Institutionalisation of Derivatives Trading and Economic Growth: Evidence from South Africa

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Abstract

The purpose of this paper is to foresee the likely developmental impact of the proposed institutionalisation of derivatives trading in sub-Saharan Africa(n) (SSA) countries. The case of South Africa is emphasised to illustrate how domestic derivatives trading could influence economic growth and economic growth volatility; measuring growth in real GDP. From an empirical standpoint, the influence of local derivatives activity on economic growth could not be proven, even though a long-run Granger causality is reported from economic growth to the expansion of local derivatives. These results at least sustain the realistic view that developing derivatives markets is a rather long-run process, and that efficient trading could not be achieved over the short-run. GARCH (1, 1) representation of a significant negative effect of derivatives trading on growth volatility establishes the stabilising effect of derivatives markets on the economy, but this does not constitute sufficient evidence to prove that derivatives trading can contribute to economic growth. Recommendation is that further research should look into the impact of derivatives trading on the liquidity of capital markets so as to assess the extent to which derivatives markets are able induce liquidity in their underlying capital markets, and thus provide suitable conditions for their own expansion and survival.

Keywords: *African derivatives markets; capital market development; derivatives-growth relationship; growth volatility; GMM, Granger Causality with VECM; GARCH*

1 Introduction

The advocacy for the institutionalisation of derivatives markets in SSA is being made as a convenient way for enhancing regional countries' growth prospects

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(FEED[1] & World Bank 2012). Hence, the present paper investigates the possible impact of derivatives markets on the regional economies, in consideration of the possibility of concomitant capital markets development.

Şendeniz-Yüncü, Akdeniz and Aydoğan (2007), Baluch and Ariff (2007), Haiss and Sammer (2010) as well as Rodrigues, Schwarz and Seeger (2012) have examined the relationship between derivatives trading and economic growth before. While Haiss and Sammer (2010) revealed that derivatives trading can be weakly linked to economic growth in more advanced economies such as the United States, Şendeniz-Yüncü et al. (2007), Baluch and Ariff (2007) and Rodrigues et al. (2012), on the other hand, reported the significantly positive impact of derivatives markets on growth using some panels of developed and developing countries data. In fact, Şendeniz-Yüncü et al. (2007) argued that countries with a medium-sized derivatives market relative to their GDPs exhibit a more significant positive relationship between the development of their derivatives market and economic growth than both the countries with large and small derivatives market values relative to their GDPs. Baluch and Ariff (2007) and Şendeniz-Yüncü et al. (2007) agree that countries with well-functioning derivatives markets experience a higher growth than countries without. According to Baluch and Ariff (2007), the effect that derivatives markets have on economic growth is dependent on the utilisation of such markets, and the risk transfer function of derivatives markets is more likely to contribute towards economic growth. Rodrigues et al. (2012) reported that the existence of derivatives markets makes a significantly positive contribution to countries' growth, even in South Africa, and also hinted that the establishment of derivatives exchanges can lower GDP growth volatility. Tiberiu's (2007) formally unveiled a significant positive relationship between the amount of the derivatives products traded and the reduction of economic instability in the context of those countries of which the financial markets are members of Euronext[2], excluding Portugal

The establishment of vibrant, well-regulated and well-supervised derivatives markets is vital to prevent the risks of derivatives-aggravated disasters occurring; hence the need to anticipate the infrastructural requirements of these markets. As Pickel (2006) explained, the evolution of derivatives can only be possible if the adequate infrastructures to support such innovative financial products are in place. Additionally, Wahl (2009) and Haiss and Sammer (2010) warned that the majority of derivative instruments are ensuing products of the prevailing

[1] The Task Force on Financial Engineering for Economic Development (FEED) was created to promote the creation of well-functioning capital market frameworks in developing countries and facilitating the use of derivatives and other financial products by such countries in managing the risks that obstruct sustainable development. FEED provides advice to countries with the least developed financial markets on derivatives, capital markets, microfinance and structured products.

[2] Euronext is a cross-borde European electronic stock exchange based in Amsterdam, Netherlands, that was created in 2000 from the merger of the Amsterdam, Brussels and Paris stock exchanges. The Euronext group was expanded in 2001 and 2002 through the acquisition of the London International Financial Futures and Options Exchange (LIFFE) and the Portuguese stock exchange, Bolsa de Valores de Lisboa e Porto (BVLP), respectively, and it thus became one of the world's largest exchanges. On April 4, 2007, Euronext completed its merger with the NYSE Group, resulting in the formation o NYSE Euronext.

system of deregulated international markets that has been labelled "the casino economy"[3], in which financial intermediaries such as banks chiefly benefit. As it happened, the latest financial crisis was believed to be a product of this casino system which, according to Wahl (2009), chiefly promotes the finance principle of "profit/wealth maximisation at all times" and fails to allow adequate progress to be made in the domain of development and create more social inequalities. Kohler (2012) and Sylla (2003) explain that very risky bets on movements in the price of underlying assets are often made in these markets, whereby incomes can flow among market participants without them actually trading in any underlying assets; especially in the so-called OTC markets. Countries could simply see their average output growth increased after the proposed introduction of formal derivatives trading, but the existence of local derivatives exchanges could lead to greater volatility in the regional economies.

