A CAUSAL RELATIONSHIP BETWEEN DERIVATIVES TRADING, CAPITAL MARKET DEVELOPMENT AND ECONOMIC GROWTH: EVIDENCE FROM SOUTH AFRICA

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Abstract

This article is based on empirical research on the relationship between derivatives and capital market development and also between derivatives and economic growth on the Johannesburg Stock Exchange (JSE) for the period between 1994 and 2012. The study employed the Autoregressive Distributed Lag (ARDL)-bound testing approach and the Granger causality tests to examine the linkage between capital market development and derivatives, and the nexus between derivatives and economic growth to capture the short-run and long-run dynamics. The results show that there is a significant relationship between derivatives and capital markets development. Further tests indicated that there is a unidirectional Granger causality running from capital market development to derivatives both in the short run and long run, implying that derivatives do not Granger cause capital market development. Results also revealed that there is no direct linkage between derivatives and economic growth. Based on the research it is recommended that further research should be conducted to investigate how derivatives enhance capital market development through augmentation of liquidity and efficiency, leverage, and reduction of transaction costs through the role of derivatives as risk management tools in capital markets.

Keywords: Derivatives, Capital Markets Development, Economic Growth, ARDL-Bounds Testing Approac, Granger Causality

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1. Introduction

After the Mexican financial crisis in 1994, the East Asian financial crisis in 1997, the Euro crisis that started in 2010 and especially the global financial crises of 2008/9 the word 'derivative' seems to have caused a shock wave within the ranks of many financial commentators. It is, though, perhaps not wise to throw out the baby with the bath water, but to look at the positive role derivatives can play, especially in Africa, where there is a need for modern tools of risk management. This situation compelled the author to investigate the nature of the relationship between derivative trading and capital market development, and also the nature of the relationship between derivative trading and economic growth in South Africa.

Despite the drawbacks and complexities of derivatives, they are widely used as a tool in managing financial risk and have enhanced capital market development and economic growth in many countries. These instruments are thought of as potential development enhancers for developing countries as it is believed that derivatives could potentially reduce economic volatility (Tiberiu, 2007). Tsetsekos and Varangis (1998) argue that derivatives markets create an atmosphere for risk transfer, enhanced public information, and lower transaction costs, thereby allowing a climate of effective price discovery and market transparency to develop.

Goromonzi (2010) points out that the institutionalisation of derivatives trading in Africa will serve towards the deepening of financial markets through the introduction of new products that will enhance risk management operations. Finance professionals feel that derivatives are expected to improve financial market performance by allowing for adequate price discovery, providing for opportunities for hedging risk, permitting investments to become more productive, and thereby leading to a higher rate of economic growth (Şendeniz-Yüncü, Akdeniz and Aydoğan, 2007).

The approach used for the research on which this article reports differs from other approaches in three main respects. Firstly, the focus is mainly on the nature of the relationship between derivative trading

and capital market development, and also between derivatives and economic growth with the analysis including the cointegration and causality relationships. Secondly, the author considers JSE stock market capitalisation over a more recent period, thus providing more appropriate and contemporary empirical evidence from emerging markets. Lastly, the empirical analysis does not only focus on the nature of relationship of variables in question but also looks at the implications of this interconnectedness in the context of the financial risk management framework, financial deepening and economic growth.

The aim of the research was to investigate the nature of the relationship between derivative trading and capital market development, and also the nature of the relationship between derivative trading and economic growth. The evidence was based on the Johannesburg Stock Exchange (JSE) market capitalisation and the South Africa Gross domestic Product (GDP) per capita from 1994 to the end of 2012. The Autoregressive Distributed Lag (ARDL)-bound test approach and Granger causality testing were utilised in an attempt to find the nexus between derivatives trading and capital markets development, and also derivative trading and economic growth.

The article is organised in the following manner: the first part discusses facts on JSE derivative trading, financial market developments in South Africa and South Africa's economic growth. The second part constitutes a brief discussion of the literature and the empirical framework as applied in this article. The third part presents the estimation method and empirical results. Finally, conclusions and recommendations are presented and policy implications are drawn.

2. Development of derivatives in the world

The global derivatives market has witnessed substantial growth in the past years as its scope has expanded beyond the boundaries of the industrialised world (De Rato 2007; Mihaljek and Packer, 2010). Before the financial crisis, between 1998 and 2008, the overall exchanges' activity showed increases for trading volumes in terms of all groups of derivatives products.

