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Article

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Review of Development Finance

Provided in Cooperation with:

Africagrowth Institute, Bellville

Suggested Citation: Bundoo, Sunil Kumar (2017) : Stock market development and integration in SADC (Southern African Development Community), Review of Development Finance, ISSN 2959-0930, Elsevier, Amsterdam, Vol. 7, Iss. 1, pp. 64-72,
<https://doi.org/10.1016/j.rdf.2017.01.005>

This Version is available at:

<https://hdl.handle.net/10419/313606>

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Full length article

Stock market development and integration in SADC (Southern African Development Community)

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Acknowledgement: The author acknowledges the financial and technical support of the AERC (African Economic Research Consortium) for undertaking the research. The author is thankful to the resource persons at the AERC technical workshops and anonymous referees for useful suggestions and comments on earlier drafts of the paper.

Abstract

The paper analyses the extent of stock market integration in SADC by first analyzing beta and sigma convergence and then using cointegration analysis. The US market and the SSA index were used as benchmarks. The sample period was from January 1999 to December 2011 using daily market index data. We observe beta convergence but not sigma convergence; though the sigma values are falling for most of the SADC countries. Under normal conditions, no cointegrating vector was identified when using the US market as benchmark. When using the SSA index as benchmark one cointegrating vector was identified. The paper also takes stock of the extent of software and hardware stock market integration in SADC. The SADC stock exchanges must work towards greater integration so that they can attract more sustained portfolio flows rather than volatile portfolio flows and also greater FDI flows which are much needed for the financial and economic development of the SADC countries. We also need to consolidate and reduce the number of exchanges with the view to improve market capitalization, liquidity, market infrastructure, governance amongst others but most importantly to increase the visibility, robustness and reputation of SADC stock markets at the international level.

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Keywords: Stock market; Mauritius

JEL classification: G12

1. Introduction and background

Many markets in Africa are small and there are major scale inefficiencies. The challenge for most African stock markets is to increase liquidity, expand access and reduce the cost of capital. Although some progress has been made in deepening financial instruments in Africa in recent years, there is still a lot to be done. Financial market activities remain limited, with low capitalization and inadequate liquidity in capital markets. Most financial instruments continue to be concentrated at the short end

of the term structure. Consequently, lending rates remain very high and spreads are large. Moreover, there is a lack of involvement by domestic investors. The stock markets in the Southern African Development Community (SADC), except for a few, exhibit the same characteristics. In view of promoting financial market development within the SADC region, it is accepted that there is the need to: integrate and consolidate SADC financial markets; to facilitate the access to information and its free flows; to harmonize the regulatory and legislative frameworks for stock market and listing of securities operations; and to speed up the implementation and monitoring of the Financial and Investment Protocol.

In fact, a main aim of the Financial and Investment Protocol (FIP) was to inform U.S. based institutional investors of the investment opportunities offered by African stock exchanges. Forums such as these could help African participants to showcase some of the high-performing companies listed on their countries' exchanges, while also drawing attention to the need for more public–private partnerships between large international companies, African SMEs, and international donors, to nurture nascent African private sectors to grow, create jobs, and contribute to economic growth.

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Peer review under responsibility of Africagrowth Institute.



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<http://dx.doi.org/10.1016/j.rdf.2017.01.005>

Source: AfDB Regional Integration Brief, 2013.

Within the SADC region, stock markets such as the “Johannesburg Stock Exchange” and the “Stock Exchange of Mauritius” could definitely play a key role in this regard. The SADC region constitutes an interesting space, one which could be used as a pilot case to understand the changes that need to be brought to the operational, regulatory and technological framework for stock exchanges in the region to foster the growth of intra-regional trading, intra-regional portfolio investments and intra-regional funding of listed companies. South Africa and to some extent Mauritius have emerged as significant sources of investment into other SADC countries. Some other countries can also become significant regional investors while others may become major recipients of SADC investment. Such a trend needs to be encouraged in order to develop the industrial base of the SADC countries (AfDB Regional Integration Brief, 2013).