Here, the case of South Africa, the only SSA country with an active derivatives exchange, is mainly emphasised to predict how domestic derivatives trading could effect on the economies of SSA countries. Under the heading "Derivatives, capital market development and economic growth", section 2 addresses the possible ways of derivatives markets' influence on economic growth. Subsequently, section 3 deals with the infrastructural requirements for well-functioning derivatives markets. After considering the empirical methodology in section 4, the discussion revolving around the findings of study is emphasised in section 5, and then recommendations for further research are ultimately made under section 6.

2 Derivatives, capital market development and economic growth

Derivatives markets can become a factor of development in capital markets, and thus an important contributor towards financial markets' completeness (Kumari 2011 Ngugi, Amanja & Maana 2009). SSA countries are therefore encouraged to develop transactions resembling derivative contracts along their capital markets in order to boost growth as coinciding launches of new equities, debt instruments and derivatives will broaden and enhance countries' investment opportunities. (Bahgat 2002; FEED n.d.; FEED & World Bank 2012; Dodd 2002; Goromonzi 2010; Haiss & Sammer 2010; Making Finance Work for Africa n.d.; Miloš Sprèiæ 2007; Raghu & Zeineddine 2007; Sreenu 2012; Zimmermann & Gibson 1996).

[3] After the elimination in 1973 of the political regulation of the Bretton Woods system, which at its core promoted stable rates of exchange between important currencies and the control of capital transactions, new derivatives were being invented for various businesses. For example, from the fluctuation of rates, derivatives contracts were created that applied to underlyings varying from rates of exchange to shares, and up to aggregated indicators such as the Dow Jones or Dax (Wahl 2009)

2.1 *Derivatives and capital market developments*

High levels of derivatives trading are usually associated with a high level of stock trading, although volatility in underlying equity markets could also increase after the introduction of related derivatives markets. Investors may become able to deal with the risks of their equity positions more easily. Increasing liquidity in the underlying equity markets owing to investors' interaction while hedging, speculating and arbitraging could then provide a certain extent of growth and stability in these markets (Kapadia 2006; Mathieson & Roldos 2004; Siopis & Lyroudi 2007; Wells 2004). Similarly, debt markets may develop as debt derivatives would allow for the hedging of the risks inherent to fluctuating interest rates, and also add to the offering of debt instruments (Gautam 2003; OECD, World Bank & IMF 2007). On the other hand, banks constitute a crucial element to the functioning of the capital markets. As such, their participation in related derivatives markets could generally lead to the sophistication and efficiency of banking sectors (Dudley & Hubbard 2004; Mboweni 2006; National Stock Exchange of India 2009; Rivas, Ozuna & Policastro 2006). Such well-developed capital markets and banking sectors can help the mobilisation of countries' funds towards long-term project financing, making financial markets more efficient and fostering growth (Badun 2009; Baluch & Ariff 2007; Kirkpatrick 2000; Levine, Loayza & Beck 2000; Mboweni 2006; United Nations 1999).

Nonetheless Charlton (2008, Ocampo, Spiegel and Stiglitz (2008), Stiglitz (2000) as well as Stiglitz, Ocampo, Spiegel, Ffrench-Davis and Nayyar (2006) argued that capital markets might not always be associated with stronger economies, conceding that capital markets could fail to achieve higher levels of economic growth and macroeconomic stability since they can sometimes associate with market failures, less attractive investment prospects, sudden capital flights and instabilities that could weaken economies in the developing world.

2.2 *The channels of influence of derivatives on a country's growth*

Haiss and Sammer (2010) and Rodrigues et al. (2012) discussed the channels through which derivatives markets can influence countries' economic development:

1. As an integral part of the financial markets, the *volume channel* of derivatives' influence on financial markets and then economic development refers to the ability of derivatives markets to facilitate the accumulation of capital and mobilising savings towards diversified portfolios investments of risky projects. In fact, derivatives markets can pool enormous amounts of capital into the financial markets, allowing them to take advantage of economies of scale to fund activities capable of yielding higher returns, and thus to drive economic growth. In addition, the *efficiency channel* of derivatives markets' indirect influence on growth via the financial markets

entails their efficiency in substituting cash market trades, their ability in transferring resources across time and space, and their role in managing risk and providing pricing information, which all result in improved efficiency in the ways in which the economy combines capital and labour in production. Finally, the *risk channel* is the conduit through which derivatives may amplify the potentially negative effects of financial markets on economic development. The destabilising power of derivatives markets flows from their ability to create new risks for market participants, especially their ability to increase systemic risk, which makes them capable of causing trouble in financial systems (Haiss & Sammer 2010; Rodrigues et al. 2012).