Figure 1 captures the pre-crisis developments globally over the counter (OTC) and exchange trades of equity-linked derivatives as evidence of the growing expansion of global derivatives markets. In the OTC markets, an annual average growth rate of 22% in the outstanding amounts of OTC derivatives was registered, with a particular boost from the segment for collateralised debt securities (CDS) which levelled at an outstanding value close to US$ 60 billion at end of June 2008.

Figure 1. The Pre-crisis OTC and Exchange-traded Equity Derivatives Trading
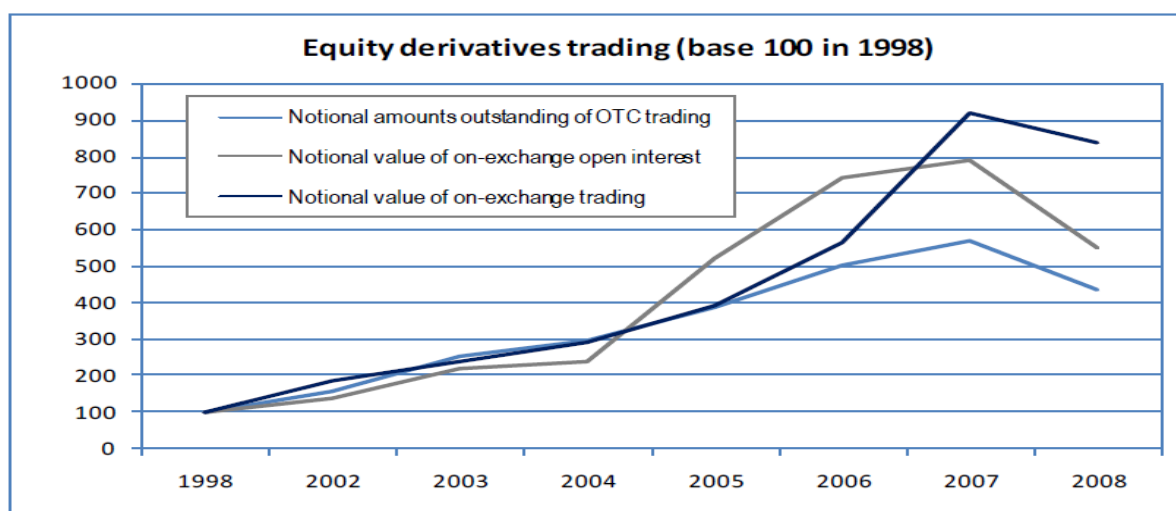
From a global perspective, the use of derivatives as instruments has continued to be significant in both exchange-traded and OTC markets (Van Wyk , 2012).

## 3. Development of derivatives in emerging markets

The number of local derivatives markets in developing countries has been rapidly growing since the 1990s. Starting in the late 1980s, larger emerging economies became established and increasingly used futures markets as a possible solution to the financial volatility. Thus, markets for financial derivatives were initiated in Hong Kong, Japan, Brazil, and South Africa in the 1980s. The exchange in South Africa lists among the deepest and most liquid fixed

income derivatives markets. The JSE also figures among the most active traders of equity index derivatives; and a local credit derivatives activity is even currently developing there (Lien and Zhang, 2008). Figure 2 below shows that developing countries trade derivatives almost in equal proportions OTC and on exchanges.