Moreover, a plan that aims to forge an integrated network of autonomous national exchanges—as envisaged by the Southern African Development Community’s Committee of SADC Stock Exchanges—is likely to gain more support from participating member countries than a plan that closes down and replaces existing national exchanges with a single regional exchange. The inherent nature of nation states implies that it is not uncommon for all regional integration plans to encounter some resistance at the national government level. Governments may oppose the idea of relinquishing the symbol of national sovereignty that a national exchange represents. Of course, resistance is likely to vary according to the degree to which sovereignty is relinquished (Irving, 2005). Therefore greater regional stock market integration can make SADC countries compete better for international capital which is much needed for the economic development of these countries.

1.1. Objectives of the study

This study seeks to determine to what extent has integration of the SADC African stock markets been achieved and to find out if there is a long-run relationship in the returns of the SADC African stock markets? The specific objectives of this study are to take stock of the progress made with respect to stock integration in the SADC stock markets in terms of harmonization of market infrastructure and to assess the extent of the linkages among the stock markets in the SSA and see whether they are integrated with each other and with the larger international stock markets such as the USA. This will be done by assessing the degree of beta and sigma convergence and identifying the existence of long-run equilibrium relationships in the stock market returns.

1.2. Motivation of the study

The motivation of the study is based on the following main factors. First, the empirical literature confirms that for decades the African stock markets are characterized by small sizes, poor liquidity, high concentration and insufficiently developed market infrastructure. So we contend that greater stock market integration is much needed and should be the way forward. Regional

integration, if carried out at the right pace and in a pragmatic way, could improve the liquidity, efficiency, and competitiveness of the region’s stock exchanges. Cooperation and integration of national stock exchanges could offer a way of overcoming some of the impediments to development that most of the African stock markets now face as relatively fledgling and illiquid exchanges.

Second, the empirical literature shows that on balance the benefits of regional stock market integration tend to outweigh the costs; yet the progress towards significant stock market integration for African stock exchanges has been rather slow. This paper argues that we need more concrete action on the ground and greater political commitment with respect to stock market integration and do nothing is not an option. When we study the capital flows to Africa relatively speaking they are still low and they can be increased substantially through regional stock market integration. Capital flows which Africa badly need.

The economic and financial crisis of 2008/2009 brought wider awareness that financial integration comes with considerable benefits and non-negligible costs. When mechanisms for maintaining financial stability are not in place; the costs of financial integration generated by a crisis can be considerable. Therefore, monitoring the degree of financial integration is useful in both good times, when the long-run benefits of economic growth are realized, and in bad times, when the costs of financial integration (through contagion) are present.

SADC countries need large amounts of financing to build infrastructure for sustained growth. Capital markets are needed as an alternative source of financing, supplementing commercial banks. Recognizing the benefits of capital markets and the limitations of individual country approaches, the creation of regional stock exchanges can help significantly for a quantum leap in harnessing much needed capital to the African countries. From the literature there seems to be no empirical study of stock market convergence/integration analyzing the SADC countries together, which serves as our motivation to explore for this empirical evidence in this study and thus add some knowledge based on our findings to the existing literature.

2. Characteristics of African stock markets

Africa’s markets are perceived as being excessively risky, highly illiquid and the institutional environments in which they operate are underdeveloped. Stock markets in Africa have received little attention due to under development and illiquidity of the markets. However, there have been considerable improvements, rapid growth and liberalisation in a number of African countries stock markets (see Allen et al., 2011). They carried out a comprehensive study on Africa’s financial systems. The study shows that there has been a rapid increase in the establishment of stock exchanges, particularly in Sub-Saharan Africa (SSA). There were 5 stock exchanges in SSA about two decades ago, but now there are about 20 in operation [see Hearn and Piesse, 2008]. Capital flows to Africa¹ also show that Africa (except

¹ Table not reported due to space limitation but available upon request.

Table 1
Market capitalization and turnover ratios: 2002–2010.

