The derivatives debate: do derivatives disclosures add value during difficult times?

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Received 21 November 2022
Revised 5 June 2023
6 August 2023
Accepted 26 August 2023

Abstract

Purpose – This study investigates whether the disclosure of derivatives is value relevant in emerging markets and evaluates the effects of the 2008/2009 global financial crisis on the value relevance of derivative disclosures.

Design/methodology/approach – Panel regression models using sub-samples and a crisis interaction term were applied to a sample of the 200 largest non-financial firms by market capitalization listed on the Johannesburg Stock Exchange (JSE) from 2005 to 2017 to assess the consequences of the financial crisis.

Findings – The results suggest that the disclosure of derivatives is value relevant in the hitherto understudied context of emerging markets. The 2008/2009 financial crisis had a significant impact on derivatives use and the value relevance of derivatives disclosure by JSE-listed companies.

Practical implications – Companies should reconsider both how they employ derivatives as part of their risk management practices and how they communicate derivatives use to stakeholders in the financial statements. The findings facilitate a comparative analysis across various market contexts by researchers and assist investors in better decision-making. The findings can influence regulatory practices and can help standard setters to review disclosure requirements.

Originality/value – The benefits of corporate hedging were studied from an emerging market perspective, using an original dataset and approach to investigate the effects of international financial volatility on emerging markets. The authors tested whether companies are valued differently, based on their disclosure of the use of derivatives in the financial statements, and the effect of the financial crisis on the value relevance derivatives disclosures.

Keywords Derivatives, Emerging markets, Financial crisis, Hedging, Value relevance

Paper type Research paper

1. Introduction

Derivatives use has grown rapidly in recent years: by 2000, more than 60% of firms in 47 countries used at least one type of derivative, and by 2013, notional amounts for over-the-counter (OTC) derivatives exceeded $650tn (Bartram, 2019). However, the question of whether such derivatives use is indeed beneficial to companies, or adds value to companies during difficult times, remains unresolved in the risk management literature. This study investigates whether derivatives use is value relevant for companies listed in an emerging market, South Africa. We also investigate the possible effect of the 2008/2009 financial crisis on the value relevance of derivatives disclosure for these companies listed on the Johannesburg Stock Exchange (JSE).

In perfect capital markets, corporate hedging should be irrelevant to firm value (Modigliani and Miller, 1958), but several market imperfections can lead to financial distress

International Journal of Emerging Markets
Vol. 20 No. 13, 2025
pp. 181-200
Emerald Publishing Limited
1746-8809
DOI 10.1108/IJOEM-11-2022-1753

costs (Smith and Stulz, 1985). These imperfections include convex tax functions (Smith and Stulz, 1985), costly external financing (Froot, 1993) and information asymmetry between managers and shareholders (DeMarzo and Duffie, 1991), all of which provide an incentive for corporate risk management. Managing cash flow volatility through corporate risk management strategies such as using derivatives may reduce market frictions and influence shareholder value positively. However, some studies have reported that using derivatives can be detrimental to firm value, either because they are ineffective in reducing risk (Hagelin and Pramborg, 2004) or because they add risk arising from speculative trading (Adam *et al.*, 2017).

Empirical studies have reported mixed results regarding the value-enhancing effect of derivatives under imperfect market conditions, possibly because often these studies have focused only on individual markets or events, particular market sectors, or different risk exposures. Allayannis and Weston's (2001) seminal study found a significant value premium for a large sample of United States (US) firms that used foreign exchange derivatives. Since then, studies conducted on US high-tech firms (Gleason *et al.*, 2005), the airline industry (Carter *et al.*, 2006) and pharmaceutical and biotech firms (Choi *et al.*, 2013) have confirmed that firm value is enhanced by derivatives hedging, but no such value premium was found in the US oil and gas sector (Jin and Jorion, 2006). Venkatachalam (1996) found US banks' derivative value disclosures to have incremental explanatory power and Wang *et al.* (2005), found such disclosure by US banks to be value relevant. Several other single country studies have provided further conflicting evidence on the value-enhancing abilities of corporate hedging. Several studies have found evidence of a value enhancing effect in corporate derivatives use in countries such as the United Kingdom (UK) (Clark and Judge, 2009), Spain (Vivel-Búa *et al.*, 2013), Sweden (Jankensgård, 2015; Pramborg, 2004) and South Korea (Bae *et al.*, 2018). By contrast, studies on France (Khediri and Folus, 2010), Australia (Nguyen and Faff, 2003) and New Zealand (Li *et al.*, 2014) found no value enhancing effect, or found a negative effect, of corporate use of derivatives on shareholder or company value.

Campbell *et al.* (2019) show that the derivatives literature in accounting research has grown in recent years, spurred by the increased economic importance of derivatives and by the improvement in disclosure quality, making information more readily available. But despite the rise in research on derivatives use, recent research has clouded rather than clarified the question of the value relevance of derivatives use, as results continue to be mixed. For example, Ayadi *et al.* (2022) found little evidence that using derivatives adds value to firms in developed countries such as the US, UK, Canada, France, Germany, Japan and Australia.

In sum, empirical knowledge about the benefits of derivatives remains incomplete. Most of the existing research also focuses primarily on firms in developed economies. Moreover, there is little understanding of the effect of derivatives use during financial crises, including the temporal effects of global financial crises. This situation persists despite intensified scrutiny of firms' use of derivatives and its effect on the stability of global financial markets, triggered by growth in international derivatives markets, which has in turn been propelled by globalization, advances in technology and financial theory (Allayannis *et al.*, 2012) and the role of derivatives in causing and exacerbating the effects of the 2008/2009 financial crisis. Corporate risk management is particularly crucial in emerging market economies, given that banking crises such as the 2008/2009 financial crisis can hinder companies' access to external finance if banks must cut back on lending (Dell'Ariccia *et al.*, 2008). These effects are stronger in emerging market economies with less access to foreign finance. As emerging markets are still coupled to the US (Dooley and Hutchison, 2009; Frank and Hesse, 2009), they responded strongly to the effects of the US sub-prime mortgage crisis. Their policy measures to insulate themselves from the effects of the financial crisis proved ineffective.

