_BIN	-0.069589	0.108954	-0.638705	0.5232
FORSALESWINS_BIN	0.779964	0.270568	2.882686	0.0040
CRWINS	-0.247282	0.142127	-1.739868	0.0822
LEVDAWINS	0.097530	0.736224	0.132473	0.8946
LNTOTASS	-0.431607	0.150428	-2.869194	0.0042
DUMPERIOD2	-0.914228	0.270424	-3.380724	0.0008
DUMPERIOD3	-0.445591	0.292819	-1.521730	0.1284
TELEDUM	-0.466960	0.379939	-1.229039	0.2193
TECHDUM	-0.658921	0.515212	-1.278931	0.2012
CONSGOODSDUM	-0.819536	0.311476	-2.631137	0.0086
CONSSERVDUM	0.573582	0.416650	1.376650	0.1689
INDUSTRIALSDUM	-0.924061	0.359851	-2.567898	0.0104
HEALTHCAREDUM	-0.475726	0.387742	-1.226913	0.2201

R-squared	0.107853	Mean dependent var	1.851964
Adjusted R-squared	0.093954	S.D. dependent var	2.684686
S.E. of regression	2.555457	Akaike info criterion	4.730489
Sum squared resid	6706.682	Schwarz criterion	4.811106
Log likelihood	-2452.315	Hannan-Quinn criterion	4.761065
F-statistic	7.759736	Durbin-Watson statistic	1.941931
Prob(F-statistic)	0.000000	Wald F-statistic	11.16602
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 14:27
Sample: 1 1237
Included observations: 1009
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.541374	0.347598	7.311245	0.0000
DERTOTAL_BIN	0.143496	0.049031	2.926659	0.0035

ROAWINSB	0.039993	0.003924	10.19303	0.0000
DIVYIELDWINS_BIN	-0.068903	0.053311	-1.292471	0.1965
RDSALESWINS_BIN	-0.000665	0.057082	-0.011646	0.9907
FORSALESWINS_BIN	0.331121	0.057581	5.750487	0.0000
CRWINS	-0.104341	0.028727	-3.632133	0.0003
LEVDAWINS	-0.011116	0.097362	-0.114169	0.9091
LNTOTASS	-0.070787	0.022347	-3.167648	0.0016
DUMPERIOD2	-0.409211	0.079701	-5.134340	0.0000
DUMPERIOD3	-0.175216	0.068479	-2.558682	0.0107
TELEDUM	-0.151071	0.149904	-1.007785	0.3138
TECHDUM	-0.023965	0.115577	-0.207354	0.8358
CONSGOODSDUM	-0.099022	0.083206	-1.190076	0.2343
CONSSERVDUM	0.446208	0.104968	4.250899	0.0000
INDUSTRIALSDUM	-0.273267	0.072181	-3.785849	0.0002
HEALTHCAREDUM	0.225400	0.131914	1.708682	0.0878

R-squared	0.366057	Mean dependent var	1.597520
Adjusted R-squared	0.355832	S.D. dependent var	0.843233
S.E. of regression	0.676780	Akaike info criterion	2.073763
Sum squared resid	454.3664	Schwarz criterion	2.156601
Log likelihood	-1029.213	Hannan-Quinn criterion	2.105233
F-statistic	35.80056	Durbin-Watson statistic	2.103641
Prob(F-statistic)	0.000000	Wald F-statistic	35.78950
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 14:28
Sample: 1 1277
Included observations: 1042
Huber-White-Hinkley (HC1) heteroskedasticity consistent-standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.541890	0.342556	7.420370	0.0000
DERTOTAL_BIN	0.095230	0.048257	1.973382	0.0487
ROAWINSB	0.042114	0.003863	10.90304	0.0000
DIVYIELDWINS_BIN	-0.109525	0.050806	-2.155761	0.0313
RDSALESWINS_BIN	-0.010124	0.054760	-0.184877	0.8534
FORSALESWINS_BIN	0.325285	0.053539	6.075725	0.0000
CRWINS	-0.133243	0.026356	-5.055573	0.0000
LEVDAWINS	-0.132373	0.102987	-1.285345	0.1990
LNTOTASS	-0.060847	0.020722	-2.936294	0.0034
DUMPERIOD2	-0.424204	0.077351	-5.484129	0.0000
DUMPERIOD3	-0.254592	0.064250	-3.962523	0.0001
TELEDUM	0.018055	0.133660	0.135081	0.8926
TECHDUM	0.002383	0.106322	0.022412	0.9821
CONSGOODSDUM	-0.076947	0.086324	-0.891384	0.3729
CONSSERVDUM	0.423595	0.095068	4.455702	0.0000
INDUSTRIALSDUM	-0.203498	0.070664	-2.879785	0.0041
HEALTHCAREDUM	0.377497	0.132277	2.853835	0.0044

R-squared	0.365045	Mean dependent var	1.596138
Adjusted R-squared	0.355134	S.D. dependent var	0.835424
S.E. of regression	0.670875	Akaike info criterion	2.055714
Sum squared resid	461.3257	Schwarz criterion	2.136454
Log likelihood	-1054.027	Hannan-Quinn criterion	2.086339
F-statistic	36.83049	Durbin-Watson statistic	2.001380
Prob(F-statistic)	0.000000	Wald F-statistic	33.69055
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 14:30
Sample: 1 1257
Included observations: 1038
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.820453	0.334817	8.423867	0.0000
DERTOTAL_BIN	0.125661	0.049015	2.563727	0.0105
ROAWINSB	0.040402	0.003784	10.67725	0.0000
DIVYIELDWINS_BIN	-0.061140	0.051760	-1.181225	0.2378
RDSALESWINS_BIN	0.038100	0.052552	0.724987	0.4686
FORSALESWINS_BIN	0.341353	0.052600	6.489660	0.0000
CRWINS	-0.146414	0.026215	-5.585222	0.0000
LEVDAWINS	-0.025893	0.105704	-0.244959	0.8065
LNTOTASS	-0.089689	0.020088	-4.464844	0.0000
DUMPERIOD2	-0.379454	0.071421	-5.312884	0.0000
DUMPERIOD3	-0.130580	0.061477	-2.124042	0.0339
TELEDUM	0.063436	0.124490	0.509571	0.6105
TECHDUM	-0.101534	0.101498	-1.000351	0.3174
CONSGOODSDUM	-0.073252	0.081090	-0.903343	0.3666
CONSSERVDUM	0.595280	0.090032	6.611857	0.0000
INDUSTRIALSDUM	-0.222205	0.071249	-3.118716	0.0019
HEALTHCAREDUM	0.523558	0.133775	3.913718	0.0001

R-squared	0.373423	Mean dependent var	1.599089
Adjusted R-squared	0.363604	S.D. dependent var	0.841070
S.E. of regression	0.670958	Akaike info criterion	2.056023
Sum squared resid	459.6391	Schwarz criterion	2.137011
Log likelihood	-1050.076	Hannan-Quinn criterion	2.086748
F-statistic	38.03056	Durbin-Watson statistic	2.085893
Prob(F-statistic)	0.000000	Wald F-statistic	35.26777
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 14:31
Sample: 1 1304
Included observations: 1050
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.904427	0.323645	8.974109	0.0000
DERTOTAL_BIN	0.174965	0.050987	3.431537	0.0006
ROAWINSB	0.034334	0.003684	9.319279	0.0000
DIVYIELDWINS_BIN	-0.022832	0.052445	-0.435358	0.6634
RDSALESWINS_BIN	0.032340	0.051473	0.628294	0.5300
FORSALESWINS_BIN	0.332472	0.055365	6.005139	0.0000
CRWINS	-0.114119	0.030114	-3.789549	0.0002
LEVDAWINS	-0.059500	0.112931	-0.526871	0.5984
LNTOTASS	-0.089506	0.020749	-4.313706	0.0000
DUMPERIOD2	-0.418668	0.080780	-5.182808	0.0000
DUMPERIOD3	-0.240082	0.068973	-3.480823	0.0005
TELEDUM	0.163172	0.155144	1.051742	0.2932
TECHDUM	-0.003339	0.110636	-0.030177	0.9759
CONSGOODSDUM	-0.039845	0.092381	-0.431312	0.6663
CONSSERVDUM	0.383081	0.100028	3.829739	0.0001