Country	Market capitalization as a % of GDP					Turnover ratios				
	2002	2004	2006	2008	2010	2002	2004	2006	2008	2010
Botswana	28.28	25.35	35.06	26.39	27.43	3.69	2.14	2.27	3.05	3.46
Cote d'Ivoire	11.56	13.45	23.92	30.18	31.16	1.30	2.52	3.30	4.08	1.99
Egypt	29.70	48.85	86.96	52.74	37.68	10.14	17.10	54.82	61.85	43.04
Ghana	12.02	29.79	15.85	11.89	11.28	1.78	3.22	2.14	5.19	3.37
Kenya	10.82	24.17	50.56	36.35	46.04	2.94	8.54	14.63	11.83	8.59
Malawi	–	6.05	18.83	43.46	26.69	–	5.07	3.49	–	1.45
Mauritius	27.85	37.25	55.29	35.70	66.87	4.75	4.40	4.42	8.85	6.35
Morocco	21.25	44.01	75.20	73.97	75.82	6.64	8.77	35.26	31.05	16.28
Namibia	–	6.69	6.78	6.89	9.66	0.88	4.71	3.78	2.84	1.82
Nigeria	9.70	16.46	22.34	24.04	26.27	8.53	13.90	13.64	29.30	12.53
South Africa	166.17	207.91	273.94	178.46	278.39	48.60	45.02	48.80	60.61	39.59
Swaziland	12.22	9.84	7.48	–	–	0.13	0.02	0.03	–	–
Tanzania	6.54	5.22	3.77	6.24	5.48	3.43	2.51	2.21	–	–
Tunisia	10.12	9.38	14.36	15.60	24.11	9.97	8.85	14.25	25.48	17.16
Uganda	0.78	1.20	1.16	–	–	1.68	0.22	5.21	–	–
Zambia	6.27	8.34	11.07	–	17.39	0.82	1.10	2.10	–	–
Zimbabwe	248.47	34.23	510.37	–	153.55	21.05	3.92	6.19	–	–
Malaysia	122.83	152.31	150.36	84.322	172.63	22.65	33.41	32.11	33.23	27.06
Brazil	24.55	49.76	65.30	35.66	74.02	31.09	33.13	42.92	74.27	66.43
Russia	35.98	45.33	106.79	23.91	67.88	36.05	52.46	64.06	59.17	85.71

Source: Compiled from Afego (2011).

South Africa) is not faring so well compared to Asia and the BRICS countries.

With regards to listing on the African stock markets, [Senbet and Otchere \(2008\)](#) show that in 2007 the mean number of firms listed on the African stock markets was 129 far less as compared with individual countries such as Malaysia with 911 firms listed and 158 companies in Mexico. Similarly, [Afego \(2011\)](#) reports that for most African stock markets, market capitalisation as a percentage of GDP is still low, below 50% for 11 out of 15 of the exchanges on which data is available (see [Table 1](#) above). So African stock markets suffer from depth; though the situation has improved.

Liquidity is a major problem, illustrated by low turnover ratios. Although most countries have conducted domestic retail investor awareness campaigns, stock exchange investment is out of reach for the majority of the population. With the exception of the Johannesburg Stock Exchange (JSE), Africa's stock markets are small, illiquid, have few listed assets, lack the necessary infrastructure and offer a very limited range of tradable instruments compared with developed country markets [see [Alagidede, 2009](#)]. The other African markets are characterised by long periods of inactivity broken only with occasional small listings, mostly of privatised state owned enterprises or foreign multinationals. As can be seen from [Table 2](#) the turnover ratios are low for most markets.

Though there have been significant improvements in market infrastructure to facilitate trading for some stock exchanges such as Mauritius, South Africa, Nairobi, Botswana etc., same cannot be said for all of them. International fund managers are crucially important to African stock markets but are cautious given their limited size and activity. Since the demise of the Morgan Stanley Africa Investment Fund in 2002, only two major developed

Table 2
Beta values for full sample.