Unlike most other accounting items, by their very nature, derivative instruments already encompass a timing element: the disclosure of derivatives (and its possible value relevance) may be expected to be time-dependent because of the embedded time characteristic in a derivatives contract. Moreover, derivatives are used for corporate hedging and are expected to have a marked effect in smoothing the volatility created by fluctuating business cycles. It is thus surprising that the existing research has ignored, or only considered to a limited extent, the intersection between economic conditions and temporal effects on the value relevance of derivatives. It could be argued that the value relevance of derivatives disclosure would differ depending on the time horizon, and, more specifically, on the economic conditions in a particular time horizon.

The current study thus addresses two research questions. How does the use of derivatives affect the valuation of companies operating in emerging markets? Is this relationship susceptible to influence by macro-economic events, notably financial crises? Given that companies communicate their use of derivatives through disclosure in their financial statements, these research questions are best approached through the lens of value relevance research, which seeks to determine whether companies are valued differently, depending on the derivatives information disclosed in the financial statements, and whether the timing of such disclosure matters. This study is motivated by the need to explore how using derivatives affects the valuation of firms: if derivatives use is perceived positively, it implies that corporate hedging enhances value for firms. If, however, investors' perception of a firm and its derivatives use is affected by changes in economic conditions, it should then become important to factor in economic conditions to understand the value relevance of derivatives.

In our study, South Africa is used as a proxy for emerging markets. This country has comparatively well-developed financial systems, the world's 19th largest stock exchange and a sophisticated futures exchange. The financial markets and infrastructure, regulatory framework and corporate governance protocols and adherence to accounting standards, are relatively more developed in South Africa compared to many other emerging market economies (Du Toit and Esterhuyse, 2021). South Africa, together with Hong Kong and Singapore, has some of the most liquid OTC currency derivatives markets in the world (Lien and Zhang, 2008). Data on companies' use of derivatives are also readily available, since JSE-listed firms have to comply with the International Accounting Standards (IAS) and International Financial Reporting Standards (IFRS) reporting standards. South Africa's alignment with globally accepted accounting standards (IFRS) enhances comparability across international markets, since IFRS promotes transparency and consistency in financial reporting. This level of development and compliance can thus also provide a conducive environment for studying the use and relevance of accounting information. Furthermore, African companies, and by extension, other emerging market economies, often offer researchers extreme conditions, as there is some similarity in companies' lack of support in terms of infrastructure and from institutions, unlike their counterparts in developed countries (Barnard *et al.*, 2017).

These extreme conditions were especially visible in the disproportionate impact of the 2008/2009 financial crisis on emerging markets (Essers, 2013; Griffith-Jones and Ocampo, 2009; Frank and Hesse, 2009). Since emerging markets are still coupled to developed economies (Dooley and Hutchison, 2009; Frank and Hesse, 2009), emerging markets have a strong incentive to protect themselves against adverse movements in international financial markets. If the findings of the current study hold true under such extreme conditions, then one should be able to extrapolate these findings to other emerging market economies that experience similar challenges, and inferences could be made regarding countries where such conditions do not prevail.

Our research used a sample of the 200 largest non-financial firms by market capitalization listed on the JSE. We used panel regression analyses to compare the value relevance of derivatives over different economic periods (2005–2009 and 2010 to 2017), and specifically incorporated the effects of the global financial crisis of 2008/2009. This study contributes towards resolving the corporate hedging debate, as highlighted by Campbell *et al.* (2019), by showing that derivatives use is beneficial to emerging market companies to shield themselves against contagion from global economic volatility, but that one has to be careful to interpret the results based on the broader prevailing economic conditions.

The study contributes to the discourse on derivatives use in several ways. The study contributes to financial theory by providing insights into risk management practices in the previously understudied context of emerging markets. Methodologically, the study employs panel regression models, sub-samples, and a crisis interaction term to analyse a comprehensive dataset of 200 non-financial firms. This approach enhances the rigour and reliability of the findings, enabling a more nuanced examination of the impact of derivatives use on firm value and the effects of the financial crisis.

The study's findings have significant practical implications for a variety of stakeholders. Companies are urged to reassess their approach to employing derivatives as part of their risk management practices, and more specifically, how they communicate these practices to stakeholders through disclosure in the financial statements. If they recognize the value relevance of derivatives disclosures, companies can refine their strategies and enhance transparency in their financial reporting. Furthermore, the study's insights can aid investors in making more informed decisions in evaluating investment opportunities in emerging markets. The findings may also influence regulatory practices and standard setters, prompting a review of disclosure requirements to promote transparency and effective risk management disclosure in emerging markets.

The remainder of this article provides a brief overview of the relevant literature and hypothesis development, followed by a description of the research methodology used and the results of the research. We then discuss the findings and conclude with implications for future research and the practice.

2. Literature review and hypothesis development

2.1 Derivatives, risk management and firm value

The literature on derivatives use and firm value in established financial markets is wide-ranging, but inconclusive. Berkman and Bradbury (1996) were among the first to look at the *extent* of derivatives use (not just their use) in their study on derivatives use in New Zealand. Allayannis and Weston (2001) found a statistically significant positive relationship between the use of foreign currency derivatives and firm value. Bartram *et al.* (2011) found strong evidence that using derivatives reduced both total and systematic risk and had a positive effect on firm value. A significant finding for the current study is Bartram *et al.*'s (2011) data showing that derivative use was associated with significantly higher value, larger profits and abnormal returns during the economic downturn in 2001 and 2002, suggesting that firms were successful in hedging downside risk by using derivatives.