INDUSTRIALSDUM	-0.295424	0.070069	-4.216191	0.0000
HEALTHCAREDUM	0.449569	0.129368	3.475129	0.0005

R-squared	0.329065	Mean dependent var	1.599607
Adjusted R-squared	0.318673	S.D. dependent var	0.851448
S.E. of regression	0.702807	Akaike info criterion	2.148589
Sum squared resid	510.2375	Schwarz criterion	2.228838
Log likelihood	-1111.009	Hannan-Quinn criterion	2.179017
F-statistic	31.66520	Durbin-Watson statistic	2.091757
Prob(F-statistic)	0.000000	Wald F-statistic	32.31682
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 14:36
Sample (adjusted): 2 1237
Included observations: 1010 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.694814	0.349764	7.704662	0.0000
DERTOTAL_BIN	0.180582	0.053063	3.403129	0.0007
ROAWINSB	0.035423	0.003983	8.893910	0.0000
DIVYIELDWINS_BIN	-0.019132	0.052518	-0.364287	0.7157
RDSALESWINS_BIN	-0.072328	0.053290	-1.357240	0.1750
FORSALESWINS_BIN	0.296314	0.053746	5.513249	0.0000
CRWINS	-0.135503	0.027782	-4.877370	0.0000
LEVDAWINS	-0.120405	0.105743	-1.138664	0.2551
LNTOTASS	-0.069174	0.021627	-3.198478	0.0014
DUMPERIOD2	-0.529135	0.079968	-6.616791	0.0000
DUMPERIOD3	-0.331837	0.069446	-4.778361	0.0000
TELEDUM	0.054434	0.143742	0.378693	0.7050
TECHDUM	0.025476	0.114835	0.221849	0.8245
CONSGOODSDUM	-0.020515	0.085906	-0.238811	0.8113
CONSSERVDUM	0.459573	0.104820	4.384389	0.0000
INDUSTRIALSDUM	-0.204564	0.067796	-3.017355	0.0026
HEALTHCAREDUM	0.445182	0.139686	3.187017	0.0015

R-squared	0.362759	Mean dependent var	1.589003
Adjusted R-squared	0.352491	S.D. dependent var	0.827712
S.E. of regression	0.666043	Akaike info criterion	2.041764
Sum squared resid	440.5083	Schwarz criterion	2.124537
Log likelihood	-1014.091	Hannan-Quinn criterion	2.073209
F-statistic	35.32995	Durbin-Watson statistic	2.086658
Prob(F-statistic)	0.000000	Wald F-statistic	36.13462
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 14:37
Sample (adjusted): 2 1247
Included observations: 1023 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.741126	0.338874	8.088923	0.0000

DERTOTAL_BIN	0.151129	0.050073	3.018175	0.0026
ROAWINSB	0.036416	0.003814	9.547750	0.0000
DIVYIELDWINS_BIN	-0.017409	0.051048	-0.341027	0.7332
RDSALESWINS_BIN	0.016590	0.055292	0.300037	0.7642
FORSALESWINS_BIN	0.302220	0.053167	5.684339	0.0000
CRWINS	-0.113594	0.029234	-3.885725	0.0001
LEVDAWINS	-0.020394	0.111248	-0.183322	0.8546
LNTOTASS	-0.081520	0.021138	-3.856534	0.0001
DUMPERIOD2	-0.502101	0.072200	-6.954319	0.0000
DUMPERIOD3	-0.243984	0.062482	-3.904852	0.0001
TELEDUM	0.170027	0.134101	1.267902	0.2051
TECHDUM	-0.041056	0.109304	-0.375609	0.7073
CONSGOODSDUM	-0.002884	0.085696	-0.033648	0.9732
CONSSERVDUM	0.502707	0.095608	5.257998	0.0000
INDUSTRIALSDUM	-0.216432	0.069268	-3.124548	0.0018
HEALTHCAREDUM	0.396010	0.138612	2.856960	0.0044

R-squared	0.351981	Mean dependent var	1.595544
Adjusted R-squared	0.341675	S.D. dependent var	0.824678
S.E. of regression	0.669121	Akaike info criterion	2.050775
Sum squared resid	450.4094	Schwarz criterion	2.132709
Log likelihood	-1031.971	Hannan-Quinn criterion	2.081881
F-statistic	34.15149	Durbin-Watson statistic	2.047466
Prob(F-statistic)	0.000000	Wald F-statistic	31.67651
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 14:40
Sample (adjusted): 2 1283
Included observations: 1070 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.755907	0.318243	8.659759	0.0000
DERTOTAL_BIN	0.175103	0.049978	3.503583	0.0005
ROAWINSB	0.035626	0.003946	9.028514	0.0000
DIVYIELDWINS_BIN	-0.066083	0.051954	-1.271946	0.2037
RDSALESWINS_BIN	0.008024	0.056054	0.143150	0.8862
FORSALESWINS_BIN	0.323838	0.052104	6.215164	0.0000
CRWINS	-0.094923	0.030955	-3.066419	0.0022
LEVDAWINS	-0.031410	0.111918	-0.280652	0.7790
LNTOTASS	-0.082612	0.020164	-4.096964	0.0000
DUMPERIOD2	-0.417379	0.077141	-5.410597	0.0000
DUMPERIOD3	-0.256160	0.066202	-3.869375	0.0001
TELEDUM	-0.011265	0.124800	-0.090268	0.9281
TECHDUM	-0.033752	0.112643	-0.299637	0.7645
CONSGOODSDUM	-0.056716	0.083357	-0.680405	0.4964
CONSSERVDUM	0.499113	0.100390	4.971753	0.0000
INDUSTRIALSDUM	-0.252762	0.071250	-3.547542	0.0004
HEALTHCAREDUM	0.341087	0.128238	2.659791	0.0079

R-squared	0.325588	Mean dependent var	1.591791
Adjusted R-squared	0.315340	S.D. dependent var	0.827348
S.E. of regression	0.684582	Akaike info criterion	2.095745
Sum squared resid	493.4915	Schwarz criterion	2.174793
Log likelihood	-1104.223	Hannan-Quinn criterion	2.125690
F-statistic	31.77247	Durbin-Watson statistic	2.035179
Prob(F-statistic)	0.000000	Wald F-statistic	31.48021
Prob(Wald F-statistic)	0.000000		

Key to variables in Table B.4:

TOBINQWINS	Tobin's Q
DERTOTAL_BIN	Dummy variable of 1/(0) if derivatives amount is/(not) reported
LNTOTASS	Natural logarithm of total assets
DIVYIELDWINS_BIN	Dividend yield
RDSALESWINS_BIN	Ratio of research and development costs divided by sales
FORSALESWINS_BIN	Ratio of foreign sales divided by sales
ROAWINSB	Return on assets
CRWINS	Current ratio
LEVDAWINS	Leverage calculated as the ratio of debt to assets
DUMPERIOD2	Year dummy variable
HEALTHCAREDUM	Sector dummy variable

Table B.5: Random sample permutation tests Hypothesis 3_Three period continuous

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 14:50
Sample (adjusted): 162 1260
Included observations: 383 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.393524	0.460774	0.854050	0.3936
DERTOTALWINSB	1.47E-07	1.48E-07	0.987472	0.3241
ROAWINSB	0.065506	0.006486	10.09917	0.0000
DIVYIELDWINS_BIN	-0.000793	0.084735	-0.009353	0.9925
RDSALESWINS_BIN	0.120108	0.074420	1.613928	0.1074
FORSALESWINS_BIN	0.148696	0.069020	2.154398	0.0319
CRWINS	-0.147184	0.041880	-3.514412	0.0005
LEVDAWINS	0.108643	0.127805	0.850062	0.3958
LNTOTASS	0.041347	0.027394	1.509381	0.1321
DUMPERIOD2	-0.327632	0.153095	-2.140059	0.0330
DUMPERIOD3	-0.071813	0.146799	-0.489189	0.6250
HEALTHCAREDUM	0.220935	0.155347	1.422204	0.1558
INDUSTRIALSDUM	-0.026566	0.094078	-0.282388	0.7778
TELEDUM	-0.156116	0.210840	-0.740451	0.4595
TECHDUM	0.126969	0.154966	0.819332	0.4131
CONSGOODSDUM	0.065574	0.108399	0.604933	0.5456
CONSSERVDUM	0.678452	0.166885	4.065392	0.0001

R-squared	0.572788	Mean dependent var	1.651771
Adjusted R-squared	0.554112	S.D. dependent var	0.836882
S.E. of regression	0.558827	Akaike info criterion	1.717416
Sum squared resid	114.2971	Schwarz criterion	1.892656
Log likelihood	-311.8852	Hannan-Quinn criterion	1.786931
F-statistic	30.66988	Durbin-Watson statistic	1.833997
Prob(F-statistic)	0.000000	Wald F-statistic	25.46601
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 14:52
Sample (adjusted): 9 1203
Included observations: 354 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.472124	0.413830	3.557313	0.0004
DERTOTALWINSB	9.97E-08	1.59E-07	0.628948	0.5298
ROAWINSB	0.057018	0.006913	8.247531	0.0000
DIVYIELDWINS_BIN	-0.071663	0.101621	-0.705196	0.4812
RDSALESWINS_BIN	0.092783	0.096407	0.962412	0.3365
FORSALESWINS_BIN	0.175423	0.075352	2.328045	0.0205
CRWINS	-0.087437	0.073662	-1.186998	0.2361
LEVDAWINS	0.063894	0.128390	0.497655	0.6191
LNTOTASS	-0.003883	0.026333	-0.147446	0.8829
DUMPERIOD2	-0.526537	0.130027	-4.049434	0.0001
DUMPERIOD3	-0.225033	0.117007	-1.923251	0.0553