Botswana	−0.952095
Malawi	−1.182819
Mauritius	−1.155254
Namibia	−0.991850
South Africa	−1.116580
Tanzania	−1.006299
Zambia	−1.441151

**All beta values are significant at 1% level.

The Sub-Saharan African index is taken as the benchmark index.

country fund management companies still offer African equity investment funds: Old Mutual (Bermuda) and Lazard Brothers (Luxembourg). These have country specific funds concentrating on South Africa and Egypt, respectively. Few other fund managers outside Africa offer investment vehicles to access SSA markets and the absence of active funds further complicates matters as there are no benchmarks with which to provide pricing and risk measurement metrics for potential investors [see [Irving, 2005](#); [Hearn and Piesse, 2008](#)]. Yet African stock markets have performed remarkably well in terms of absolute returns (see [Allen et al., 2011](#)).

There is therefore a pressing need to promote regional stock markets in order to benefit from economies of scale and improve market infrastructure and liquidity. On balance, the empirical evidence [see [Alagidede, 2009](#); [Hearn and Piesse, 2008](#)] tends to show that African stock markets are not well integrated with each other. There are weak stochastic trends between African markets and the rest of the world, indicating that Africa's markets tend to respond to local rather than global information. Although the weak trends present an opportunity for portfolio diversification into African markets, the risk perception and the

institutional underdevelopment remain obstacles to the development of Africa's emerging equity markets. This regional integration will also make African markets more visible at the international level and in competing for portfolio flows. By having more efficient markets this will also attract more FDI flows.

3. Summary of literature review

A review of the empirical literature shows many studies on the European Union and Asia as these were the first markets to embrace the concept of financial integration. There are some studies on South Africa, West Africa and a few on East Africa and some on African counties, the region with the least developed financial market. Below we provide a summarized review of the empirical studies across these regions.

Some studies focus on markets in accordance with their levels of stock market development: developed (for instance see, Berben and Jansen, 2005; Rua and Nunes, 2009), and emerging markets (see Umutlu et al., 2010; Ali et al., 2011). Some other studies look at integration on a regional basis: Asia (Henry et al., 2007; Yu et al., 2010), between Asia and OECD markets (see Mallik, 2006); Euro-zone (Mylonidis and Kollias, 2010), Latin America (see Chen et al., 2002; Hunter, 2006), NAFTA (Aggarwal and Kyaw, 2005), and OECD (Apergis et al., 2011) markets. For instance, Narayan et al. (2011) have the most extensive coverage of these homogeneous panels of markets with similar characteristics based on the levels of development and geographical locations. Bekaert et al. (2011) and Pukthuanthong and Roll (2009), studied market integration across global developed and emerging markets. Regarding the Western Europe, analysis of capital markets integration at national levels is reported by the European Commission (1999) and by Hartmann et al. (2003); the analysis on national and sectoral levels is performed by Baca et al. (2000).

The concept of changing integration over time (a time-varying measure of financial integration) was introduced by Bekaert and Harvey (1995). Their results show that world capital markets overall are becoming increasingly integrated, but that decreasing integration is also occurring for some individual countries. Bekaert et al. (2000) also find that the degree of integration among emerging equity markets is higher than earlier thought when structural breaks in the series are taken into account. Berger and Pozzi (2011) studied the time-varying integration of stock markets among the US, Japan and selected European countries over the period 1970–2010. They find evidence of rising stock market integration among all countries, except Japan.

A number of studies evaluate the extent of stock market integration in non-OECD countries. Applying the co-integration approach, Azman-Saini et al. (2002) find limited evidence of long-run relationships among five Asian equity markets. Yang et al. (2003) present further evidence on co-movements among ten Asian emerging stock markets and in relation to the US and Japan. Phylaktis and Ravazzolo (2002) simultaneously examine financial and economic linkages for the Pacific Basin countries. They find that financial integration occurs along with economic

integration. Study of co-movements between stock markets in three Central and Eastern European countries (CEECs), on the one hand, and between the CEECs and Western European countries represents a subject of research of Égert and Kočenda (2005). Evidence from intraday data reveals no robust cointegration relationship for either intra-CEECs or CEEC-Western European stock market linkages.