Ehlers and Packer (2013) posit that a possible reason for strong growth in the derivatives market and progress in the internationalization of emerging market economies' currencies is a growing demand from international investors that exposure to currency risk be hedged, as is reflected in the strong correlation between growth in emerging market economies' currency turnover and cross-border mutual fund flows. There is evidence that during the 2008/2009

financial crisis, investors with high exposure to emerging equity markets generated high returns when most US stock indices decreased significantly (Atilgan *et al.*, 2016). During the same period, the total trading volume for individual stocks and index funds also increased significantly in emerging market economies. Such findings have spurred research on emerging market economies. According to Atilgan *et al.* (2016), research on derivatives benefits from the availability of unique datasets in emerging market economies. However, the still limited research from emerging market economies also often reports contradictory results about the benefits of derivatives hedging. Furthermore, few, if any, studies from emerging markets have thus far specifically incorporated the temporal effects of financial crises.

In Brazil, Júnior and Laham (2008) found a value premium for firms that adopted a hedging policy. Their results were contradicted by later Brazilian studies by Serafini and Sheng (2011) and Dos Santos *et al.* (2017). Serafini and Sheng (2011) found no increase in firms' market value from using foreign exchange derivatives; both companies that started and companies that stopped using derivatives experienced an increase in market value. Dos Santos *et al.* (2017) also found no evidence that derivatives use has a statistically significant impact – Brazilian companies use derivatives to manage cash flows, rather than to create value. A study focusing on Colombia by Gómez-Gonzáles *et al.* (2012) reported a positive impact of hedging practices on firm value.

Growth in derivatives trading has been significant in some emerging market economies in Asia, but not others (Jobst, 2008). According to Ayturk *et al.* (2016), only 36.41% of their sample of Turkish non-financial firms used derivatives and derivatives use did not affect firm value for these firms. On the other hand, using foreign exchange derivatives had a positive, but insignificant, association with hedging premium and corporate value for Chinese multinational companies (Luo, 2016). Studies in Malaysia also found conflicting evidence. Derivatives use was associated with lower firm market value (Lau, 2016), even though derivatives use contributed to an increase in return on equity (ROE) and return on assets (ROA), which are both drivers of firm value. Hadian and Adaoglu (2020) found that derivatives hedging created a value premium range in the short and long run for Malaysian multinationals, using Tobin's Q as a proxy for firm value.

The current study considers data from companies listed on the JSE in South Africa, where derivatives use was found to compare favourably with that by companies in developed economies (Correia *et al.*, 2012). Upper and Valli (2016) laud South Africa for significant currency trading market activity and for coming closest, among the emerging market economies, to the total turnover (relative to GDP), and the foreign exchange derivatives turnover (relative to trade) of developed economies. However, these ratios are still far below the average of developed economies. Since South Africa's financial infrastructure functions well, and information on financial markets is easily available, South African data can be fruitfully used as a proxy for data on similar emerging market economies and to offer inferences relevant to developed economies.

Walker *et al.* (2014) found no significant value premium for users of derivatives for 117 JSE-listed non-financial firms over a four-year period (2006–2009). Similarly, Toerien and Lambrechts (2016) found no significant impact from derivatives use on firm value where ROE, ROA, the Tobin's Quotient (Tobin's Q), and economic value added (EVA) were used as measures of firm value. This study addresses a notable gap in the existing literature, in that prior research on derivatives use and its impact on firm value has yielded conflicting results even for developed economies, and there has been little research on emerging markets. Hence, the following hypothesis is developed to address this gap:

H1. The disclosure of derivatives in the financial statements of JSE-listed firms is value relevant.

2.2 Derivatives and the 2008/2009 financial crisis

Many reasons for the 2008/2009 financial crisis have been postulated, not least the role played by financial instruments, including derivatives, in causing and magnifying the effects of the crisis (Essers, 2013; Jickling, 2009; Petrova, 2009; Stulz, 2010). The internationalization of financial markets means that few domestic markets can isolate themselves from the impact of a global crisis (Petrova, 2009), but the role that derivatives played should be counterbalanced by the purpose for which non-financial companies used derivatives. Cyree *et al.* (2012) found that the economic consequences of banks' derivatives use did not alter significantly with the cyclical fluctuations caused by the 2008/2009 financial crisis – there is no evidence that the average bank used derivatives in ways that harmed the banking system (Cyree *et al.*, 2012). Despite being associated with losses and uncertainty at some institutions, derivatives enabled other entities to hedge against, and reduce the effects of, the financial crisis caused by an increase in sub-prime mortgage loan default rates (Stulz, 2010).

Emerging market economies are particularly vulnerable to economic shocks, so they were affected by the 2008/2009 financial crisis. The effect was direct if they held toxic assets, or had invested in foreign institutions holding toxic assets (Naude, 2009), or indirect, through international trade, private capital flows, the remittances of migrant workers and bilateral aid (Essers, 2013; Griffith-Jones and Ocampo, 2009). The impact of the 2008/2009 crisis was more pronounced in individual emerging market economies with weaker economic fundamentals and higher trade and financial linkages, such as demand in advanced economies and foreign bank claims (Chivakul *et al.*, 2010). Higher reserves and better policy fundamentals and vulnerability indicators during the pre-crisis period helped buffer emerging economies against the crisis. The vulnerability of these economies to external shocks is concerning – it seems that output volatility caused by external shocks to such economies reduces growth and hampers poverty reduction (Essers, 2013).