2. Through their role in the expansion of business activities, derivatives markets, according to Rodrigues et al. (2012), can make risk management cheaper on firms' level. Firms that hedge with derivatives have more growth opportunities, as they can reduce the costs of running their businesses (e.g. tax, transaction costs etc.), and thereby free up capital to invest in new value-enhancing and growth-driving projects, which can subsequently lead to higher macroeconomic levels of growth. Furthermore, Kirkpatrick (2000) posits that derivatives trading can promote the development of more sophisticated and competitive business environments, leading to greater growth in developing countries.

3. Via their effects on economic growth volatility, as argued by Lien and Zhang (2008) and Rodrigues et al. (2012), the effect of derivatives markets on economic growth may translate into a reduction of economic volatility in developing countries. Derivatives trading can stabilise prices and improve liquidity in their underlying markets, but the possibility of increasing volatility subsist since derivatives have equally been attributed destabilising traits (Gahlot, Datta & Kapil 2010; Lien & Zhang 2008).

3 The Infrastructures of a Derivatives Market

The riskiness of derivatives trading places the utmost importance on the structure of derivatives markets to ensure the quality, soundness and timeliness of risk management and controls on derivatives transactions (Deutsche Börse Group 2009; National Treasury of South Africa 2009). Therefore, some very **important institutions** need to be considered when structuring formal trading. Some **exchange(s)** must provide the infrastructure that brings together the buyers and sellers of most derivative instruments and matches the bids and offers of the securities, including standardised OTC instruments, (Deutsche Börse group 2009; Rodríguez 2009; Thomas 2000). Increased transparency market and enhanced price discovery, as result of the automation of such on-exchange trading facility, can facilitate the supervision of the market and ensure secure trading (Scalcione 2011). In addition, some **Clearinghouse(s) and/or central counterparty (CCP)** are required to make margin calls and charge collaterals to

on-exchange trades such as to ensure prompt clearing and settlement for all transactions, and thereby guaranteeing the completion of the transactions as the credit risk arising from the parties' obligations is completely transferred to such central counterparts (Rodríguez 2009) The use of CCP clearing is recommended for on-exchange trading of standardised OTC instruments, in order to move such derivatives from bilateral clearing and minimise the systemic risk associated with the OTC segment (Deutsche Börse Group 2009). Ultimately, a **centralised trade repository (TR)** should maintain a secure and reliable electronic recording for open derivatives transactions, including OTC transactions, so as to ease the monitoring of trades and open interest in the market. TRs are recognised to add to the reduction of systemic risk, to improve transparency, and to protect both investors and financial institutions (Deutsche Börse Group 2009; Strate 2013)

The derivatives institutions normally regulate their own activity and the activities of authorised members, as well as the activities of the clients of these members (Adelegan 2009; Banks 2003; Van Wyk, Botha & Goodspeed 2012). Nonetheless, a **sound regulatory environment** remains a vital requirement for a successful derivatives exchange. Evolving regulations that support the innovations of the market must provide up-to-date regulatory environment for the markets all the time (Alberta Market Solutions 2003; Pickel 2006; Tsetsekos & Varangis 1997). In the wake of the financial crisis, the Financial Markets Bill of 2012 (FMB) was adopted in South Africa to replace the Securities Services Act (2004) t adhere to the G-20's new commitment for the standardisation of OTC derivatives, the clearing of these instruments through CCPs, and the reporting of all derivatives contracts to trade repositories (Van Wyk et al. 2012). The FMB prescribes the regulation and supervision of derivatives market institutions, and also emphasise the relationship of these institutions with their respective members in order to reduce systemic risk, ensure markets that are fair, efficient and transparent, and also to protect investors (Kane 2008; National Treasury of South Africa 2009). Moreover, new **derivatives rules** govern South Africa's derivatives trading in agreement with the guidelines of the International Organisation of Securities Commission (IOSCO). These require the derivatives market to have prefunded resources from, altogether, the clearing members of SAFEX Clearing Company (SAFCOM) and the Johannesburg Stock Exchange (as the host of the South African Futures Exchange, SAFEX) on behalf of SAFCOM, which provides capital in addition to the collateral posted by market participants, and thus serves as a way for better counterparty risk management in the derivatives market (Johannesburg Stock Exchange n.d.).