Figure 2. Derivatives turnover in advanced and emerging markets
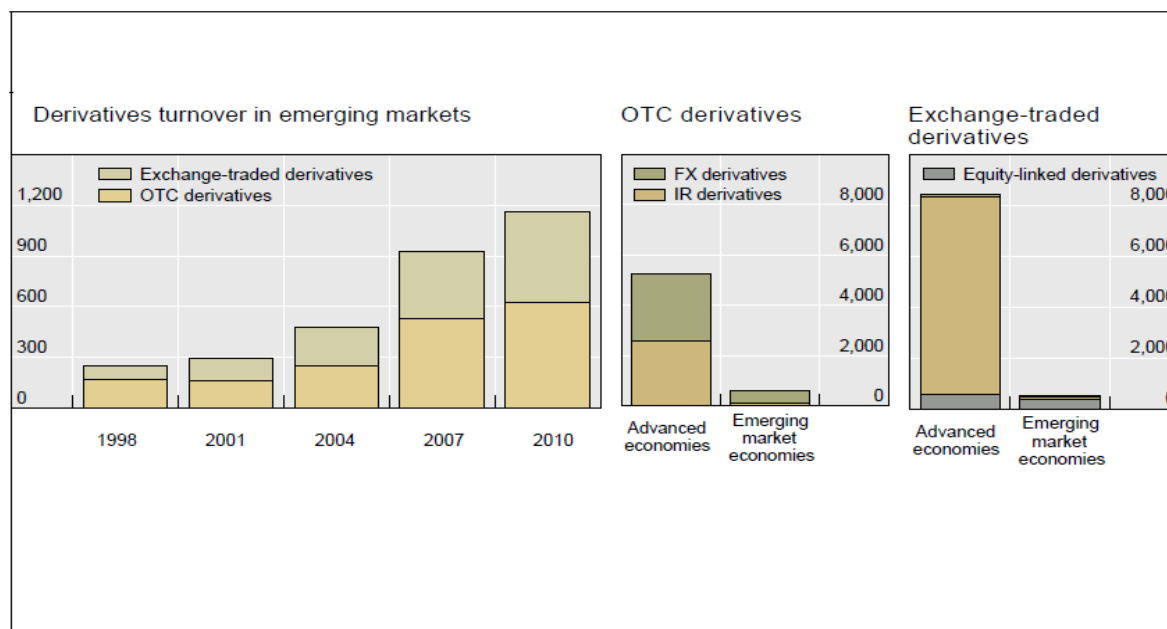
Source: Mihaljek and Packer (2010:45)

4. Literature review

Derivatives are financial instruments whose value is derived from the future price of underlying products such as equities and equity indices, bonds, loans, interest rates, exchange rates, commodities, mortgages, and even catastrophes like earthquakes and droughts (Vander Stichele, Kerckhoffs, and Van Os, 2010). In effect, the term 'derivative' comes from the fact that the value of these financial instruments or contracts derives from that of an underlying asset. These instruments consist of contracts that strive to derive payoffs from changes in the value/price of their underlying asset/product. As such, they come in many shapes and forms including forwards, futures, options, swaps, and various combinations thereof.

4.1 Derivatives, capital market development and economic growth

Derivatives contracts have been in use for quite some time and in the past they were known as 'grain loan'. The first of such instruments emerged as devices for evading fluctuations in the price of grains: for a price (in grain or silver) paid at the time the contract was entered into (before planting), a seller agreed to deliver a large amount of grain in the future (after harvest) (Swan, 2000). These kinds of commodity-linked instruments remained the solely existing form of derivatives for many

subsequent centuries, until the emergence of the now renowned financial derivatives in the 1970s as a result of growing global financial instability.

After the publication of the option pricing formula (the Black-Scholes-Merton model) and the creation of options markets in 1973, as well as the almost concurrent abolition of the Bretton Wood system that promoted fixed exchange rates among major currencies, the world of financial derivatives has seen an impressive growth of products derived from new underlying assets, including interest rates, foreign exchange rates, stocks, stock indices, bonds, swaps and even credits (Dubil, 2007; Chance, 1998). Nowadays, financial derivatives have become well accepted as the driving force of the global financial market as these have kept growing in terms of the variety of instruments and complexity (Chance, 2003).

The development of the derivatives market can be the result of the willingness by some economic agents, like large institutional investors, to protect themselves against the uncertainties of fluctuating financial asset prices. The very high degree of volatility characterising the modern financial markets provide good a ground for using these instruments. In the case of derivatives, it becomes possible to transfer price risks, and thus to minimise the impact of fluctuating asset prices with regard to the profitability and cash flow situation of the risk-averse investors.

Given underdeveloped capital markets in developing countries, implementing financial initiatives has essentially been aimed at opening up these markets to greater private capital flows and a wider range of capital vehicles such as stocks and bonds. So, some new sets of parallel financial transactions – for instance those involving derivatives need to come along with the transformation of capital markets so as to become integral to financial markets, contribute to financial sectors development, and help countries to grow overall (Dodd, 2002).