Emerging markets are thus disproportionately affected by global financial crises. However, there remains a significant research gap concerning the effectiveness of derivatives use in safeguarding firm value during such crises. Additionally, few existing studies have specifically incorporated the temporal effects of crises on the value relevance of the disclosure of derivatives information. Hence the following hypothesis was developed:

H2. The value relevance of derivatives disclosed in the financial statements of JSE-listed firms is statistically significantly different during specific economic periods.

3. Research design and methods

3.1 Sampling and data collection

The data for the current study were captured from the financial records of a sample of the 200 largest non-financial firms, ranked by market capitalization, listed on the JSE. The data were collected from the Thomson Reuters DataStream and IRESS repositories of financial data. The sample period covered the entire time frame in which South African companies were required to disclose derivatives in accordance with IAS 39, which was effective from 2005 to 2017. A new accounting standard, *IFRS 9*, became effective from 2018, to address some of the criticism of IAS 39's failure to capture the economic substance of financial instruments. The dataset included only non-financial firms (financial companies have an added incentive to use derivatives speculatively to time market movements to gain profits). It is often difficult to differentiate between firms' use of derivatives for hedging or speculation purposes (Chernenko and Faulkender, 2011; Géczy *et al.*, 2007; Hentschel and Kothari, 2001), but we assumed that all the sample firms used derivatives to manage risk.

The dataset was unbalanced since the data collected were financial. It is often difficult to collect complete datasets from company financial statements. However, an unbalanced data structure offers the advantage of mitigating attrition bias (Pindado and Requejo, 2015).

3.2 Research model and instruments

3.2.1 Dependent variable. Like most previous studies, we used Tobin's Q as a proxy for firm value (Allayannis and Weston, 2001; Bartram *et al.*, 2011). 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; it is considered a good proxy for firm value (Wernerfelt and Montgomery, 1988).

3.2.2 Explanatory variable. To measure the value effect arising from the disclosure of derivatives for hedging purposes, we followed previous studies in using a dummy variable, *DerTotalBin,* to proxy derivatives use (Jankensgård, 2015; Khediri and Folus, 2010; Pramborg, 2004). Derivatives users were denoted by 1, non-users by 0. A positive value of the coefficient indicated for these proxies of corporate hedging increased firm value. Conversely, a negative value of the coefficient decreased firm value. To isolate the impact of using derivatives on firm value, we followed Allayannis *et al.* (2012), Allayannis and Weston (2001), Ayturk *et al.* (2016), Jin and Jorion (2006) and others in including other known drivers of firm value in the regression, including firm size, profitability, leverage, liquidity, access to financial markets, growth prospects geographic diversification, industry effects and time effects.

As was done in previous studies (Ayturk *et al.*, 2016; Jankensgård *et al.*, 2014; Khediri and Folus, 2010), we used the natural logarithm of total assets (*Size = Ln(TotAss)*) to control for company size, since firm size has been shown to affect firm value.

More profitable firms tend to be valued higher by the market; hence, the effects of profitability have to be controlled for (*Profitability (ROA)*) (Ayturk *et al.*, 2016; Jankensgård *et al.*, 2014; Luo, 2016). Profitability of firms was proxied by the ROA ratio.

Highly leveraged firms (those more dependent on debt financing than equity financing) have a higher incentive to use derivatives (Bartram *et al.*, 2011; Shu and Chen, 2003). Leverage was calculated as the ratio of total debt to total assets (*Leverage (LevDA)*).

The current ratio was used to express a company's liquidity (*Liquidity (CR)*). Firms with a relatively 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 and French, 1998; Pramborg, 2004).

Companies without easy access to financial markets have an incentive to invest only in very profitable projects with a positive net present value to increase firm value. Firms paying dividends have fewer restrictions in the financial markets – issuing dividends sends a positive signal and increases firm value (Asquith and Mullins, 1983; Fazzari *et al.*, 1988). The dividend yield (*Div*) was used to control for dividends on firm value.

Firms with higher growth prospects (*Growth prospects (RD/Sales)*) 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 research and development (R&D) costs to total sales (Géczy *et al.*, 1997; Rogers, 2002).

Geographic diversification (For/Sales) Firms operating in more than one country may be more likely to be valued higher (Allayannis *et al.*, 2012). The ratio of foreign sales divided by total sales was used.

Firms might be valued differently depending on the industry in which they operate. We used dummy variables to control for industry effects (*IndustryDum*). Companies were classified according to their sector, as designated by IRESS, as a reputable international data repository and software and technology provider. The seven sectors classified by IRESS and used by the study were the following: basic materials, consumer goods, consumer services, health care, industrials, technology and telecommunications.

Firm value fluctuates over time as different macroeconomic factors influence the broader economy in which a company operates. To test Hypothesis 2, two different approaches were used. First, the data sample was separated into two sub-sample periods, namely a before-crisis period (2005–2009) and a post-crisis period (2010–2017), to compare the value relevance between two different periods, in view of a significant economic shock.

A second panel regression model employing a crisis-period dummy variable and an interaction term between the crisis period and the derivatives variable was created to assess the effect of the financial crises on the value relevance of derivatives disclosures. The research method employed in this study (panel regression models with sub-samples and a crisis interaction term) was chosen because it allowed the researchers both to investigate comprehensively the value relevance of derivative disclosures and systematically assess the effects of the 2008/2009 global financial crisis. Since derivatives disclosures are often influenced by both short-term and long-term factors, panel regression models have the added advantage of demonstrating how risk disclosure changes over time and how it responds to changes in various determinants.