4 Empirical methodology

Growth (GDP_GW) in terms of this study measures the first difference of the logarithmic (log) levels of the country's GDP The study's focus is on both the pre- and post-1990 establishment of the South Africa's derivatives exchange and, accordingly, yearly time series of relevant variables were selected that comprise

data covering a period running from 1971 to 2012. A dummy-based Generalised Method of Moment (GMM) regression was conducted first on the data over the period 1971–2012, but the post-1990 establishment of the derivatives exchange was especially emphasised when investigating the relationship between growth of GDP and SAFEX's historical derivatives trading volumes in terms of the causality study. This subsequent use of the series pertaining to the actual domestic derivatives activity restricted the period under review in the causality test to 1994–2012 due to the lack of data pertaining to the exchange's activity before 1994. Ultimately, the assessment of the impact of derivatives trading on growth volatility/stability entailed an appraisal of GDP growth from 1971 to 2012 to determine whether the operation of the derivatives exchange has reduced or increased the volatility/stability of the local economy.

Data (see appendix) were sourced from the online databases of the South Africa Reserve Bank (SARB), the World Bank and the World Federation of Exchange (WFE). While the data such as that pertaining to the country's GDP, the so-called Solow factors and the capital market development factors were sourced and ascertained from both the databases of the World Bank and SARB the information relative to SAFEX's trading history was provided by the WFE.

4.1 *GMM estimation*

A dummy variable (DER_DUM) substituted for the development of the organised derivatives exchange in the GMM growth regression analysis to highlight if the existence of the derivatives exchange in South Africa makes a difference, as opposed to when the country did not operate such an exchange. The dummy was created such that it takes the value of 1 (one) for years in which the derivatives exchange has existed and 0 (zero) for years during which the exchange did not exist.

To prevent model misspecification, two categories of control variables were included in the regression model, along with the variables of the primary interest of the study, including macroeconomic variables resembling the Solow model and variables capturing the development of the financial system. The chosen groups of control variables are in line with common practice in the empirical growth literature (Rodrigues et al. 2012). The model under consideration reads as follows:

$$\Delta y_t = (\alpha - 1)y_{t-1} + \delta DER\_DUM_t + \boldsymbol{\beta}\mathbf{x}_t + u_t \tag{1}$$

Where y_t is the natural logarithm of output, and DER_DUM_t denotes the dummy variable for the existence of the derivatives exchange, as described earlier. $\mathbf{x}_t$ represents the vector of control variables, including in terms of the Solow model factors, the representative series forgross national savings as a percentage of GDP (SAVINGS), gross national expenditure as a percentage of GDP (EXPENDITURE), as well as inflation, denoted (INFLCIP), which is measured as the growth in the Consumer Price Index (CPI). Controlling for the development of the financial (capital) markets, the net inflow of Foreign Direct Investment as a percentage of GDP (FDI) was included to measure the extent of

stock market development, domestic credit to the private sector as a percentage of GDP (PRIVCREDIT) for the development of the bonds market, and broad money stock in percentage of GDP (M2) for the sophistication of the banking sector. The parametric estimates to be generated include an autoregression coefficient α; the coefficient to "DER_DUM", δ; and the (vector) set of β coefficients that are individually assigned to each control variable.

4.2 *Granger causality test: A VECM (restricted VAR) framework*

A Granger causality test in a Vector Error Correction Model (VECM) framework examined the direction of the causal relationship between the development of derivatives markets in South Africa and the country's economic growth, using a series on South African Futures Exchange (SAFEX)'s actual trading volumes as a proxy for the development of South Africa's derivatives trading. The selected approach of causality test using VECM is popular for its modelling of variables that are individually non-stationary, but linked together by long-run relationships (Asteriou & Hall 2011; Ghafoor, Mustafa, Mushtaq & Abedullah 2009; Harris 1995; Obayelu).

The Granger causality test can be implemented in a VECM framework by running the following regressions (Ageli 2013; Odhiambo 2009):

$$y_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1i} y_{t-i} + \sum_{i=1}^{n} \alpha_{2i} DER\_VOL_{t-i} + ECT_{t-1} + \mu_t \qquad (2)$$

$$Dervol_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} DER\_VOL_{t-i} + \sum_{i=1}^{n} \beta_{2i} y_{t-i} + ECT_{t-1} + \varepsilon_t \qquad (3)$$

Where, in the preceding equations:

1. n denotes the number of lagged variables
2. $\alpha_1, \alpha_2, \beta_1$ and β_2 are the parameters to be estimated
3. α_0 and β_0 are constant terms that represent the intercepts of the equations
4. u_t and ε_t are mutually uncorrelated white noise residual
5. ECT_t is the error correction term lagged one period.