HEALTHCAREDUM	0.310528	0.184432	1.683702	0.0932
INDUSTRIALSDUM	-0.205210	0.100358	-2.044780	0.0417
TELEDUM	-0.172981	0.179723	-0.962486	0.3365
TECHDUM	-0.072134	0.199444	-0.361677	0.7178
CONSGOODSDUM	-0.032920	0.122173	-0.269456	0.7877
CONSSERVDUM	0.596091	0.222857	2.674765	0.0078

R-squared	0.502540	Mean dependent var	1.642623
Adjusted R-squared	0.478922	S.D. dependent var	0.810640
S.E. of regression	0.585167	Akaike info criterion	1.812991
Sum squared resid	115.3955	Schwarz criterion	1.998805
Log likelihood	-303.8994	Hannan-Quinn criterion	1.886920
F-statistic	21.27762	Durbin-Watson statistic	1.930751
Prob(F-statistic)	0.000000	Wald F-statistic	16.65568
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 14:56
Sample (adjusted): 11 1285
Included observations: 353 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.559217	0.468722	1.193068	0.2337
DERTOTALWINSB	1.07E-07	1.62E-07	0.659436	0.5101
ROAWINSB	0.069065	0.006828	10.11437	0.0000
DIVYIELDWINS_BIN	-0.012087	0.100003	-0.120863	0.9039
RDSALESWINS_BIN	0.161351	0.079993	2.017059	0.0445
FORSALESWINS_BIN	0.185074	0.071938	2.572675	0.0105
CRWINS	-0.117330	0.044278	-2.649872	0.0084
LEVDAWINS	0.090054	0.131523	0.684703	0.4940
LNTOTASS	0.023320	0.029810	0.782305	0.4346
DUMPERIOD2	-0.257002	0.129903	-1.978408	0.0487
DUMPERIOD3	0.016027	0.113273	0.141493	0.8876
HEALTHCAREDUM	0.284178	0.141101	2.014003	0.0448
INDUSTRIALSDUM	-0.061837	0.102269	-0.604654	0.5458
TELEDUM	-0.170187	0.182116	-0.934497	0.3507
TECHDUM	0.128439	0.166447	0.771654	0.4409
CONSGOODSDUM	-0.039597	0.114750	-0.345071	0.7303
CONSSERVDUM	0.544838	0.176429	3.088146	0.0022

R-squared	0.573254	Mean dependent var	1.645446
Adjusted R-squared	0.552932	S.D. dependent var	0.851054
S.E. of regression	0.569041	Akaike info criterion	1.757232
Sum squared resid	108.7993	Schwarz criterion	1.943435
Log likelihood	-293.1514	Hannan-Quinn criterion	1.831324
F-statistic	28.20957	Durbin-Watson statistic	1.787181
Prob(F-statistic)	0.000000	Wald F-statistic	22.57057
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 14:57
Sample (adjusted): 49 1275
Included observations: 375 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.916035	0.449885	2.036153	0.0425
DERTOTALWINSB	7.99E-08	1.59E-07	0.502245	0.6158
ROAWINSB	0.064484	0.006038	10.68017	0.0000
DIVYIELDWINS_BIN	0.092766	0.070027	1.324718	0.1861
RDSALESWINS_BIN	0.060964	0.081067	0.752020	0.4525
FORSALESWINS_BIN	0.191700	0.066373	2.888209	0.0041
CRWINS	-0.091543	0.039184	-2.336216	0.0200
LEVDAWINS	0.106202	0.117876	0.900964	0.3682
LNTOTASS	0.013284	0.027432	0.484248	0.6285
DUMPERIOD2	-0.444913	0.116641	-3.814367	0.0002
DUMPERIOD3	-0.178304	0.109242	-1.632199	0.1035
HEALTHCAREDUM	0.305882	0.163858	1.866742	0.0628
INDUSTRIALSDUM	-0.172896	0.090334	-1.913959	0.0564
TELEDUM	-0.189262	0.178809	-1.058460	0.2906
TECHDUM	-0.081755	0.154518	-0.529100	0.5971
CONSGOODSDUM	-0.090075	0.114628	-0.785806	0.4325
CONSSERVDUM	0.538417	0.152631	3.527566	0.0005

R-squared	0.587460	Mean dependent var	1.612855
Adjusted R-squared	0.569023	S.D. dependent var	0.816007
S.E. of regression	0.535699	Akaike info criterion	1.633787
Sum squared resid	102.7367	Schwarz criterion	1.811808
Log likelihood	-289.3350	Hannan-Quinn criterion	1.704462
F-statistic	31.86218	Durbin-Watson statistic	1.730893
Prob(F-statistic)	0.000000	Wald F-statistic	20.94096
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 14:58
Sample (adjusted): 49 1247
Included observations: 359 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.249117	0.447060	0.557233	0.5777
DERTOTALWINSB	9.91E-08	1.31E-07	0.753678	0.4516
ROAWINSB	0.073254	0.006501	11.26822	0.0000
DIVYIELDWINS_BIN	0.027091	0.093146	0.290848	0.7713
RDSALESWINS_BIN	0.146750	0.073417	1.998866	0.0464
FORSALESWINS_BIN	0.189088	0.064884	2.914224	0.0038
CRWINS	-0.074053	0.044869	-1.650436	0.0998
LEVDAWINS	0.272391	0.121785	2.236667	0.0260
LNTOTASS	0.036850	0.026433	1.394097	0.1642
DUMPERIOD2	-0.427511	0.123318	-3.466746	0.0006
DUMPERIOD3	-0.143671	0.107570	-1.335605	0.1826
HEALTHCAREDUM	0.281635	0.226171	1.245227	0.2139
INDUSTRIALSDUM	-0.047589	0.082704	-0.575412	0.5654
TELEDUM	-0.053163	0.116143	-0.457733	0.6474
TECHDUM	-0.124739	0.161802	-0.770938	0.4413
CONSGOODSDUM	0.064600	0.106954	0.604000	0.5462
CONSSERVDUM	0.864282	0.157589	5.484415	0.0000

R-squared	0.627055	Mean dependent var	1.669006
Adjusted R-squared	0.609607	S.D. dependent var	0.838970
S.E. of regression	0.524200	Akaike info criterion	1.592311
Sum squared resid	93.97685	Schwarz criterion	1.776201

Log likelihood	-268.8198	Hannan-Quinn criterion	1.665436
F-statistic	35.93908	Durbin-Watson statistic	1.845668
Prob(F-statistic)	0.000000	Wald F-statistic	29.57221
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 14:59
Sample (adjusted): 203 1297
Included observations: 364 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.207608	0.507858	2.377846	0.0180
DERTOTALWINSB	4.12E-07	1.58E-07	2.606995	0.0095
ROAWINSB	0.060183	0.005429	11.08440	0.0000
DIVYIELDWINS_BIN	0.057387	0.093021	0.616926	0.5377
RDSALESWINS_BIN	0.153322	0.075748	2.024119	0.0437
FORSALESWINS_BIN	0.136783	0.069179	1.977229	0.0488
CRWINS	-0.135209	0.045083	-2.999149	0.0029
LEVDAWINS	0.039992	0.148954	0.268488	0.7885
LNTOTASS	0.011699	0.030551	0.382920	0.7020
DUMPERIOD2	-0.679899	0.134241	-5.064761	0.0000
DUMPERIOD3	-0.408766	0.123502	-3.309779	0.0010
HEALTHCAREDUM	0.491476	0.200263	2.454157	0.0146
INDUSTRIALSDUM	-0.058271	0.085525	-0.681326	0.4961
TELEDUM	-0.007838	0.193335	-0.040541	0.9677
TECHDUM	0.049032	0.177157	0.276771	0.7821
CONSGOODSDUM	0.115498	0.111349	1.037261	0.3003
CONSSERVDUM	0.656067	0.189761	3.457336	0.0006

R-squared	0.582003	Mean dependent var	1.642251
Adjusted R-squared	0.562729	S.D. dependent var	0.842710
S.E. of regression	0.557254	Akaike info criterion	1.713986
Sum squared resid	107.7546	Schwarz criterion	1.895996
Log likelihood	-294.9455	Hannan-Quinn criterion	1.786327
F-statistic	30.19685	Durbin-Watson statistic	1.770693
Prob(F-statistic)	0.000000	Wald F-statistic	23.96258
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 15:00
Sample (adjusted): 53 1230
Included observations: 351 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.966748	0.398829	2.423962	0.0159
DERTOTALWINSB	2.51E-07	1.56E-07	1.607560	0.1089
ROAWINSB	0.060536	0.007645	7.918215	0.0000
DIVYIELDWINS_BIN	0.158127	0.095808	1.650457	0.0998
RDSALESWINS_BIN	-0.031025	0.080657	-0.384661	0.7007
FORSALESWINS_BIN	0.146085	0.067815	2.154156	0.0319
CRWINS	-0.107109	0.066697	-1.605912	0.1092
LEVDAWINS	-0.027060	0.139944	-0.193365	0.8468