Bush (2012) argues that derivatives can help developing countries address their vulnerabilities without government intervening in the underlying markets and spending unnecessary public money. For this reason, derivatives advocacy in the development of such countries has been gaining serious momentum. These instruments are used as a potential medium to respond to the ever-increasing global markets' volatility, more precarious livelihoods, the rising prominence and sophistication of global financial markets and actors, and among poor countries, a growing discontent with the global economic system.

The derivatives markets in the developing countries have remained relatively small compared to those in advanced economies; nonetheless derivatives have shown sustained growth despite the 2009 slowdown (Mihaljek and Packer, 2010).

Developing countries' growing international trade relations, coupled with the rapid spread of financial globalisation, as well as the individual progressive regulatory reforms in countries, constitute some fairly good reasons for encouraging booming derivatives markets in the developing world (Mihaljek and Packer, 2010). The fastest growing derivatives exchanges in the world are located in China and India (Bush, 2012).

Derivative instruments are now recognised as some cost-efficient tools of risk management in the developing world, and countries that do not provide such globally accepted risk management facilities are disadvantaged in the prevailing rapidly integrating global economy (Lien and Zhang, 2008). Although not every country has a derivatives market or even a stock exchange, the number of derivatives exchanges in developing countries is rising. Most of the larger and more prosperous emerging market economies now have them and more will follow soon (Dodd, 2006). These developing countries already have long-term plans underway to introduce local derivatives exchanges (Lien and Zhang, 2008).

Kirkpatrick (2000) emphasised the fact that the size and depth of the financial system is an important contributor to economic growth, as it is the key determinant of a country's savings and investment capabilities. A larger and deeper financial system enhances a country's ability to benefit from economies of scale while at the same time pushing towards the relief of credit constraints.

Kumari (2011) argues that the growth of derivatives markets in the developing parts of the globe may become a remarkable factor for the development of capital markets in developing countries. However, in the absence of efficient bond and stock markets, funds for business expansion may shrink, resulting in a reduction of business activity, high unemployment, and slow growth (Mishkin and Eakins, 2012).

Banks commonly buy and sell derivatives as a natural extension of their activities in the financial markets (Chance, 2003). To illustrate: accepting interest rate risk is a normal part of the activity of banks. Changing interest rates affect banks' earnings because it has an effect on their net interest income and the level of other interest – sensitive income and operating expenses. Hedging, using derivative securities is an effective way for maintaining banks' risks within some prudential levels, thus guaranteeing the safety and soundness of banks (Srivastava and Srivastava, 2010).

The participation of banks in derivatives markets results in the modernisation of banking systems, which involves increasing globalisation of banks' financial activities (National Stock Exchange of India, 2009) as well as an increase of the efficiency of banks in developing countries (Rivas, Ozuna and Policastro, 2006).

Despite some evidence of the negative impact an unstable banking system may have on the economy, banks play a vital role in supporting economic growth: the larger the banking system, the more capital is able flow from savers to investors in a way capable of enhancing financial development, thus leading to greater economic growth (Kirkpatrick, 2000).

The need for bigger financial markets makes it necessary for new financial instruments to emerge in developing financial markets as more complete market structures require the presence of equity, debt and derivatives markets (Raghu and Zeineddine, 2007).

Accordingly, the trend in the majority of developing countries' financial development initiatives is toward the increasing use of derivatives in order to develop some efficient local markets for stocks and bonds. Such a structural modernisation of domestic financial markets is vital for enhancing financial intermediation and stability as well as for sustaining economic growth (Sreenu, 2012).

The development of these markets is indeed seen by financial professionals as a vehicle for improved efficiency and stability in financial intermediation, enhanced cross-border lending and new opportunities for mitigating exchange rates and other financial risks (Mathieson and Roldos, 2004).

The use of derivatives is more inclined to unpredictability in the markets of stock and stock indices they underlie, thereby leading to a certain extent of greater liquidity and stability in these markets (Siopis and Lyroudi, 2007; Kapadia, 2006). Furthermore, Wells (2004) established that active equity derivatives markets do not harm the equity cash markets at all. According to Wells (2004), there is generally a strong link between the development of an equity cash market and a derivatives market, because higher levels of derivatives trading tend to be associated with a high level of cash stock trading.