4.3 *GARCH volatility estimation*

GARCH(1,1) was used to ascertain the change in country's economic growth volatility as a result of derivatives trading. Two variables were reintroduced in terms of this analysis, that is GDP_GW and the dummy variable DER_DUM, which stood proxies for economic growth and the implementation of the derivatives exchange, respectively. Such modelling of DER_DUM is viable for the

identification of any statistically significant change in growth volatility of a stationary GDP_GW series as a result of derivatives trading over the full sample period under review; that is 1971 to 2012. The results reported in terms of the current GARCH (1, 1) estimation were obtained under the assumption of Gaussian normal distribution.

The GARCH (1, 1) model is expressed as follows(De Beer 2008)

$$y_t = \rho + \theta y_{t-1} + \varepsilon_t \quad ; \varepsilon \tilde{} N(0, \sigma^2) \quad \text{[Mean equation]} \tag{4}$$

$$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 + DER\_DUM; \omega > 0, \alpha > 0, \omega \geq 0 \text{ [Variance equation]} \tag{5}$$

Where:

1. y_t represents the dependent variable; in this case it will refer to levels of GDP growth
2. θ and y_{t-1} correspond to the autoregressive coefficient and explanatory (lagged) variable, respectively
3. ε_t is the normally distributed error term with zero mean and time-varying (heteroscedastic) variance
4. ρ and ω denote some constants, where ω (also known as the unconditional variance) is a measure of the long-run variance (volatility) of the series
5. α and ε_{t-1}^2 correspond, in that order, to the "news/information' coefficient and the ARCH(1) term
6. β and σ_{t-1}^2 are the volatility persistence coefficient (old news) and GARCH(1) term, respectively

5 Empirical Results

5.1 *GMM estimation and results*

Preliminary ADF stationarity tests revealed that not the all variables were stationary in level. While the series pertaining to GDP_GW, real GDP, INFLCPI (stationary in levels at 5% with trend and intercept) and FDI are stationary in their raw forms, the series referring to SAVINGS, EXPENDITURE, PRIVCREDIT and M2 was detected with first-differenced stationarity defect. This led to the creation of new series referring to D_SAVINGS, D_EXPENDITURE, D_PRIVCREDIT, D_M2, through the differencing of the respective individual data series. The series generated were used in substitution of their corresponding variables in the regression estimation.

The summarised output of the GMM regression analysis is presented in Table 1.

A number of instrumental variables were used, with lagged output introduced as instrumental variable for the lagged dependent variable. Weak exogeneity is

assumed for the time-varying regressors, and accordingly lagged values ofgross savings, expenditure, inflation, FDI net inflows, private sector credit extension and broad money were also included as instruments. The dummy variable served as its own instrument lagged one period.

The GMM output indicates a negative ($\delta = -2.654282$) but highly insignificant ($p - value = 0.2101$) relationship between the existence of the derivatives exchange (the derivatives dummy) and economic growth. The fact that none of the variables controlling for financial development is statistically significant, coupled with the insignificance of the derivatives dummy, indicates that developments in financial markets are not strong drivers of economic growth in South Africa. The local financial markets might not be as sophisticated as in some advanced economies. Therefore some of the theorised benefits of an institutionalised derivatives exchange (e.g. increased access to information, improved risk and hedging strategies, etc.) might not be present in such a developing economy since these markets remain insufficiently developed to take full advantage of these opportunities.

However, the results of the GMM regression are rather consistent with preliminary T-test (see appendix), which failed to prove a statistically significant difference between the average GDP growth in the pre- and post-establishment of the derivatives exchange. This actually hinted that the GMM regression could be irrelevant in capturing statistics confirming a significant change in growth as result of South Africa's derivatives trading.

5.2 *Granger causality test*

The VECM-based causality test aimed to verify the possibility of any short- or long-run causal relationships between SAFEX's actual trading volumes, as a proxy for the expansion of the country's derivatives trades, and growth. The causality test was estimated with two lags as the maximum lag length structure, with the number of co-integration set to one. The results obtained are summarised in the following table:

The results of the causality test exhibit no evidence of short-run causation between GDP_GW and DER_VOL, and are in conformity with the earlier findings. Short-run causality is denied by the p-values of associated F-statistics, which are all statistically insignificant as their values lie all above the restrictive critical values of 10%, 5% and 1%. This confirms the absence of correlation between derivatives trading and economic growth.

While a long-run Granger causality from derivatives volumes to GDP growth is also denied by an ECT_{t-1} coefficient that is both positive and insignificant ($p-$value $= 0.1688$), there is evidence of a long-run causality from growth in GDP to derivatives trading. The negative and statistically significant (p-value $= 0.0203 < 0.05$) lagged error correction terms sufficiently provide for the existence of a unidirectional causal relationship from GDP_GW to DER_VOL at a 5% level of significance.