LNTOTASS	0.017370	0.024578	0.706738	0.4802
DUMPERIOD2	-0.469992	0.132423	-3.549168	0.0004
DUMPERIOD3	-0.228204	0.111709	-2.042838	0.0419
HEALTHCAREDUM	0.494373	0.169688	2.913418	0.0038
INDUSTRIALSDUM	-0.182879	0.091306	-2.002917	0.0460
TELEDUM	-0.082627	0.183060	-0.451363	0.6520
TECHDUM	0.093994	0.199994	0.469982	0.6387
CONSGOODSDUM	-0.018323	0.119575	-0.153236	0.8783
CONSSERVDUM	0.516741	0.219650	2.352568	0.0192

R-squared	0.520689	Mean dependent var	1.644256
Adjusted R-squared	0.497728	S.D. dependent var	0.836568
S.E. of regression	0.592885	Akaike info criterion	1.839589
Sum squared resid	117.4053	Schwarz criterion	2.026579
Log likelihood	-305.8479	Hannan-Quinn criterion	1.914010
F-statistic	22.67713	Durbin-Watson statistic	1.653359
Prob(F-statistic)	0.000000	Wald F-statistic	19.51447
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 15:01
Sample (adjusted): 98 1242
Included observations: 364 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.089828	0.437727	2.489746	0.0133
DERTOTALWINSB	1.36E-07	1.45E-07	0.939807	0.3480
ROAWINSB	0.055277	0.006634	8.331809	0.0000
DIVYIELDWINS_BIN	0.084661	0.090599	0.934455	0.3507
RDSALESWINS_BIN	0.013130	0.080326	0.163457	0.8703
FORSALESWINS_BIN	0.140545	0.070636	1.989700	0.0474
CRWINS	-0.068012	0.056733	-1.198810	0.2314
LEVDAWINS	0.029060	0.144077	0.201699	0.8403
LNTOTASS	0.015331	0.025670	0.597210	0.5508
DUMPERIOD2	-0.566568	0.123878	-4.573599	0.0000
DUMPERIOD3	-0.273148	0.113679	-2.402795	0.0168
HEALTHCAREDUM	0.337540	0.177394	1.902766	0.0579
INDUSTRIALSDUM	-0.210742	0.088973	-2.368589	0.0184
TELEDUM	-0.013042	0.162342	-0.080336	0.9360
TECHDUM	0.096415	0.201647	0.478137	0.6329
CONSGOODSDUM	-0.024624	0.128651	-0.191404	0.8483
CONSSERVDUM	0.456181	0.211707	2.154775	0.0319

R-squared	0.505932	Mean dependent var	1.638844
Adjusted R-squared	0.483150	S.D. dependent var	0.806280
S.E. of regression	0.579653	Akaike info criterion	1.792802
Sum squared resid	116.5911	Schwarz criterion	1.974812

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 15:02
Sample (adjusted): 11 1282
Included observations: 387 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.

C	1.064958	0.473727	2.248040	0.0252
DERTOTALWINSB	1.62E-07	1.57E-07	1.033386	0.3021
ROAWINSB	0.059507	0.007498	7.936748	0.0000
DIVYIELDWINS_BIN	0.069202	0.090109	0.767980	0.4430
RDSALESWINS_BIN	0.015012	0.080641	0.186162	0.8524
FORSALESWINS_BIN	0.220396	0.064552	3.414259	0.0007
CRWINS	-0.085906	0.057764	-1.487198	0.1378
LEVDAWINS	0.077163	0.124290	0.620832	0.5351
LNTOTASS	0.001600	0.029098	0.054975	0.9562
DUMPERIOD2	-0.286356	0.144578	-1.980633	0.0484
DUMPERIOD3	-0.074148	0.131991	-0.561766	0.5746
HEALTHCAREDUM	0.196010	0.153069	1.280529	0.2012
INDUSTRIALSDUM	-0.202787	0.092393	-2.194846	0.0288
TELEDUM	-0.086922	0.161773	-0.537305	0.5914
TECHDUM	0.090298	0.221668	0.407358	0.6840
CONSGOODSDUM	-0.038236	0.125323	-0.305103	0.7605
CONSSERVDUM	0.389028	0.217629	1.787576	0.0747

R-squared	0.490344	Mean dependent var	1.634757
Adjusted R-squared	0.468304	S.D. dependent var	0.816717
S.E. of regression	0.595529	Akaike info criterion	1.844201
Sum squared resid	131.2224	Schwarz criterion	2.018085
Log likelihood	-339.8529	Hannan-Quinn criterion	1.913150
F-statistic	22.24870	Durbin-Watson statistic	1.978091
Prob(F-statistic)	0.000000	Wald F-statistic	16.59446
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINSQ*
Method: Least Squares
Date: 07/01/20 Time: 15:16
Sample (adjusted): 98 1242
Included observations: 364 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.460867	0.664739	2.197655	0.0286
DERTOTALWINSB	5.09E-08	1.72E-07	0.295774	0.7676
ROAWINSB	0.077141	0.011420	6.755172	0.0000
DIVYIELDWINS_BIN	0.027464	0.116840	0.235055	0.8143
RDSALESWINS_BIN	-0.010735	0.117973	-0.090999	0.9275
FORSALESWINS_BIN	0.196722	0.095970	2.049839	0.0411
CRWINS	-0.073061	0.072961	-1.001374	0.3173
LEVDAWINS	0.157959	0.194126	0.813696	0.4164
LNTOTASS	0.007524	0.034077	0.220781	0.8254
DUMPERIOD2	-0.869350	0.249132	-3.489510	0.0005
DUMPERIOD3	-0.483112	0.225302	-2.144286	0.0327
HEALTHCAREDUM	0.055983	0.273353	0.204799	0.8378
INDUSTRIALSDUM	-0.447211	0.179731	-2.488222	0.0133
TELEDUM	-0.264515	0.220302	-1.200696	0.2307
TECHDUM	-0.063467	0.261334	-0.242859	0.8083
CONSGOODSDUM	-0.311056	0.218947	-1.420687	0.1563
CONSSERVDUM	0.460055	0.248190	1.853641	0.0646

R-squared	0.467028	Mean dependent var	1.714101
Adjusted R-squared	0.442453	S.D. dependent var	1.089819
S.E. of regression	0.813757	Akaike info criterion	2.471268
Sum squared resid	229.7838	Schwarz criterion	2.653278
Log likelihood	-432.7709	Hannan-Quinn criterion	2.543609
F-statistic	19.00414	Durbin-Watson statistic	1.904817

Prob(F-statistic)	0.000000	Wald F-statistic	10.66980
Prob(Wald F-statistic)	0.000000		

Key to variables in Table B.5

TOBINQWINS	Tobin's Q
DERTOTALWINSB	The total amount of derivatives reported in the financial statements
LNTOTASS	Natural logarithm of total assets
DIVYIELDWINS_BIN	Dividend yield
RDSALESWINS_BIN	Ratio of research and development costs divided by sales
FORSALESWINS_BIN	Ratio of foreign sales divided by sales
ROAWINSB	Return on assets
CRWINS	Current ratio
LEVDAWINS	Leverage calculated as the ratio of debt to assets
DUMPERIOD2	Year dummy variable
HEALTHCAREDUM	Sector dummy variable

Table B.6: Random sample permutation tests Hypothesis 3_Two-period binary

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 16:17
Sample (adjusted): 2 1266
Included observations: 1044 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.427503	0.338327	7.175013	0.0000
DERTOTAL_BIN	0.061942	0.049279	1.256951	0.2091
ROAWINSB	0.038856	0.003807	10.20613	0.0000
DIVYIELDWINS_BIN	-0.072471	0.052559	-1.378858	0.1682
RDSALESWINS_BIN	0.040948	0.053257	0.768891	0.4421
FORSALESWINS_BIN	0.331151	0.055688	5.946565	0.0000
CRWINS	-0.141118	0.025934	-5.441467	0.0000
LEVDAWINS	-0.061808	0.108375	-0.570317	0.5686
LNTOTASS	-0.073482	0.020900	-3.515870	0.0005
DUMPEIODB	0.055046	0.046776	1.176794	0.2396
TELEDUM	0.020963	0.132716	0.157956	0.8745
TECHDUM	0.047628	0.113495	0.419646	0.6748
CONSGOODSDUM	0.003935	0.085075	0.046252	0.9631
CONSSERVDUM	0.462892	0.099265	4.663203	0.0000
INDUSTRIALSDUM	-0.187437	0.072887	-2.571624	0.0103
HEALTHCAREDUM	0.427015	0.141051	3.027384	0.0025