Likewise, the use of derivatives in developing debt markets can be conducive to significant transformation within these markets. Hence, the increasing availability of derivatives instruments tends to facilitate the broadening of debts markets in emerging market countries (OECD, World Bank and IMF, 2007).

Kirkpatrick (2000) established that efficient stock and bond markets on their own can significantly contribute to a country's growth. The liquidity of a stock market can have a positive influence on capital accumulation, productivity growth, and thus the current and future rates of economic growth. Indeed, stock markets encourage long-term growth by promoting specialisation, the acquisition and dissemination of information, and the mobilisation of efficient savings in order to promote investment. Similarly, bond markets play an important role in financial development and the effective allocation of capital. With derivatives, investors are allowed to generate more profits on shares and bonds (Schwegler, 2010; Kirkpatrick, 2000). Consequently, the markets for derivatives instruments are some confidence enhancers capable of encouraging international investors to participate in local bond and stock markets, and hence of increasing the flow of international capital into a particular country.

Rodrigues, Schwarzand, and Seeger (2012) unveiled three major channels through which derivatives markets can influence a country's economic growth: (1) as an integral part of financial markets and through the influence they exert on the development these markets; (2) through the role they hold in expanding business activities within a given country; and (3) via their effects on economic growth volatility.

As an integral part of modern financial markets, derivatives can have an impact on the investment behaviour of the users of these markets, thus helping to channel the resources available therein into growth (Rodrigues et al., 2012). Haiss and Sammer (2010) argue that derivatives may influence a particular country's economic development, as they are valuable financial instruments that have an important bearing on financial markets.

The literature reviewed in this section shows that derivatives may be useful tools in the financial sector and that they can probably improve capital markets and ultimately enhance economic growth. All the findings of the literature referred to in this article and confirming the usefulness of derivatives arose from case studies. There is a need to test these findings empirically, hence the focus of this article. The following section tests the linkages between derivatives and capital markets development and also between derivatives and economic growth empirically.

5. Data, empirical model specification and estimation techniques

Having examined as part of the study's literature component the potential impact of derivatives markets on capital markets' development and economic growth, the attention is now focused on the empirical aspects of the investigation of the nature of the relationship between the South African derivative trading and capital markets.

5.1 Data sources and the definition of variables

The study used annual time series data for the period between 1994 and 2012 and all data used in the research were obtained from the McGregor data base and the central bank of South Africa. The analysis pertaining to the causal relationship between the three main parameters under consideration was restricted to 1994–2012 due to the apparent lack of derivatives exchange activity data before 1994. The trading volume of derivatives was computed as a total volume of all derivative instruments traded on the JSE in the month under consideration. JSE all share market capitalisation was used as a proxy for capital market development while the GDP per capita was used as a proxy for economic growth. Initially, in an attempt to establish a long-run cointegration relationship between derivative trading and the growth variables under consideration, the Autoregressive Distributed Lag (ARDL)-bound testing approach by Pesaran, Shin and Smith (2001) model was adapted. Finally, the Granger causality test was performed to determine the nexus between derivative trading and the two growth variables.

5.2 Unit root tests

The data sets of three variables (Derivative trading volumes (DTV), JSE all share capitalisation (JSEA) and GDP per capita (GDPc)) were tested for stationarity using Phillip-Perron and Augmented Dickey Fuller tests before they were tested for cointegration – using the ARDL-bounds approach. The results of the stationarity tests on differenced variables are presented in Table 1.

Table 1. Stationarity tests of variables on first difference – Augmented Dickey Fuller (ADF) test and Phillips-Perron (PP) test

Variable	No trend	Trend	Intercept
Stationary tests of variables on fist difference – **Augmented Dickey Fuller (ADF) test**			
DTV	-3.5821***	-3.2180	-3.3631**
JSEA	-6.6660***	-6.1506***	-6.5440***
GDPc	-3.5821***	-3.2180	-3.3631**
Stationary tests of variables on fist difference – **Phillips-Perron (PP) test**			
DTV	-5.7823***	-6.2642***	-5.8236***
JSEA	-6.9226***	-6.1506***	-6.5440***
GDPc	-5.7823***	-6.2642***	-5.8236***

*** Denotes 1% level of significance*
*** Denotes 5% level of significance*

Using the Phillips-Perron (PP) criterion the results in the table above show that the hypothesis that first difference of derivative trading volumes, JSE all share capitalisation and GDP per capita have unit roots that can be rejected.