Hence, causation generally runs from economic growth to the expansion of derivatives trading, which leads to the acknowledgement that developing deriv-

atives markets adhere to the demand-following hypothesis which supports that it is the economic growth that leads to the development of a derivatives market. In other words, the expansion of the economy is the factor that creates new demands for derivatives instruments in South Africa. Accordingly, some large and sophisticated market infrastructures need to precede the liberalisation of derivatives trading. Strong financial institutions must thus first be established in order to satisfy the new demand for these financial instruments (Adenuga 2010).

Contrary to what Şendeniz-Yüncü et al. (2007), Baluch and Ariff (2007), Haiss and Sammer (2010) and Rodrigues et al. (2012) advised, derivatives trading does not seem to influence growth in South Africa. This may however be reflective of the fact that SAFEX's activity was rather inefficient for a number of years in the beginning of South Africa's derivatives history, as anti-apartheid sanctions led the country to rely on its domestic financial markets for a long time before it could benefit from an open participation in the international financial markets. The data of these years of inefficient trading has been used together with more recent data, resulting perhaps in the overall rejection of delta (Δ). Nevertheless, the long-run causality, even though only flowing from economic growth towards derivatives market development, is at least supportive of a more realistic view that developing financial markets is a rather long-run process. Accordingly, efficient derivatives trading would not be achieved over the short-run (Standley 2010).

5.3 *GARCH (1, 1) parametric estimation and interpretation*

As described in Table 3, the findings of the dummy-based GARCH estimation of the effect of derivatives trading on economic volatility show that the value of α is -0.185347 and statistically significant; and the value of the β coefficient is 0.953165 and also significant. α violates the non-negative requirement for the ARCH and GARCH coefficients. Such realisation of the negative estimates serves as empirical evidence for unsuspected leverage effect, which is indicative of the tendency of volatility to be higher after negative news than good news (Black 1976; Brooks 2008). On the other hand, the large value of the GARCH lag coefficient ($\beta = 0.953165$) indicates that shocks to conditional variance take a long time to dissipate, which confirms the finding of volatility persistence. Additionally, the sum of α and β is 0.767818, which is close to unity. Both statistically significant the ARCH and GARCH coefficients (-0.185347 and 0.953165, respectively) and the close to unity root coefficients ($\alpha + \beta$ is 0.767818) indicates that shocks to volatility have a persistent effect on the conditional variance; hence a very persistent conditional volatility. The close to unity autoregressive root is in fact conversant with the fact that volatility shocks certainly persist for many subsequent future periods, thereby hinting at the "long memory" of the factors that govern growth in the economy. Any shock in conditional variance at a given time will therefore have a prolonged changing effect on all the future values of volatility (Goudarz & Ramanarayanani 2010). The derivatives exchange

is credited a decreasing effect on economy volatility, as shown by the negativity and significance of the dummy variable coefficient (δ = -0.943978, and a p-value of 0.0502 $<$ 0.10). This corroborates Tiberiu's (2007) report of the stabilising effect of derivatives trading on the economy, validating that the operation of a formal derivatives centre can reduce economic volatility and lead to more stable economic conditions under the unique circumstances of a developing country.

6 Recommendations

Overall, the results rather indicate that growth in the economy stimulate the development of derivatives markets in South Africa over the long-term; but the local derivatives markets have a stabilising power on country's growth. Given the overall small size of SAFEX relative to the JSE, and the GDP of the country, it is quite likely that the regulated derivatives market does not make a big impact on overall growth. Both the use of a dummy for the existence of the derivatives exchange and the subsequent modelling of actual exchange's trading volumes history do not account for the OTC segment of the market, which is much bigger than the on-exchange market and, accordingly, could explain a greater portion of the country's economic growth. Provided the small size of the majority of SSA economies, the ongoing efforts to develop regional capital markets should also be relevant for derivatives markets in order to overcome scale constraints.

As with economic growth, the development of derivatives trading should also follow that of the exchanges (equities, bond, etc) that create the need for related derivatives. At this point, a derivatives exchange in SSA is most likely to add value to growth if competitive instruments are offered on commodities such as oil (in countries like Nigeria, Angola, etc), gold, coffee, etc., especially since other international exchanges already provide the buyers and sellers of these underlying commodities with the opportunity to hedge their exposure.