R-squared	0.342724	Mean dependent var	1.596465
Adjusted R-squared	0.333134	S.D. dependent var	0.831076
S.E. of regression	0.678672	Akaike info criterion	2.077850
Sum squared resid	473.4926	Schwarz criterion	2.153724
Log likelihood	-1068.638	Hannan-Quinn criterion	2.106627
F-statistic	35.73543	Durbin-Watson statistic	2.024001
Prob(F-statistic)	0.000000	Wald F-statistic	34.25952
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 16:19
Sample (adjusted): 2 1210
Included observations: 981 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.354537	0.365044	6.450017	0.0000
DERTOTAL_BIN	0.119440	0.053186	2.245689	0.0249
ROAWINSB	0.039504	0.004068	9.711622	0.0000
DIVYIELDWINS_BIN	-0.064134	0.056616	-1.132777	0.2576
RDSALESWINS_BIN	0.046569	0.058263	0.799304	0.4243
FORSALESWINS_BIN	0.358211	0.059857	5.984408	0.0000
CRWINS	-0.117709	0.033683	-3.494617	0.0005
LEVDAWINS	0.011940	0.117652	0.101486	0.9192
LNTOTASS	-0.071912	0.022847	-3.147539	0.0017
DUMPEIODB	0.033135	0.048712	0.680225	0.4965
TELEDUM	-0.131823	0.129699	-1.016375	0.3097
TECHDUM	-0.016542	0.115952	-0.142664	0.8866
CONSGOODSDUM	-0.140127	0.091935	-1.524194	0.1278

CONSSERVDUM	0.422393	0.096525	4.375988	0.0000
INDUSTRIALSDUM	-0.300702	0.078126	-3.848927	0.0001
HEALTHCAREDUM	0.346367	0.138643	2.498258	0.0126

R-squared	0.352985	Mean dependent var	1.582119
Adjusted R-squared	0.342928	S.D. dependent var	0.841936
S.E. of regression	0.682473	Akaike info criterion	2.089988
Sum squared resid	449.4675	Schwarz criterion	2.169720
Log likelihood	-1009.139	Hannan-Quinn criterion	2.120320
F-statistic	35.09764	Durbin-Watson statistic	1.935684
Prob(F-statistic)	0.000000	Wald F-statistic	32.00400
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 16:21
Sample: 1 1292
Included observations: 1044
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.607995	0.334339	7.800458	0.0000
DERTOTAL_BIN	0.081766	0.049066	1.666427	0.0959
ROAWINSB	0.038756	0.003774	10.26998	0.0000
DIVYIELDWINS_BIN	-0.078973	0.055109	-1.433041	0.1522
RDSALESWINS_BIN	0.035181	0.057476	0.612100	0.5406
FORSALESWINS_BIN	0.348145	0.053460	6.512250	0.0000
CRWINS	-0.132051	0.030002	-4.401453	0.0000
LEVDAWINS	-0.080717	0.123031	-0.656066	0.5119
LNTOTASS	-0.083239	0.020649	-4.031131	0.0001
DUMPEIODB	0.059299	0.048003	1.235318	0.2170
TELEDUM	0.016506	0.139934	0.117955	0.9061
TECHDUM	-0.000189	0.117425	-0.001610	0.9987
CONSGOODSDUM	-0.065842	0.092194	-0.714163	0.4753
CONSSERVDUM	0.441791	0.099851	4.424487	0.0000
INDUSTRIALSDUM	-0.270481	0.077008	-3.512363	0.0005
HEALTHCAREDUM	0.290884	0.120174	2.420530	0.0157

R-squared	0.330900	Mean dependent var	1.601715
Adjusted R-squared	0.321137	S.D. dependent var	0.843889
S.E. of regression	0.695306	Akaike info criterion	2.126278
Sum squared resid	496.9874	Schwarz criterion	2.202153
Log likelihood	-1093.917	Hannan-Quinn criterion	2.155056
F-statistic	33.89289	Durbin-Watson statistic	1.905146
Prob(F-statistic)	0.000000	Wald F-statistic	36.81492
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 16:23
Sample: 1 1237
Included observations: 1009
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.405460	0.349637	6.879875	0.0000

DERTOTAL_BIN	0.095678	0.049163	1.946144	0.0519
ROAWINSB	0.040562	0.003932	10.31657	0.0000
DIVYIELDWINS_BIN	-0.060532	0.054757	-1.105460	0.2692
RDSALESWINS_BIN	0.019598	0.058678	0.333995	0.7385
FORSALESWINS_BIN	0.340742	0.058345	5.840074	0.0000
CRWINS	-0.117121	0.028641	-4.089223	0.0000
LEVDAWINS	-0.013433	0.099807	-0.134588	0.8930
LNTOTASS	-0.073982	0.022721	-3.256073	0.0012
DUMPEIODB	0.059214	0.048997	1.208522	0.2271
TELEDUM	-0.187393	0.150114	-1.248340	0.2122
TECHDUM	-0.031572	0.118017	-0.267522	0.7891
CONSGOODSDUM	-0.108923	0.084197	-1.293661	0.1961
CONSSERVDUM	0.464949	0.106059	4.383865	0.0000
INDUSTRIALSDUM	-0.287952	0.073622	-3.911232	0.0001
HEALTHCAREDUM	0.224152	0.133950	1.673401	0.0946

R-squared	0.348260	Mean dependent var	1.597520
Adjusted R-squared	0.338415	S.D. dependent var	0.843233
S.E. of regression	0.685868	Akaike info criterion	2.099466
Sum squared resid	467.1216	Schwarz criterion	2.177432
Log likelihood	-1043.181	Hannan-Quinn criterion	2.129086
F-statistic	35.37430	Durbin-Watson statistic	2.047823
Prob(F-statistic)	0.000000	Wald F-statistic	33.57925
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 16:24
Sample: 1 1277
Included observations: 1042
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.399529	0.347894	6.897294	0.0000
DERTOTAL_BIN	0.046950	0.047216	0.994365	0.3203
ROAWINSB	0.043298	0.003896	11.11383	0.0000
DIVYIELDWINS_BIN	-0.102355	0.052321	-1.956285	0.0507
RDSALESWINS_BIN	0.010648	0.055381	0.192270	0.8476
FORSALESWINS_BIN	0.349086	0.054853	6.364086	0.0000
CRWINS	-0.141318	0.026844	-5.264462	0.0000
LEVDAWINS	-0.123244	0.107611	-1.145271	0.2524
LNTOTASS	-0.066904	0.021442	-3.120238	0.0019
DUMPEIODB	0.010670	0.046550	0.229226	0.8187
TELEDUM	-0.010931	0.135483	-0.080679	0.9357
TECHDUM	-0.002291	0.108329	-0.021149	0.9831
CONSGOODSDUM	-0.063507	0.088294	-0.719275	0.4721
CONSSERVDUM	0.427778	0.096083	4.452159	0.0000
INDUSTRIALSDUM	-0.213493	0.071812	-2.972932	0.0030
HEALTHCAREDUM	0.365484	0.138434	2.640141	0.0084

R-squared	0.343500	Mean dependent var	1.596138
Adjusted R-squared	0.333903	S.D. dependent var	0.835424
S.E. of regression	0.681830	Akaike info criterion	2.087162
Sum squared resid	476.9789	Schwarz criterion	2.163153
Log likelihood	-1071.412	Hannan-Quinn criterion	2.115986
F-statistic	35.78896	Durbin-Watson statistic	1.944974
Prob(F-statistic)	0.000000	Wald F-statistic	33.51240
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 16:26
Sample: 1 1257
Included observations: 1038
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.714165	0.338135	8.026856	0.0000
DERTOTAL_BIN	0.085621	0.048354	1.770709	0.0769
ROAWINSB	0.041055	0.003794	10.82120	0.0000
DIVYIELDWINS_BIN	-0.058823	0.052349	-1.123670	0.2614
RDSALESWINS_BIN	0.064939	0.052944	1.226545	0.2203
FORSALESWINS_BIN	0.352171	0.054022	6.519074	0.0000
CRWINS	-0.154682	0.026594	-5.816329	0.0000
LEVDAWINS	-0.034617	0.108844	-0.318042	0.7505
LNTOTASS	-0.093651	0.020598	-4.546587	0.0000
DUMPEIODB	0.073765	0.045783	1.611187	0.1074
TELEDUM	0.050445	0.126996	0.397219	0.6913
TECHDUM	-0.099990	0.102190	-0.978477	0.3281
CONSGOODSDUM	-0.064476	0.081153	-0.794504	0.4271
CONSSERVDUM	0.583194	0.090130	6.470569	0.0000
INDUSTRIALSDUM	-0.229332	0.072107	-3.180436	0.0015
HEALTHCAREDUM	0.508413	0.140284	3.624177	0.0003