A number of empirical studies implement the cointegration analysis approach. Serletis and King (1997) and Bley (2009) investigate stock market integration across the EU. Manning (2002) and Yu et al. (2010) apply the technique to assess integration of Asian stock markets. However, there has been little empirical work on assessing long-run linkages among African stock markets. Wang et al. (2003) conduct the cointegration analysis focusing on African stock markets. They find no cointegrating relationship among five African stock markets and the US market between July 1999 and May 2002. On the other hand, Adjasi and Biekpe (2006) select seven African economies and identify two cointegrating vectors for the period November 1997 to August 2005.

4. African stock market integration

In 2008 Senbet and Otchere argued that stock markets provide an important opportunity for integrating Africa into the global financial market place and attracting global capital. The rate of return on FDI was substantially higher for the sub-Saharan African Frontier Markets (FMs) than for other regions during the last few years. Return on FDI reached above 40% in sub-Saharan African Frontier Markets in 2008, well above the returns from other regions. A number of initiatives have been undertaken to integrate African stock exchanges. The markets are working towards a pan-African stock exchange through the African Stock Exchanges Association (ASEA) and integration with the world economy. All markets are open to foreign investments and have implemented free market reforms. There have also been various common policies, such as harmonising trading practices, encouraging cross-border listing of shares, developing computerized trading systems and promoting greater inter and intra regional trade.

The Southern African Development Community (SADC) members have established national stock exchanges in Botswana, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia, and Zimbabwe (see Table 2 for market statistics on SADC exchanges). The Committee of SADC Stock Exchanges (COSSE), formed in 1997 as a private sector initiative within the sub-regional grouping, aims to contribute to economic development in the 14 SADC member states by “facilitating the raising of capital in compliance with acceptable listing requirements.” The Committee aims to achieve this vision of regionalization of autonomous national stock markets by promoting a transparent regulatory environment that protects market participants and attracts investors; improving the exchanges' operational capacity and technical underpinnings; promoting cooperation among the exchanges; promoting harmonization of trading, clearance, and settlement procedures; and providing a forum for information exchange

and discussion on development of the region's stock markets (see Yartey and Adjasi, 2007). COSSE also encouraged the harmonization of listing rules across the region. As at 2000, all SADC exchanges had harmonized listing requirements in accordance with the JSE system (Irving, 2005). By 2000, all SADC exchanges had harmonized their listing requirements based on the 13 principles of the JSE's listing requirements.

Since 1998, the JSE has also offered use of its trading system, along with technical assistance, to the other SADC exchanges. The exchanges have been looking at how the JSE's trading system might be adopted as the sub-region's trading platform, as well as considering other technology options for an integrated network of exchanges (Irving, 2005). In August 2003, the JSE announced that it had begun serious discussions with other African exchanges on a proposal to set up a so-called pan-African board whereby large companies could be traded on a virtual African exchange. This would enable a qualifying company to effectively list simultaneously on all participating exchanges. A number of Memorandum of Understandings (MoUs) on collaborative program has also been signed amongst African exchanges. Many African exchanges have signed Memorandums of Understanding (MOUs) with other African, European and Middle Eastern exchanges that share technology, information and business skills.

5. Data & methodology

5.1. Data sources

The data obtained are daily stock market index data (closing values), covering the period January 1999 to November 2011. The time period of January 2007 to June 2008 were initially excluded in order not to contaminate the results due to the recent financial crisis starting in the US. Then in another sample, they were included in the estimates. Data were obtained on the following stock market indices²: Botswana, Malawi, Mauritius, Namibia, South Africa, Tanzania, Zambia and for the USA from the respective stock exchanges. For South Africa and USA, market index data was obtained from on-line data sources such as [finance@ yahoo.com](http://finance.yahoo.com) and from Standard and Poors.

5.2. Methodology

The methodology used here follows the approaches of several studies that have researched on stock market integration and on assessing international linkages between stock markets. Financial integration is often measured following the approach adopted by Baele et al. (2004). They consider three broad categories of financial integration measures: price-based measures, news-based measures, and quantity-based measures. In this paper, we make use of the price-based approach to measure stock market integration. We will first analyse beta convergence; then

sigma convergence and finally perform a cointegration analysis. These are further explained below.