3.3 Robustness analyses

Robustness analysis is important to ensure the reliability of the results of regression models. The panel estimated generalized least squares regression models were robust in meeting the assumptions necessary for the analysis of the data. The regression modelling was conducted in Eviews11. Using panel regression methods, the process involved conducting an OLS regression on panel data (panel least squares). Diagnostics included testing for serial correlation, heteroskedasticity and whether a fixed or random model applied. In order to address the presence of autocorrelation and heteroskedasticity, period SUR estimates were applied to correct for heteroskedasticity and general correlation of observations within a cross-section. White's diagonal standard errors and covariance, which is a robust standard error estimation method, was also applied to ensure that the significance values were not influenced by heteroskedasticity. It must be noted that, although the Hausman test indicated that a fixed model applied, the presence of industry dummies in the model could lead to singularity if the fixed model was applied. Outliers in the original data sample were excluded by winsorizing data at the 5 and 95% percentiles. Since no tolerance values were below 0.1 and no Variance Inflation Factor (VIF) values were above 10, the assumption of no multicollinearity was met. The Durbin–Watson statistic of two fell within the expected range of 1–2, so the assumption of the absence of serious autocorrelation was met. The absence of heteroskedasticity was confirmed by the Breusch Pagan test. Normality of the residuals could be assumed (where the Jarque-Bera test indicated that the assumption was not met, the test and the skewness and kurtosis values were used only to provide a reasonable justification if the assumption was met/not met). Standard error clustering was applied by using the appropriate robust standard error and covariance estimation. The adjusted R-squared was 41% and the F-statistic was 9.09, $p < 0.01$ for the panel regression model to test H1 (see Table 3). The adjusted R-squared was 50%, and the F-statistic was 5.89, $p < 0.01$ for the panel regression model testing the sub-sample period 2005–2009 (see Table 4). The adjusted R-squared was 76%, and the F-statistic was 23.37, $p < 0.01$ for the panel regression model testing the sub-sample period 2010 to 2017 (see Table 5), These results indicate the overall goodness-of-fit of the models. In Table 6, which shows the results for the interaction of the crisis period with the derivatives variable, the adjusted R-squared of 60% and the F-statistic of 18.26 indicate the model's goodness-of-fit.

4. Results and discussion

4.1 The value relevance of derivatives disclosure

The descriptive statistics for the variables are presented in Table 1. Table 2 reports the Pearson correlation coefficients between Tobin's Q and the explanatory variables. Of the 200 companies in the initial unbalanced panel data set, 114 used at least one type of disclosed derivative during the sample period (2005–2017). Thus, more than half of the companies listed on the JSE during the overall sample period used derivatives (57%). The dependent variable, Tobin's Q, is a proxy of the market value of a firm. Derivatives use, proxied by a

Table 1. Descriptive statistics of the variables

	N								
	Valid	Missing	Mean	Median	Std. Deviation	Skewness	Kurtosis	Minimum	Maximum
Tobin's Q	2,227	503	1.58	1.33	0.82	1.15	0.559	0.28	3.69
Derivatives total (ZAR)	783	1,947	154,278	27,344	299,158	2.57	5.610	220	1,179,827
Total assets (ZAR)	2,398	332	9,638,881	2,121,024	16,040,889	2.07	3.154	130	58,580,710
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
Leverage: debt/assets	2,730	0	33	33	29	23	−1.331	0.00	85
Foreign sales/sales	973	1757	33.9	24.39	28.12	0.82	−0.554	0.01	92.59
RD/sales	415	2,315	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

Source(s): Own compilation

Table 2.
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		2,535									
Total assets	Pearson correlation	0.586**	0.485**	1								
	N	783	2,265	2,398								
ROA	Pearson correlation	−0.083*	0.008	−0.022	1							
	N	765	2,192	2,316	2,316							
Interest cover	Pearson correlation	−0.115**	−0.011	−0.053**	0.301**	1						
	N	783	2,535	2,398	2,316	2,730						
Leverage Debt/ Assets	Pearson correlation	0.003	0.219**	0.058**	−0.089**	0.101**	1					
	N	783	2,535	2,398	2,316	2,730	2,730					
Current ratio	Pearson correlation	−0.110**	−0.143**	−0.133**	0.102**	0.179**	−0.400**	1				
	N	783	2,245	2,377	2,297	2,377	2,377	2,377				
Dividend yield	Pearson correlation	−0.131**	0.270**	−0.163**	0.184**	0.105**	−0.057*	0.168**	1			
	N	607	2,535	1,546	1,537	1,552	1,552	1,546	1,552			
Tobin's Q	Pearson correlation	0.043	0.046*	0.061**	0.431**	0.264**	0.081**	−0.088**	−0.060*	1		
	N	744	2,110	2,226	2,203	2,227	2,227	2,207	1,543	2,227		
RD/Sales	Pearson correlation	0.109	0.194**	0.066	−0.038	0.130**	−0.011	0.030	0.088	0.107*	1	
	N	200	2,535	415	406	415	415	415	304	396	415	
Foreign sales/ Sales	Pearson correlation	0.278**	0.376**	0.347**	−0.183**	0.009	−0.102**	0.119**	−0.032	−0.192**	0.107	1
	N	495	2,535	973	955	973	973	973	788	934	262	973

Note(s): ** Significant at the 1% level (using two-tailed significance), * Significant at the 5% level (using two-tailed significance)
Key to variables in Table 2: R&D/SALES=Ratio of research and development costs divided by sales; ROA = Return on assets
Source(s): Own compilation

binary value of 1 if a company disclosed a derivatives amount captured from the financial statements (0 otherwise), was positively correlated with firm value and was statistically significant (0.046, $p < 0.05$). Firm value was positively correlated with profitability (0.431, $p < 0.01$), firm size (0.061, $p = 0.004$) and growth opportunities (0.107, $p = 0.033$). Firm value was also negatively and significantly correlated with liquidity (−0.088, $p < 0.01$), geographic diversification (−0.192, $p < 0.01$) and the dividend dummy variable (−0.06, $p = 0.018$). This implies that the firm value for JSE-listed companies was a function of size, liquidity, growth opportunities, the amount of foreign operations and whether or not the firm issued a dividend. Leverage or derivatives use did not relate to firm value at a statistically significant level, based on the results of the univariate analysis.