R-squared	0.358145	Mean dependent var	1.599089
Adjusted R-squared	0.348724	S.D. dependent var	0.841070
S.E. of regression	0.678757	Akaike info criterion	2.078188
Sum squared resid	470.8470	Schwarz criterion	2.154412
Log likelihood	-1062.579	Hannan-Quinn criterion	2.107106
F-statistic	38.01727	Durbin-Watson statistic	2.041254
Prob(F-statistic)	0.000000	Wald F-statistic	34.96695
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 16:27
Sample: 1 1304
Included observations: 1050
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.765273	0.326983	8.456932	0.0000
DERTOTAL_BIN	0.112473	0.049964	2.251081	0.0246
ROAWINSB	0.035495	0.003715	9.554555	0.0000
DIVYIELDWINS_BIN	-0.013580	0.052666	-0.257854	0.7966
RDSALESWINS_BIN	0.069144	0.053382	1.295265	0.1955
FORSALESWINS_BIN	0.347442	0.056581	6.140618	0.0000
CRWINS	-0.128841	0.030447	-4.231601	0.0000
LEVDAWINS	-0.076833	0.116058	-0.662016	0.5081
LNTOTASS	-0.094706	0.021269	-4.452841	0.0000
DUMPEIODB	0.023287	0.048287	0.482248	0.6297
TELEDUM	0.137306	0.157652	0.870944	0.3840
TECHDUM	0.001021	0.113643	0.008988	0.9928
CONSGOODSDUM	-0.043588	0.094973	-0.458952	0.6464
CONSSERVDUM	0.403233	0.101620	3.968061	0.0001
INDUSTRIALSDUM	-0.291883	0.071213	-4.098748	0.0000
HEALTHCAREDUM	0.469982	0.132006	3.560309	0.0004

R-squared	0.309647	Mean dependent var	1.599607
Adjusted R-squared	0.299633	S.D. dependent var	0.851448
S.E. of regression	0.712560	Akaike info criterion	2.175215
Sum squared resid	525.0046	Schwarz criterion	2.250743
Log likelihood	-1125.988	Hannan-Quinn criterion	2.203853
F-statistic	30.91902	Durbin-Watson statistic	2.053473
Prob(F-statistic)	0.000000	Wald F-statistic	31.41192
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 16:28
Sample (adjusted): 2 1237
Included observations: 1010 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.494574	0.360341	6.922822	0.0000
DERTOTAL_BIN	0.121544	0.052767	2.303387	0.0215
ROAWINSB	0.036517	0.004065	8.983023	0.0000
DIVYIELDWINS_BIN	-0.017547	0.054018	-0.324843	0.7454
RDSALESWINS_BIN	-0.044290	0.055070	-0.804246	0.4214
FORSALESWINS_BIN	0.329816	0.055998	5.889805	0.0000
CRWINS	-0.143926	0.028658	-5.022226	0.0000
LEVDAWINS	-0.095996	0.111143	-0.863712	0.3880
LNTOTASS	-0.073306	0.022788	-3.216869	0.0013
DUMPEIODB	-0.042618	0.047838	-0.890881	0.3732
TELEDUM	-0.019953	0.143752	-0.138800	0.8896
TECHDUM	0.019322	0.119291	0.161977	0.8714
CONSGOODSDUM	-0.045570	0.087310	-0.521927	0.6018
CONSSERVDUM	0.453255	0.108637	4.172215	0.0000
INDUSTRIALSDUM	-0.232778	0.069184	-3.364621	0.0008
HEALTHCAREDUM	0.438230	0.145392	3.014126	0.0026

R-squared	0.329192	Mean dependent var	1.589003
Adjusted R-squared	0.319069	S.D. dependent var	0.827712
S.E. of regression	0.683016	Akaike info criterion	2.091118
Sum squared resid	463.7121	Schwarz criterion	2.169023
Log likelihood	-1040.015	Hannan-Quinn criterion	2.120713
F-statistic	32.51966	Durbin-Watson statistic	1.991029
Prob(F-statistic)	0.000000	Wald F-statistic	31.30368
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 16:31
Sample (adjusted): 2 1247
Included observations: 1023 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.584773	0.348004	7.427431	0.0000
DERTOTAL_BIN	0.109758	0.050579	2.170028	0.0302
ROAWINSB	0.037892	0.003851	9.839729	0.0000
DIVYIELDWINS_BIN	-0.009032	0.052632	-0.171598	0.8638

RDSALESWINS_BIN	0.053878	0.056775	0.948970	0.3429
FORSALESWINS_BIN	0.316868	0.054757	5.786795	0.0000
CRWINS	-0.132308	0.029756	-4.446394	0.0000
LEVDAWINS	-0.036839	0.117290	-0.314085	0.7535
LNTOTASS	-0.086128	0.021980	-3.918538	0.0001
DUMPEIODB	0.058222	0.045875	1.269138	0.2047
TELEDUM	0.122745	0.139095	0.882458	0.3777
TECHDUM	-0.053279	0.112380	-0.474098	0.6355
CONSGOODSDUM	-0.023804	0.086513	-0.275148	0.7833
CONSSERVDUM	0.482053	0.096913	4.974080	0.0000
INDUSTRIALSDUM	-0.250425	0.071452	-3.504805	0.0005
HEALTHCAREDUM	0.352178	0.144338	2.439955	0.0149

R-squared	0.323611	Mean dependent var	1.595544
Adjusted R-squared	0.313535	S.D. dependent var	0.824678
S.E. of regression	0.683272	Akaike info criterion	2.091669
Sum squared resid	470.1286	Schwarz criterion	2.168783
Log likelihood	-1053.889	Hannan-Quinn criterion	2.120946
F-statistic	32.11915	Durbin-Watson statistic	1.974589
Prob(F-statistic)	0.000000	Wald F-statistic	28.99601
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 16:35
Sample (adjusted): 2 1283
Included observations: 1070 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.622776	0.322790	8.125321	0.0000
DERTOTAL_BIN	0.117907	0.049310	2.391120	0.0170
ROAWINSB	0.037267	0.003952	9.429910	0.0000
DIVYIELDWINS_BIN	-0.062461	0.052977	-1.179025	0.2387
RDSALESWINS_BIN	0.046208	0.055996	0.825187	0.4095
FORSALESWINS_BIN	0.331702	0.053495	6.200672	0.0000
CRWINS	-0.107316	0.031503	-3.406525	0.0007
LEVDAWINS	-0.034139	0.116454	-0.293150	0.7695
LNTOTASS	-0.089144	0.020768	-4.292372	0.0000
DUMPEIODB	0.035044	0.046812	0.748624	0.4543
TELEDUM	-0.041036	0.128536	-0.319260	0.7496
TECHDUM	-0.016013	0.115059	-0.139172	0.8893
CONSGOODSDUM	-0.065419	0.083379	-0.784600	0.4329
CONSSERVDUM	0.484205	0.100890	4.799323	0.0000
INDUSTRIALSDUM	-0.267268	0.072997	-3.661364	0.0003
HEALTHCAREDUM	0.280291	0.134519	2.083643	0.0374

R-squared	0.304897	Mean dependent var	1.591791
Adjusted R-squared	0.295005	S.D. dependent var	0.827348
S.E. of regression	0.694674	Akaike info criterion	2.124093
Sum squared resid	508.6314	Schwarz criterion	2.198492
Log likelihood	-1120.390	Hannan-Quinn criterion	2.152277
F-statistic	30.82151	Durbin-Watson statistic	1.981893
Prob(F-statistic)	0.000000	Wald F-statistic	29.99572
Prob(Wald F-statistic)	0.000000		

Key to variables in Table B.6

TOBINQWINS	Tobin's Q
DERTOTAL_BIN	Dummy variable of 1/(0) if derivatives amount is/(not) reported
LNTOTASS	Natural logarithm of total assets
DIVYIELDWINS_BIN	Dividend yield
RDSALESWINS_BIN	Ratio of research and development costs divided by sales
FORSALESWINS_BIN	Ratio of foreign sales divided by sales
ROAWINSB	Return on assets
CRWINS	Current ratio
LEVDAWINS	Leverage calculated as the ratio of debt to assets
DUMPERIOD2	Year dummy variable
HEALTHCAREDUM	Sector dummy variable

Table B.7: Random sample permutation tests Hypothesis 3_Two-period continuous

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 16:40
Sample (adjusted): 162 1260
Included observations: 383 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.183281	0.445871	0.411063	0.6813
DERTOTALWINSB	1.33E-07	1.45E-07	0.921320	0.3575
ROAWINSB	0.066530	0.006407	10.38428	0.0000
DIVYIELDWINS_BIN	-0.019754	0.084461	-0.233889	0.8152
RDSALESWINS_BIN	0.139489	0.074668	1.868123	0.0625
FORSALESWINS_BIN	0.160606	0.070229	2.286878	0.0228
CRWINS	-0.150266	0.043385	-3.463584	0.0006
LEVDAWINS	0.097496	0.129047	0.755508	0.4504
LNTOTASS	0.041483	0.027344	1.517066	0.1301
DUMPEIODB	0.142627	0.064874	2.198531	0.0285
TELEDUM	-0.168309	0.202530	-0.831031	0.4065
TECHDUM	0.145003	0.156488	0.926603	0.3547
CONSGOODSDUM	0.082166	0.108562	0.756865	0.4496
CONSSERVDUM	0.667063	0.166356	4.009861	0.0001
INDUSTRIALSDUM	-0.026578	0.095481	-0.278359	0.7809
HEALTHCAREDUM	0.236079	0.158674	1.487826	0.1377