5.3 Cointegration test – ARDL-bounds testing procedure

To establish a long-run cointegration relationship between derivative trading and growth variables the ARDL-bounds testing approach as per the model by Pesaran et al. (2001) was adopted. The ARDL approach is unique and superior in that it does not require all the variables under investigation to be integrated in the same order. The ARDL approach can therefore be used in a situation even if the regressors are integrated in any order that is order one (I(1)), order zero (I(0)) or partially integrated (Pesaran and Pesaran, 1997). Laurenceson (2003) argues that using the ARDL approach avoids problems resulting from non-stationary time series data.

The ARDL framework for equation 1, 2, 3 and 4 is as follows:

$$\Delta DTV_t = \mu_0 + \sum_{i=1}^{n} \gamma_{1i} \Delta DTV_{t-i} + \sum_{i=1}^{n} \gamma_{2i} \Delta JSEA_{t-i} + \gamma_3 DTV_{t-1} + \gamma_4 JSEA_{t-1} + \varepsilon_t \tag{1}$$

$$\Delta JSEA_t = \kappa_0 + \sum_{i=1}^{n} \phi_{1i} \Delta JSEA_{t-i} + \sum_{i=1}^{n} \phi_{2i} \Delta DTV_{t-i} + \phi_3 JSEA_{t-1} + \phi_4 DTV_{t-1} + \varepsilon_t \tag{2}$$

$$\Delta DTV_t = \alpha_0 + \sum_{i=1}^{n} \beta_{1i} \Delta DTV_{t-i} + \sum_{i=1}^{n} \beta_{2i} \Delta GDPc_{t-i} + \beta_3 DTV_{t-1} + \beta_4 GDPc_{t-1} + \varepsilon_t \tag{3}$$

$$\Delta GDPc_t = \varphi_0 + \sum_{i=1}^{n} \rho_{1i} \Delta GDPc_{t-i} + \sum_{i=1}^{n} \rho_{2i} \Delta DTV_{t-i} + \rho_3 GDPc_{t-1} + \rho_4 DTV_{t-1} + \varepsilon_t \tag{4}$$

Where Δ – first difference operator, DTV – derivatives trading volume, JSEA – JSE all share capitalisation, GDPc – GDP per capita. In the above equations, the terms with the summation signs represent the error correction dynamics while the second part (terms with γ in equation (1), ϕ in equation (2), β in equation (3), and ρ in equation (4)) corresponds to the long-run relationship. The null hypotheses in 1, 2, 3 and 4 are:

$\gamma_3 = \gamma_4 = 0$, $\phi_3 = \phi_4 = 0$, $\beta_3 = \beta_4 = 0$, and $\rho_3 = \rho_4 = 0$

, respectively, which indicate the non-existence of the long-run relationship. The first step of the ARDL-bounds testing requires examining the order of lags on the first differenced variables in equations 1, 2, 3, and 4 using the Akaike information criterion (AIC) and the Schwartz-Bayesian criterion (SBC). The results of the AIC and the SBC suggest that optimal lag for DTV and JSEA is 4, while the optimal lag for DTV and GDPc is 5. The second step requires one to apply the bounds F-test to equations 1, 2, 3, and 4 in order to determine whether any long-run relationship between derivative trading and growth variables exists.

Table 2. Bounds F-test

Dependent variable		Function	F-test statistic
DTV		DTV (JSEA)	6.6980**
JSEA		JSEA (DTV)	60.6056
DTV		DTV (GDPc)	31.4400
GDPc		GDPc (DTV)	0.1747

*** Denotes 5% level of significance*

The results show that there is no evidence of a long-run relationship between derivatives and GDPc. All other things being equal derivatives are not influenced by economic growth in the long run. To determine whether derivative trading is driven by capital market development in the long run we used Table CI (III) as per Pesaran et al. (2001:300) to determine the asymptotic critical value bounds for the F-statistic since the models had unconstrained intercept and no trend. The lower and upper bounds for the F-test statistic at the 10%, 5%, and 1% significance levels are [4.04 4.78], [4.94 5.73] and [6.84 7.84] respectively. As the value of the F-statistic is above the upper bound at the 5% significance level,

in this case it can be concluded that there is evidence of a long-run relationship between the two time-series at this level of significance or greater.