An independent *t*-test was conducted to determine whether the differences in the total derivatives amount between the two sub-sample periods (2005–2009 and 2010 to 2017) were statistically significant. The differences were statistically significant ($Me_{p1} = 664{,}879.17$ and $Me_{p2} = 202{,}505.15$; $p < 0.05$). The independent proportion test for differences in the proportion of derivatives (binary allocation) between the two sub-sample periods (2005–2009 and 2010 to 2017) were statistically significant ($Proportion_{p1} = 0.212$ and $Proportion_{p2} = 0.369$; $p < 0.001$).

To determine the value relevance of derivatives disclosure on firm value, the following panel regression model was used:

$$\begin{aligned} Firm\ value\ = \alpha\ &+ \beta_1 Hedging/Derivatives\ + \beta_2 Firm\ size\ + \beta_3 Profitability\ + \beta_4 Leverage \\ &+ \beta_5 Liquidity\ + \beta_6 Dividends\ + \beta_7 Growth\ prospects \\ &+ \beta_8 Geographic\ diversification\ + \alpha\Sigma Sector\ + \varepsilon_i \end{aligned}$$

where

$$Dependent\ value\ = \text{firm value proxied by Tobin's Q}$$

a = intercept

Hedging/Derivatives = dichotomous variable of 1 if the company used derivatives (0 otherwise) *(Dertotal_Bin)*

Firm Size = logarithm of total assets *(LnTotAss)*

Profitability = ratio of earnings before interest and tax (EBIT) divided by total assets (ROA)

Leverage = ratio of total debt divided by total assets *(LevDA)*

Liquidity = current ratio *(CR)*

Dividends = dividend yield *(Div)*

Growth prospects =ratio of R&D expenses divided by total sales *(RD/Sales)*

Geographic diversification = ratio of foreign sales divided by total sales *(For/Sales)*

$\Sigma Sector$ = different sectors in which the firms in the sample operate *(IndustryDum)*

E = residual term

The study employed panel estimated generalized least squares. The results from this regression are presented in Table 3.

Variable	Coefficient	Std. error	*t*-statistic	Prob.
C	−0.110043	0.957408	−0.114939	0.9086
DERTOTAL_BIN	0.143858	0.085933	1.674076	0.0958
ROA	0.062327	0.007402	8.420265	0.0000
LEVDA	0.142613	0.343887	0.414709	0.6788
FOR/SALES	0.001757	0.002086	0.842295	0.4007
RD/SALES	0.363281	0.147661	2.460231	0.0148
LNTOTASS	0.083948	0.050412	1.665224	0.0976
CR	−0.155507	0.119068	−1.306036	0.1932
DIV	−0.099904	0.022410	−4.458012	0.0000
HEALTHCAREDUM	0.077008	0.208043	0.370155	0.7117
INDUSTRIALSDUM	0.015878	0.126234	0.125780	0.9000
CONSGOODSDUM	0.471935	0.340968	1.384104	0.1680
CONSSERVDUM	0.918850	0.722960	1.270956	0.2054
TECHDUM	0.063687	0.385102	0.165376	0.8688
TELEDUM	0.357116	0.240021	1.487854	0.1385
Root MSE	0.420873	*R*-squared		0.410041
Mean dependent var	0.818031	Adjusted *R*-squared		0.364908
S.D. dependent var	0.564465	S.E. of regression		0.437782
Sum squared resid	35.07250	*F*-statistic		9.085088
Durbin–watson stat	1.327761	Prob(*F*-statistic)		0.000000

Source(s): Own compilation

Table 3.
The value relevance of derivatives

The findings from this regression model show that derivatives use by companies was statistically significant (0.14, $p < 0.1$) and hence was value relevant. We thus accepted H1. Investors rewarded 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.

Results from this multiple linear regression model show that firm profitability, measured by ROA (0.06, $p < 0.01$), was statistically significantly and positively related to Tobin's Q. Firm size (0.0, $p < 0.1$) and growth prospects (0.36, $p < 0.05$) were also positively and statistically significantly related to firm value. By contrast, firm liquidity (−0.16, $p < 0.01$) and dividend yield (−0.1, $p < 0.01$) were statistically significantly and negatively related to Tobin's Q. No statistically significant results for the firms' sector dummy variables were found, indicating that the different sectors of the JSE were not valued differently during the sample period.

4.2 Value relevance of derivatives disclosure in different economic periods

The 2008/2009 financial crisis offers a unique opportunity to study whether the disclosure of derivatives was value relevant before and after the crisis period. To test H2, the data sample was divided into two sub-samples, a before-crisis period that included the 2008/2009 financial crisis (2005–2009) and a post-crisis period (2010–2017), presented in Tables 4 and Table 5. The pre-crisis period indicates that derivatives disclosure had a statistically significant impact on firm value (0.25, $p = 0.07$) before and during the crisis, but not in the period after the crisis (0.06, $p = 0.52$). During the total sample period, companies disclosed derivatives information according to IAS 39. The implication of this is that information was disclosed according to the same rules. Companies were rewarded with a higher valuation if they used derivatives before the crisis, but not so after the crisis. To assess whether accounting information is value relevant, the timing of disclosure matters.