R-squared	0.564026	Mean dependent var	1.651771
Adjusted R-squared	0.546207	S.D. dependent var	0.836882
S.E. of regression	0.563759	Akaike info criterion	1.732498
Sum squared resid	116.6415	Schwarz criterion	1.897429
Log likelihood	-315.7733	Hannan-Quinn criterion	1.797923
F-statistic	31.65286	Durbin-Watson statistic	1.788253
Prob(F-statistic)	0.000000	Wald F-statistic	25.77428
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 16:42
Sample (adjusted): 9 1203
Included observations: 354 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.202782	0.428454	2.807264	0.0053
DERTOTALWINSB	9.89E-08	1.60E-07	0.616495	0.5380
ROAWINSB	0.057699	0.006938	8.315974	0.0000
DIVYIELDWINS_BIN	-0.069577	0.101798	-0.683477	0.4948
RDSALESWINS_BIN	0.116055	0.096916	1.197486	0.2320
FORSALESWINS_BIN	0.176080	0.077231	2.279912	0.0232
CRWINS	-0.094628	0.074190	-1.275489	0.2030
LEVDAWINS	0.040865	0.134282	0.304320	0.7611
LNTOTASS	-0.006290	0.026999	-0.232979	0.8159
DUMPEIODB	0.125923	0.068355	1.842196	0.0663
TELEDUM	-0.214074	0.181531	-1.179269	0.2391
TECHDUM	-0.067249	0.202121	-0.332716	0.7396

CONSGOODSDUM	-0.044667	0.124896	-0.357634	0.7208
CONSSERVDUM	0.537206	0.220438	2.436997	0.0153
INDUSTRIALSDUM	-0.226842	0.105906	-2.141928	0.0329
HEALTHCAREDUM	0.281577	0.185425	1.518548	0.1298

R-squared	0.480771	Mean dependent var	1.642623
Adjusted R-squared	0.457728	S.D. dependent var	0.810640
S.E. of regression	0.596948	Akaike info criterion	1.850173
Sum squared resid	120.4454	Schwarz criterion	2.025056
Log likelihood	-311.4805	Hannan-Quinn criterion	1.919753
F-statistic	20.86431	Durbin-Watson statistic	1.857396
Prob(F-statistic)	0.000000	Wald F-statistic	16.75127
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 16:43
Sample (adjusted): 11 1285
Included observations: 353 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.476822	0.455151	1.047613	0.2956
DERTOTALWINSB	1.03E-07	1.60E-07	0.640736	0.5221
ROAWINSB	0.069264	0.006634	10.44126	0.0000
DIVYIELDWINS_BIN	-0.010379	0.099772	-0.104032	0.9172
RDSALESWINS_BIN	0.187703	0.080372	2.335440	0.0201
FORSALESWINS_BIN	0.201235	0.071175	2.827333	0.0050
CRWINS	-0.131560	0.045483	-2.892509	0.0041
LEVDAWINS	0.056153	0.134071	0.418828	0.6756
LNTOTASS	0.019211	0.029228	0.657309	0.5114
DUMPEIODB	0.195505	0.069478	2.813920	0.0052
TELEDUM	-0.153097	0.178997	-0.855302	0.3930
TECHDUM	0.137091	0.169314	0.809689	0.4187
CONSGOODSDUM	-0.025198	0.116642	-0.216026	0.8291
CONSSERVDUM	0.542649	0.174876	3.103049	0.0021
INDUSTRIALSDUM	-0.055303	0.104464	-0.529401	0.5969
HEALTHCAREDUM	0.261058	0.145156	1.798459	0.0730

R-squared	0.570335	Mean dependent var	1.645446
Adjusted R-squared	0.551210	S.D. dependent var	0.851054
S.E. of regression	0.570136	Akaike info criterion	1.758383
Sum squared resid	109.5436	Schwarz criterion	1.933634
Log likelihood	-294.3546	Hannan-Quinn criterion	1.828117
F-statistic	29.82208	Durbin-Watson statistic	1.791997
Prob(F-statistic)	0.000000	Wald F-statistic	22.22195
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 16:46
Sample (adjusted): 8 1237
Included observations: 354 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.

C	0.755173	0.511738	1.475703	0.1410
DERTOTALWINSB	2.09E-07	1.72E-07	1.214810	0.2253
ROAWINSB	0.062453	0.006407	9.748297	0.0000
DIVYIELDWINS_BIN	0.028300	0.100981	0.280248	0.7795
RDSALESWINS_BIN	0.050218	0.079472	0.631903	0.5279
FORSALESWINS_BIN	0.189640	0.081156	2.336727	0.0200
CRWINS	-0.146740	0.044083	-3.328752	0.0010
LEVDAWINS	0.045208	0.165537	0.273098	0.7849
LNTOTASS	0.014300	0.031398	0.455440	0.6491
DUMPEIODB	0.149795	0.068941	2.172800	0.0305
TELEDUM	-0.636490	0.203529	-3.127275	0.0019
TECHDUM	0.020469	0.195257	0.104831	0.9166
CONSGOODSDUM	-0.055283	0.118060	-0.468258	0.6399
CONSSERVDUM	0.577328	0.184174	3.134687	0.0019
INDUSTRIALSDUM	-0.149404	0.106794	-1.398996	0.1627
HEALTHCAREDUM	0.178036	0.185907	0.957661	0.3389

R-squared	0.541564	Mean dependent var	1.669206
Adjusted R-squared	0.521220	S.D. dependent var	0.842069
S.E. of regression	0.582661	Akaike info criterion	1.801721
Sum squared resid	114.7488	Schwarz criterion	1.976605
Log likelihood	-302.9046	Hannan-Quinn criterion	1.871302
F-statistic	26.61933	Durbin-Watson statistic	2.267794
Prob(F-statistic)	0.000000	Wald F-statistic	22.39442
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 16:47
Sample (adjusted): 49 1275
Included observations: 375 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.717742	0.458016	1.567068	0.1180
DERTOTALWINSB	1.11E-07	1.57E-07	0.707390	0.4798
ROAWINSB	0.065956	0.006064	10.87697	0.0000
DIVYIELDWINS_BIN	0.071224	0.073424	0.970032	0.3327
RDSALESWINS_BIN	0.072935	0.081132	0.898972	0.3693
FORSALESWINS_BIN	0.191494	0.068093	2.812239	0.0052
CRWINS	-0.100424	0.039787	-2.524034	0.0120
LEVDAWINS	0.103013	0.125227	0.822611	0.4113
LNTOTASS	0.008898	0.027566	0.322770	0.7471
DUMPEIODB	0.121451	0.063007	1.927581	0.0547
TELEDUM	-0.211990	0.188868	-1.122425	0.2624
TECHDUM	-0.078774	0.156323	-0.503918	0.6146
CONSGOODSDUM	-0.088999	0.116161	-0.766173	0.4441
CONSSERVDUM	0.521471	0.149506	3.487962	0.0005
INDUSTRIALSDUM	-0.170136	0.096681	-1.759766	0.0793
HEALTHCAREDUM	0.301706	0.166780	1.809011	0.0713

R-squared	0.572289	Mean dependent var	1.612855
Adjusted R-squared	0.554419	S.D. dependent var	0.816007
S.E. of regression	0.544700	Akaike info criterion	1.664567
Sum squared resid	106.5147	Schwarz criterion	1.832116
Log likelihood	-296.1064	Hannan-Quinn criterion	1.731085
F-statistic	32.02351	Durbin-Watson statistic	1.672811
Prob(F-statistic)	0.000000	Wald F-statistic	21.13469
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 16:48
Sample (adjusted): 49 1247
Included observations: 359 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.031555	0.429587	-0.073454	0.9415
DERTOTALWINSB	7.37E-08	1.32E-07	0.556446	0.5783
ROAWINSB	0.074403	0.006618	11.24305	0.0000
DIVYIELDWINS_BIN	0.015741	0.093963	0.167526	0.8671
RDSALESWINS_BIN	0.157488	0.075532	2.085064	0.0378
FORSALESWINS_BIN	0.177622	0.066705	2.662790	0.0081
CRWINS	-0.080025	0.047516	-1.684153	0.0931
LEVDAWINS	0.252170	0.128823	1.957494	0.0511
LNTOTASS	0.040752	0.026315	1.548633	0.1224
DUMPEIODB	0.103085	0.064053	1.609379	0.1085
TELEDUM	-0.048737	0.130012	-0.374868	0.7080
TECHDUM	-0.084255	0.165215	-0.509972	0.6104
CONSGOODSDUM	0.084034	0.106866	0.786351	0.4322
CONSSERVDUM	0.803058	0.159214	5.043897	0.0000
INDUSTRIALSDUM	-0.051734	0.085797	-0.602979	0.5469
HEALTHCAREDUM	0.265270	0.227079	1.168184	0.2435