In the end, Baluch and Ariff (2007) cautioned that liquidity in underlying markets is the most critical factor driving the successful operation of any derivatives market. With the prominently small and highly illiquid capital markets in SSA, an important direction for future research could therefore refer to the impact of derivatives trading on capital markets liquidity. This issue of derivatives' induced liquidity is not only noteworthy given the illiquidity characterising SSA capital markets; but it is even more so since derivatives markets themselves must rely on liquid underlying markets to flourish Without liquidity in the underlying capital markets there will be little hope of there being liquidity in any related derivatives (Alberta Market Solutions 2003).

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Table 1: Results of the GMM estimation

Dependent Variable: GDP_GW		
Variable	**Coefficient**	***p*-value.**
GDP(-1)	0.690665	0.0097
DER_DUM	-2.654282	0.2101
D_SAVINGS	0.631906	0.0777
D_EXPENDITURE	0.898135	0.0470
INFLCPI	-0.490028	0.0405
FDI	-0.487906	0.8032
D_PRIVCREDIT	-0.165083	0.3590
D_M2	0.057110	0.8899
R-squared	0.530457	
Adjusted R-squared	0.427745	
J-statistic	0.789788	
Prob(*J*-statistic)	0.374164	

Table 2: Results of the VECM-Based Granger causality test

	Short-run causality		**Long-run causality**
Dependent variables	Testing $\Sigma\Delta\ln GDPpc_{t-i}$	Testing $\Sigma\Delta\ln DER\_VOL_{t-i}$	Testing ECT_{t-1}
	F*-statistics *(p-value)		**Coefficient estimates *(p-value)***
$\Delta\ln GDP\_GW_t$	-	0.158663*(0.8556)*	0.789296(*0.1688*)
$\Delta\ln DER\_VOL_t$	1.294471(*0.3205*)	-	-2.761340(*0.0203*) $^{(**)}$

Note: $^{(**)}$ denotes statistical significance at the 5% level.

Table 3: Results of GARCH (1, 1) estimation of GDP growth volatility over the period 1971-2012

Variance equation estimates	
	Coefficients *(p-values)*
Constant – ω	1.569161 *(0.0171)* $^{(**)}$
ARCH(1) – α	-0.185347 (*0.0000*) $^{(***)}$
GARCH(1) – β	0.953165 *(0.0000)* $^{(***)}$
DER_DUM – δ	-0.943978 *(0.0502)* $^{(*)}$
Autoregressive root – ($\alpha + \beta$)	0.767818

Note: $^{(***)}$ denotes statistical significance at the 1% level; $^{(**)}$ denotes statistical significance at the 5% level; $^{(*)}$ denotes statistical significance at the 10% level.

Appendix:

The Data

YEAR	GDP	GDP_GW (Growth rate)	DER_VOL (number of contracts)	SAVINGS (% of GDP)	EXPENDITURE (% of GDP)	INFLCPI (%)	FDI (% of GDP)	PRIVCREDIT (% of GDP)	M2 (% of GDP)
1971	13.4594	4.19	NA	22.5	104.2	6	1.86	68.8	39.11
1972	13.47581	1.64	NA	24.4	97.5	6.5	1.32	67.6	39.34
1973	13.52051	4.47	NA	24.5	97.4	9.5	0.55	67.8	38.25
1974	13.57983	5.93	NA	24.8	100.6	11.6	0.1	63.7	37.61
1975	13.59664	1.68	NA	23.8	102.5	13.5	1.95	65.8	39.53
1976	13.61889	2.23	NA	22.5	101.2	11.1	0.51	63.5	38.92
1977	13.61795	-0.09	NA	27	95	11.3	0.05	62	37.97
1978	13.64765	2.97	NA	27.1	93.3	10.9	-0.31	60.8	38.54
1979	13.68486	3.72	NA	31	90.6	13.2	-0.24	58.7	36.83
1980	13.74896	6.41	NA	33.6	92	13.8	-0.87	55.6	34.6
1981	13.80118	5.22	NA	26.4	102	15.2	-0.01	60.7	37.01
1982	13.79734	-0.38	NA	20.5	100.4	14.7	0.07	62.5	38.02
1983	13.7787	-1.86	NA	24.8	96.3	12.4	0.41	66.8	40.77
1984	13.82844	4.97	NA	21.7	98.2	11.6	0.08	69.9	43.25
1985	13.81625	-1.22	NA	24.2	91.2	16.1	0.49	73.4	42.77
1986	13.81643	0.02	NA	23.2	91.2	18.7	-0.67	72.8	38.1
1987	13.83722	2.08	NA	21.9	90.1	16.1	-0.06	73.4	39.77
1988	13.87836	4.11	NA	22.5	93.5	12.9	-0.18	75.3	44.82
1989	13.90202	2.37	NA	22.2	94.7	14.7	0.14	77.9	47.29
1990	13.89884	-0.32	NA	18.9	94.5	14.4	-0.16	81	46.32
1991	13.88861	-1.02	NA	18.3	95.7	15.3	-0.07	93.2	46.8
1992	13.867	-2.16	NA	16.4	96	13.9	0.21	102.4	46.27
1993	13.87926	1.23	NA	16.1	95.3	9.7	0	108.2	42
1994	13.91109	3.18	4990527	16.8	97.8	9	0.01	114.3	44.77
1995	13.94177	3.07	6275351	16.5	99.3	8	0.28	119.3	44.83
1996	13.98394	4.22	8110226	16	98.5	7.4	0.83	119.9	47.79
1997	14.01006	2.61	10791224	15.2	98.8	8.6	0.57	116.2	51.14
1998	14.01522	0.52	16111532	15.2	98.9	6.9	2.56	118.2	53.04
1999	14.03853	2.33	18618331	15.7	97.4	5.1	0.41	134.4	54.93
2000	14.07924	4.07	24677939	15.6	97	5.3	1.13	133.7	51.49
2001	14.10622	2.7	36316528	15.3	96	5.7	0.73	142.3	53.34
2002	14.14225	3.6	31314309	16.7	96.2	9.2	6.14	115.1	54.02
2003	14.17131	2.91	32981740	15.7	97.7	5.8	1.33	120.7	57.64
2004	14.21585	4.45	38373074	15	100.3	1.4	0.47	132.4	57.85
2005	14.26728	5.14	51359094	14.5	100.5	3.4	0.32	144.2	61.33
2006	14.3218	5.45	105000000	14.4	102.4	4.7	2.64	163.4	65.45
2007	14.37579	5.4	317000000	14.3	102.7	7.1	0.24	167.5	69.26
2008	14.41137	3.56	494000000	15.5	103.1	11.5	2.3	147.4	69.21
2009	14.39599	-1.54	152000000	15.5	100.9	7.1	3.62	152.1	65.96
2010	14.42691	3.09	160000000	17.1	100.2	4.3	2.68	153.9	62.73
2011	14.46227	3.54	103000000	16.8	100.6	5	1.02	144.7	61.3
2012	14.48664	2.44	81685604	14.2	103	5.6	1.03	151.1	59.5