We also used a panel estimated generalized least squares regression, employing an interaction variable between derivatives use and the crisis-period of 2008/2009

Variable	Coefficient	Std. error	*t*-statistic	Prob.
C	1.151521	1.458197	0.789689	0.4322
DERTOTAL_BIN	0.253235	0.137268	1.844819	0.0690
ROA	0.070332	0.008740	8.047443	0.0000
LEVDA	−0.295519	0.392215	−0.753461	0.4535
FOR/SALES	0.000647	0.002884	0.224205	0.8232
RD/SALES	0.152154	0.295352	0.515161	0.6080
LNTOTASS	0.025518	0.075950	0.335987	0.7378
CR	−0.329935	0.119533	−2.760190	0.0073
DIV	−0.058464	0.032497	−1.799079	0.0760
HEALTHCAREDUM	−0.088653	0.425177	−0.208508	0.8354
INDUSTRIALSDUM	0.022509	0.184007	0.122327	0.9030
CONSGOODSDUM	−0.060729	0.204041	−0.297632	0.7668
CONSSERVDUM	0.534378	0.416994	1.281499	0.2040
TECHDUM	0.085818	0.228178	0.376102	0.7079
Root MSE	0.492442	*R*-squared		0.505100
Mean dependent var	1.777188	Adjusted *R*-squared		0.419317
S.D. dependent var	0.703963	S.E. of regression		0.536438
Akaike info criterion	1.735726	Sum squared resid		21.58242
Schwarz criterion	2.127197	Log likelihood		−63.23982
Hannan-Quinn criter	1.893517	*F*-statistic		5.888128
Durbin–Watson stat	1.635822	Prob(*F*-statistic)		0.000000

Source(s): Own compilation

Table 4. Value relevance of derivatives: 2005–2009

Variable	Coefficient	Std. error	*t*-statistic	Prob.
C	0.264486	0.651997	0.405655	0.6859
DERTOTAL_BIN	0.060776	0.094738	0.641514	0.5227
ROA	0.060201	0.006785	8.873329	0.0000
LEVDA	0.440112	0.227386	1.935531	0.0559
FOR/SALES	0.003877	0.001425	2.721107	0.0077
RD/SALES	0.103498	0.126712	0.816800	0.4161
LNTOTASS	0.043955	0.037826	1.162026	0.2481
CR	−0.059325	0.063090	−0.940314	0.3494
DIV	−0.079577	0.022091	−3.602290	0.0005
HEALTHCAREDUM	0.177457	0.177331	1.000711	0.3195
INDUSTRIALSDUM	−0.111998	0.127301	−0.879785	0.3812
CONSGOODSDUM	0.959852	0.116025	8.272780	0.0000
CONSSERVDUM	0.722884	0.454621	1.590082	0.1151
TECHDUM	0.076841	0.184077	0.417442	0.6773
Root MSE	0.896919	*R*-squared		0.761797
Mean dependent var	4.073332	Adjusted *R*-squared		0.729200
S.D. dependent var	2.570321	S.E. of regression		0.960737
Sum squared resid	87.68650	*F*-statistic		23.37067
Durbin–Watson stat	1.301118	Prob (*F*-statistic)		0.000000

Source(s): Own compilation

Table 5. The value relevance of derivatives: 2010–2017

(*Inter_crisisder*), with the crisis period defined as the year dummies for 2008 and 2009, over the entire sample period, presented in Table 6. Derivatives use including these interaction terms were not found to be value relevant (DerBin 0.07, $p = 0.31$), but the crisis dummy period (*Dumcrisis* −0.38, $p < 0.01$) and the interaction term (*Inter_crisisder* 0.25, $p = 0.05$) were found to be statistically significant. The negative effect of the crisis period on firm value can be seen

Variable	Coefficient	Std. error	*t*-statistic	Prob.
C	−0.033753	0.491472	−0.068678	0.9453
DERTOTAL_BIN	0.069212	0.068976	1.003418	0.3170
ROA	0.058593	0.004432	13.21939	0.0000
LEVDA	0.029783	0.165036	0.180464	0.8570
FOR/SALES	0.002106	0.001126	1.870772	0.0630
RD/SALES	0.147912	0.102334	1.445390	0.1501
LNTOTASS	0.082494	0.027690	2.979200	0.0033
CR	−0.172622	0.042774	−4.035665	0.0001
DIV	−0.060128	0.014403	−4.174671	0.0000
HEALTHCAREDUM	0.262296	0.138163	1.898449	0.0592
INDUSTRIALSDUM	−0.014282	0.095014	−0.150318	0.8807
CONSGOODSDUM	0.532586	0.095301	5.588439	0.0000
CONSSERVDUM	0.692080	0.238963	2.896187	0.0042
TECHDUM	0.189448	0.147124	1.287678	0.1995
DUMCRISES	−0.381548	0.116211	−3.283239	0.0012
INTER_CRISISDER	0.248269	0.127190	1.951950	0.0525
Root MSE	0.901874	*R*-squared		0.600750
Mean dependent var	3.382962	Adjusted *R*-squared		0.567845
S.D. dependent var	1.889164	S.E. of regression		0.940682
Sum squared resid	161.0488	*F*-statistic		18.25701
Durbin–Watson stat	1.437187	Prob (*F*-statistic)		0.000000

Source(s): Own compilation

Table 6.
The value relevance of derivatives and crisis interaction

in the negative coefficient of the crisis period dummy variable. The interaction term shows that the timing of the disclosure of derivatives information affects the value relevance of that disclosure. H2 was thus accepted.