5.4 Granger causality test

Having confirmed the existence of the long-run relationship between derivative trading and capital market development from the bounds F-test integration, the next step was to investigate the Granger causality between the two variables. The Narayan and Smyth (2008) model specification was adapted to test the direction of causality.

$$\Delta DTV_t = \mu_0 + \sum_{i=1}^{n} \gamma_{1i} \Delta DTV_{t-i} + \sum_{i=1}^{n} \gamma_{2i} \Delta JSEA_{t-i} + ECM_{t-1} + \varepsilon_t \qquad (5)$$

$$\Delta JSEA_t = \kappa_0 + \sum_{i=1}^{n} \phi_{1i} \Delta JSEA_{t-i} + \sum_{i=1}^{n} \phi_{2i} \Delta DTV_{t-i} + ECM_{t-1} + \varepsilon_t \qquad (6)$$

Where ECM_{t-1} is the lagged error-correction term obtained from the long-run equilibrium relationship. The results of these causality tests are reported in Table 3.

Table 3. Granger no-causality test

Dependent variable	Causal flow	F-statistic	t-test on ECM	R^2
Derivative Trading (DDTV)	Capital market growth (DJSEA) $\longrightarrow$ Derivative trading (DDTV)	7.06391	-2.984118	0.4157
Capital Market growth (DJSEA)	Derivative trading (DDTV) $\longrightarrow$ Capital market growth (DJSEA)	0.47585	-	-

According to the empirical results reflected in Table 3 there is a unidirectional Granger causality running from capital market development to derivatives trading both in the short and the long run. The F-statistic and the coefficient of the error-correction term in the derivative trading function are statistically significant. Results also revealed that derivative trading does not Granger cause capital market development.

6. Conclusion

Focusing on the role played by derivatives in development of capital markets and economic growth, viewed within the context of 2009/10 financial crisis, the research attempted to empirically determine the relationship between derivatives and capital markets development and also between derivatives and economic growth. This was done with the aim of establishing whether there is any causal relationship between derivatives and the two economic variables under consideration.

The evidence used was based on the

Johannesburg Stock Exchange (JSE) market capitalisation and South Africa Gross domestic Product (GDP) per capita from 1994 to the end of 2012. The Autoregressive Distributed Lag (ARDL)-bound test approach and Granger causality testing were utilised in an attempt to find the nexus between derivatives trading and capital markets development, and also between derivative trading and economic growth.

The results that are reported in this article are consistent with the view that there is a significant long-run relationship between derivatives and capital market development. Further tests indicated that there is a unidirectional Granger causality running from capital market development to derivatives both in the short run and the long run, implying that derivatives do not Granger-cause capital market development. Results also revealed that there is no direct linkage between derivatives and economic growth. The findings are consistent with the findings of Baluch and Ariff (2007) who found that derivatives do not correlate with economic growth significantly.

The results are contrary to the general belief

(Dodd, 2002; Kapadia, 2006; Tiberiu, 2007; Kumari, 2011; Bush, 2012) that derivatives have an indirect relationship with economic growth. To be more precise, derivatives are generally deemed to positively influence economic growth through capital market development. This cannot be the case as it has been shown in this article that derivatives do not influence capital market development; rather it is capital market development that influences derivatives. It is financial deepening that creates a platform for the creation of new derivative products and calls for more risk management techniques.

Based on the overall observation of the interaction of derivatives, growth in capital markets and economic growth, it is recommended that emerging markets such as the South African one should follow the capital market model. Though results indicate that derivatives are not correlated to economic growth there could be a transmission mechanism between these variables. The outcome of this research also revealed that capital market development influences derivate market growth, a conclusion which calls for further investigation.

An analysis of derivatives as presumably having a direct linkage with economic growth and capital market developments could have been the major drawback of this study. It is suggested that future studies focus on the analysis of derivatives through different mechanisms that can possibly influence capital market growth and ultimately economic growth. This could mean investigating how derivatives enhance capital market development through mechanisms such as liquidity and efficiency, leverage, reduction of transaction costs and their role as risk management tools. An understanding of the interconnections between these elements will help finance professionals appreciate the role of derivatives in financial markets.

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