Sources: The South African Reserve Bank: http://www.resbank.co.za/Research/Statistics/Pages/OnlineDownloadFacility.aspx; The World Bank: http://data.worldbank.org/indicator; The World Federation of Exchanges: http://www.world-exchanges.org/statistics/annual-query-tool.

T-Test Pre vs. Post Derivatives Exchange Establishment

Real GDP Growth	Mean	Standard deviation	Number of Observations
Pre-exchange (period 0)	2.407	2.460736	20
Post-exchange (period 1)	2.672273	2.109154	22
Difference of means	0.265273		
t_{stat} value 0.3733		Critical values at 1% significance level $t_{.10,21}$ = 1.7207; $-t_{.10,21}$ = -1.7207	
Degree of freedom	20.9872		

We compared the mean real GDP growth before (dummy=0) and after (dummy=1) the existence of the derivative exchange. We define this as pre and post institutionalization GDP growth. Considering a critical value, $t_{.10;21}$ = 1.7207, the null hypothesis of equal means cannot be rejected at a 10% significance level. The computed *t*-statistic (t_{STAT} = 0.3733 > $t_{.10;21}$ =-1.6860) does not support the alternative hypothesis that $\mu_0 < \mu_1$.

Variance Ratio Test Pre vs. Post Derivatives Exchange Establishment

Variance	GDP_GW	LogGDP
Pre-exchange	2.460736	0.010332
Post-exchange	2.109154	0.014785
Difference	-0.351582	0.004453
F_{STAT} *value*	1.36117343	2.0477355
Degree of freedom	19.21	21.19
Critical values at α significance level	1% $F_{.01;19,21}$ = 2.904 $F_{.01;21,19}$ = 2.981 10% $F_{.10;19,21}$ = 1.784 $F_{.10;21,19}$ = 1.807	5% $F_{.05;19,21}$ = 2.109 $F_{.05;21,19}$ = 2.144

In terms of the variance ratio test, we compare the variance (std^2) of GDP growth before (dummy=0) and after (dummy=1) the existence of a derivative exchange. We define this as pre and post institutionalization GDP growth volatility. The two-sample variance *F*-testing, however, indicates rejection of H_0 for the growth rate series at the 10% level (F = 1.136 < $F_{.10;19,21}$ = 1.784), but acceptance of H_0 for the level of real GDP at the 5% confidence level (F = 2.048 > $F_{.05;21,19}$ = 2.144). Interestingly, the analysis points to the fact that volatility in economic growth has not been significantly different between the two periods. However, the level of output itself has seen a significant decrease in volatility (i.e. increased stability) since 1991.