4.3 Discussion of the value relevance of derivatives disclosure and the effect of the financial crisis

Bartram *et al.* (2011) claim that hedging increases during crisis periods; they used the 2001 economic decline as their point of reference. More recent research by Ahmed *et al.* (2014) found no evidence that companies changed their corporate hedging behaviour significantly due to the 2008–2009 financial crisis, but they showed that the value enhancing effect varied over different types of contracts. Similarly, Nova *et al.* (2015) found considerable variation in derivatives use during the period 2008 to 2009 for the largest 350 non-financial FTSE-350 Index listed firms, using a sample period from 2005 to 2013. The current study supports the findings of Ahmed *et al.* (2014) and Nova *et al.* (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 results also support the findings of Allayannis and Weston (2001), Jankensgård (2015) and Pramborg (2004) that derivatives disclosure is value relevant. Derivatives use by JSE-listed firms compared well to derivatives use in developed countries, with 57% of companies disclosing derivatives at least once during the sample period. Furthermore, the 2008/2009 financial crisis had a significant impact whether derivatives disclosure was perceived to be value relevant or not. Value relevance research is concerned with the extent to which financial information is useful and relevant for investors in valuing a company or making investment decisions. In our data sample, JSE-listed companies had to disclose information according to IAS 39. Our study shows that initially investors attached significant importance to this information, leading to higher valuations for companies that disclosed derivatives

(see Table 3). However, the substantial economic shock provoked by the 2008/2009 financial crisis disrupted the perceived value that investors attributed to this information.

The derivatives amount variable is often employed as a proxy for firm risk management practices. The implication is that although firms were initially rewarded for pursuing risk management and were valued higher accordingly, the financial crisis has had a noticeable influence on how effective the market perceives this risk management to be. It is possible that the results in the current study may be ascribed to how the derivatives variable was calculated. A total amount of derivatives was calculated by adding the derivatives disclosed as either assets or liabilities in the financial statements together [1]. It is possible that assets and liabilities are viewed differently – firms were rewarded for disclosing financial instruments as assets, but penalized for disclosing them as liabilities. The 2008/2009 financial crisis could have caused many companies' exposures to increase negatively and this could have influenced the overall value relevance of the disclosures, as seen in Tables 5 and 6. It is further possible that different types of financial instruments (forwards, futures, options and swaps) have different value relevance to financial statement users (Bartram *et al.* (2011)), while the risks being hedged (foreign exchange, credit risk and commodity risk) could also be viewed differently.

Our findings have two significant implications. The first is that derivatives disclosures are value relevant, but the timing of such disclosure is important. Since value relevance research is concerned with whether reported accounting information is relevant and informative for investors and market participants in assessing a firm's value, the timing of information (when the information is reported) becomes important. The second is that, since derivatives disclosures are used as a proxy for firm risk management practices, the implication is that derivatives use was able to increase firm value before the crisis, making hedging a value adding strategy for firms. However, such derivatives use was unable to protect firm value during the economic downswing caused by the 2008/2009 crisis. Companies thus need to reconsider both how derivatives are used as part of their risk management practices, and how it is communicated to stakeholders in the financial statements [2].

5. Conclusions and recommendations

The findings suggest that the use of derivatives is value enhancing for emerging market economy companies, such as the sample of firms listed on the JSE. Furthermore, the findings highlight the importance of taking temporal effects into consideration when conducting value relevance research. This study has valuable implications for firms and for those researching the value relevance of derivatives. The results suggest that companies were rewarded with a value premium for engaging in risk management practices, implying that firms in emerging markets should carefully assess the benefits of using derivatives and the manner in which they disclose this information in the financial statements. By introducing a measure to control for an exogenous shock to the economic cycle, such as using sub-sample periods and an interaction variable, this study was better able to judge the effectiveness of companies' corporate hedging practices in protecting firm value during adverse economic conditions. The findings 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.

The findings of our study have valuable implications for future research. *IFRS 9* was introduced in 2018 to address some of the problems arising from the complexity of IAS 39. Future research may compare the value relevance under both standards to determine whether more value is gained under the new reporting requirements.

Furthermore, the COVID-19 pandemic and ensuing economic disruptions in 2020 can offer a further valuable comparative analysis opportunity. Researchers may well consider whether

risk management practices changed after the financial crisis and whether risk management practices are perceived to add more value after the COVID-19-induced economic disruption. Regulators and standard setters may review disclosure requirements to address better how risk management information is presented in financial statements. Finally, researchers should pay attention to explicitly incorporating contextual factors (including events such as temporal shocks) in their study of the benefits and disadvantages of derivative use.

Notes

1. A second approach is using the gross value or notional amounts of derivatives disclosed in the financial statements in a multiple linear regression framework (Berkman and Bradbury, 1996). Firms can hold two offsetting positions simultaneously, doubling the contract size, but halving their exposure. Hentschel and Kothari (2001) and Nguyen and Faff (2003) argue that in reality this offsetting is unlikely, so one can assume general proportionality between contract size and exposure. Both approaches to testing for derivatives use (as a dichotomous or continuous variable), were investigated in our value relevance models. The continuous model supported the findings that derivatives disclosure was value relevant during the pre-crisis period, but not so in the post-crisis period.
2. It is possible that the suggested relations above could be caused by reverse causality, and that firms with high Tobin's Q are more likely to hedge. Firms that are valued higher, for example, because of higher growth opportunities, may have an added incentive to hedge, as they pursue profitable investment opportunities. In line with Allayannis and Weston's results (2001), the reverse causality tests found that hedging caused increases in Tobin's Q, but there was no evidence that the level of Tobin's Q influenced hedging behaviour.

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