R-squared	0.609417	Mean dependent var	1.669006
Adjusted R-squared	0.592337	S.D. dependent var	0.838970
S.E. of regression	0.535670	Akaike info criterion	1.632948
Sum squared resid	98.42128	Schwarz criterion	1.806021
Log likelihood	-277.1142	Hannan-Quinn criterion	1.701772
F-statistic	35.67835	Durbin-Watson statistic	1.749233
Prob(F-statistic)	0.000000	Wald F-statistic	27.78149
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 16:49
Sample (adjusted): 203 1297
Included observations: 364 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.683460	0.508976	1.342814	0.1802
DERTOTALWINSB	4.01E-07	1.62E-07	2.472233	0.0139
ROAWINSB	0.062483	0.005637	11.08366	0.0000
DIVYIELDWINS_BIN	0.048307	0.092711	0.521052	0.6027
RDSALESWINS_BIN	0.168024	0.080259	2.093536	0.0370
FORSALESWINS_BIN	0.129077	0.073024	1.767602	0.0780
CRWINS	-0.146589	0.047283	-3.100231	0.0021
LEVDAWINS	0.001822	0.157089	0.011598	0.9908
LNTOTASS	0.013783	0.031572	0.436548	0.6627
DUMPEIODB	0.117076	0.067101	1.744775	0.0819
TELEDUM	0.016479	0.208667	0.078973	0.9371
TECHDUM	0.091715	0.179787	0.510133	0.6103
CONSGOODSDUM	0.086776	0.113980	0.761328	0.4470
CONSSERVDUM	0.611326	0.187855	3.254251	0.0012

INDUSTRIALSDUM	-0.052283	0.093440	-0.559530	0.5762
HEALTHCAREDUM	0.524586	0.200427	2.617345	0.0092

R-squared	0.554090	Mean dependent var	1.642251
Adjusted R-squared	0.534870	S.D. dependent var	0.842710
S.E. of regression	0.574732	Akaike info criterion	1.773135
Sum squared resid	114.9502	Schwarz criterion	1.944438
Log likelihood	-306.7105	Hannan-Quinn criterion	1.841220
F-statistic	28.82844	Durbin-Watson statistic	1.670187
Prob(F-statistic)	0.000000	Wald F-statistic	22.58898
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 16:51
Sample (adjusted): 53 1230
Included observations: 351 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.601838	0.396828	1.516622	0.1303
DERTOTALWINSB	2.55E-07	1.59E-07	1.605677	0.1093
ROAWINSB	0.061418	0.007687	7.990161	0.0000
DIVYIELDWINS_BIN	0.149402	0.099329	1.504112	0.1335
RDSALESWINS_BIN	-0.019079	0.081977	-0.232740	0.8161
FORSALESWINS_BIN	0.132752	0.071134	1.866214	0.0629
CRWINS	-0.109940	0.068067	-1.615169	0.1072
LEVDAWINS	-0.028631	0.145828	-0.196335	0.8445
LNTOTASS	0.022995	0.025116	0.915539	0.3606
DUMPEIODB	0.062545	0.070567	0.886326	0.3761
TELEDUM	-0.122687	0.189941	-0.645920	0.5188
TECHDUM	0.102169	0.201283	0.507590	0.6121
CONSGOODSDUM	-0.039908	0.118963	-0.335470	0.7375
CONSSERVDUM	0.489205	0.222218	2.201462	0.0284
INDUSTRIALSDUM	-0.183558	0.094069	-1.951320	0.0519
HEALTHCAREDUM	0.505284	0.167629	3.014298	0.0028

R-squared	0.503860	Mean dependent var	1.644256
Adjusted R-squared	0.481644	S.D. dependent var	0.836568
S.E. of regression	0.602303	Akaike info criterion	1.868401
Sum squared resid	121.5277	Schwarz criterion	2.044391
Log likelihood	-311.9044	Hannan-Quinn criterion	1.938444
F-statistic	22.68081	Durbin-Watson statistic	1.604841
Prob(F-statistic)	0.000000	Wald F-statistic	17.86519
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 16:53
Sample (adjusted): 98 1242
Included observations: 364 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.770011	0.454204	1.695297	0.0909
DERTOTALWINSB	1.39E-07	1.42E-07	0.983984	0.3258

ROAWINSB	0.057229	0.006837	8.370858	0.0000
DIVYIELDWINS_BIN	0.066333	0.094273	0.703626	0.4821
RDSALESWINS_BIN	0.004780	0.083692	0.057109	0.9545
FORSALESWINS_BIN	0.126424	0.073478	1.720569	0.0862
CRWINS	-0.081784	0.057975	-1.410683	0.1592
LEVDAWINS	-0.036665	0.153120	-0.239453	0.8109
LNTOTASS	0.020080	0.027159	0.739354	0.4602
DUMPEIODB	0.035394	0.066045	0.535908	0.5924
TELEDUM	-0.036267	0.172562	-0.210169	0.8337
TECHDUM	0.098035	0.209103	0.468837	0.6395
CONSGOODSDUM	-0.025080	0.131868	-0.190190	0.8493
CONSSERVDUM	0.430868	0.218000	1.976454	0.0489
INDUSTRIALSDUM	-0.219232	0.096871	-2.263140	0.0242
HEALTHCAREDUM	0.355256	0.175105	2.028824	0.0432

R-squared	0.477136	Mean dependent var	1.638844
Adjusted R-squared	0.454599	S.D. dependent var	0.806280
S.E. of regression	0.595448	Akaike info criterion	1.843956
Sum squared resid	123.3863	Schwarz criterion	2.015259
Log likelihood	-319.5999	Hannan-Quinn criterion	1.912041
F-statistic	21.17099	Durbin-Watson statistic	1.790422
Prob(F-statistic)	0.000000	Wald F-statistic	16.78503
Prob(Wald F-statistic)	0.000000		

Dependent Variable: *TOBINQWINS*
Method: Least Squares
Date: 07/01/20 Time: 16:54
Sample (adjusted): 11 1282
Included observations: 387 after adjustments
Huber-White-Hinkley (HC1) heteroskedasticity-consistent standard errors
and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.937987	0.465351	2.015653	0.0446
DERTOTALWINSB	1.71E-07	1.61E-07	1.066126	0.2871
ROAWINSB	0.060443	0.007346	8.227890	0.0000
DIVYIELDWINS_BIN	0.059050	0.089580	0.659188	0.5102
RDSALESWINS_BIN	0.024939	0.079253	0.314672	0.7532
FORSALESWINS_BIN	0.231811	0.065936	3.515730	0.0005
CRWINS	-0.088010	0.058386	-1.507369	0.1326
LEVDAWINS	0.073721	0.125777	0.586125	0.5581
LNTOTASS	-0.003739	0.029292	-0.127632	0.8985
DUMPEIODB	0.158314	0.064814	2.442573	0.0150
TELEDUM	-0.077553	0.168868	-0.459252	0.6463
TECHDUM	0.124042	0.215935	0.574442	0.5660
CONSGOODSDUM	-0.045722	0.123813	-0.369286	0.7121
CONSSERVDUM	0.339002	0.211876	1.600004	0.1104
INDUSTRIALSDUM	-0.210496	0.094021	-2.238827	0.0258
HEALTHCAREDUM	0.157785	0.157478	1.001948	0.3170

R-squared	0.487383	Mean dependent var	1.634757
Adjusted R-squared	0.466658	S.D. dependent var	0.816717
S.E. of regression	0.596451	Akaike info criterion	1.844824
Sum squared resid	131.9845	Schwarz criterion	2.008480
Log likelihood	-340.9735	Hannan-Quinn criterion	1.909718
F-statistic	23.51586	Durbin-Watson statistic	1.952790
Prob(F-statistic)	0.000000	Wald F-statistic	17.09226
Prob(Wald F-statistic)	0.000000		

Key to variables in Table B.7

TOBINQWINS	Tobin's Q
DERTOTALWINSB	The total amount of derivatives reported in the financial statements
LNTOTASS	Natural logarithm of total assets
DIVYIELDWINS_BIN	Dividend yield
RDSALESWINS_BIN	Ratio of research and development costs divided by sales
FORSALESWINS_BIN	Ratio of foreign sales divided by sales
ROAWINSB	Return on assets
CRWINS	Current ratio
LEVDAWINS	Leverage calculated as the ratio of debt to assets
DUMPERIOD2	Year dummy variable
HEALTHCAREDUM	Sector dummy variable