5.2.1. Beta convergence

Following the approach advocated by Adam et al. (2002), we make use of this concept to determine the speed of convergence of returns of the underlying stock market series. This measure involves estimating the following regression:

$$\Delta R_{i,t} = \alpha_i + \beta R_{i,t-1} + \sum_{l=1}^L \gamma_l \Delta R_{i,t-l} + \varepsilon_{i,t}$$

where $R_{i,t}$ represents the return spread of national stock exchange index between country i and the benchmark rate (here the Sub-Saharan African Index) at time t , Δ is the difference operator, $\alpha_{i,t}$ is the country specific constant, and $\varepsilon_{i,t}$ is the white-noise disturbance. The lag length is optimally selected as per the standard diagnostic tests.³

The size of coefficient β is a direct measure of the speed of convergence. A negative beta coefficient indicates the occurrence of convergence. The β coefficient can take values ranging from -2 to 0 . The closer the β coefficient is to -1 , the faster the rate of convergence. If $\beta = 0$ or $\beta = -2$, no convergence is observed. β values from -1 to 0 indicate monotonous convergence, while oscillating convergence occurs for β values between -2 to -1 . While beta-convergence measures the speed of convergence, it does not indicate to what extent markets are already integrated. To answer this question, we have to move to the concept of sigma convergence, also proposed by Adam et al. (2002).

5.2.2. Sigma-convergence

The application to financial markets involves calculating the cross-sectional dispersion in the return spread of specific assets (again national stock exchange indices) as a measure of the degree of integration. For quantification of sigma-convergence, a calculation is used of the (cross-section) standard deviation (σ), according to the formula:

$$\sigma_t = \sqrt{\left(\frac{1}{N-1}\right) \sum_{i=1}^N \left[\log(y)_{it} - \log \bar{y}_t\right]^2}$$

where y_{it} is the yield on asset i at time t , $\bar{y}_t$ is the cross-section mean yield at time t . Index i can stand for separate countries or sectors ($i = 1, 2, \dots, N$). σ takes only positive value in theory. The lower σ is, the higher level of convergence has been reached. In theory, full integration is reached, where the standard deviation is zero, while high (several digit) values of σ reflect a very low degree of integration. It is important to note that the two convergence indicators have different informational contents: beta-convergence does not imply sigma-convergence. In fact, beta-convergence can even be associated with sigma-divergence, for instance, see Quah (1993).

² Note Zimbabwe is excluded because of the high inflation rates and dollarization of the economy.

³ Based on the Final Prediction Error (FPE), or the Akaike's Information Criterion (AIC), or the Schwarz's Bayesian information criterion (SBIC) or the Hannan–Quinn information criterion (HQIC).

Table 3

Beta values when exclude years of the 2007/08 financial crisis.

Botswana	−1.070159
Malawi	−1.161622
Mauritius	−1.167178
Namibia	−1.083290
South Africa	−1.211080
Tanzania	−1.006852
Zambia	−1.526508

**All beta values are significant at 1% level.

The Sub-Saharan African index is taken as the benchmark index.

5.2.3. Cointegration analysis

Another approach widely used in assessing stock market integration is investigating long-run equilibrium of returns among stock markets using cointegration modeling. Two steps are necessary before conducting the cointegration analysis: (i) verifying whether the data series are non-stationary, containing a unit root and (ii) selecting the number of lags used in the model. For the first step, augmented Dickey–Fuller tests are conducted on the stock price data. In this analysis we employ the *Johansen and Juselius (JJ) procedure (1990)* of testing for multiple cointegrating vectors. Cointegration analysis is carried out both within the African markets and between these markets and the larger developed country markets such as the USA in this case. The usual diagnostic tests will be used to determine the optimal lag length.² For market indices, which are cointegrated, the appropriate vector ECM (V-ECM) will be formulated to show the short run and long run dynamics between the market indices.

6. Discussion and analysis of results

In this section we discuss the results. In Section 5.1 we discuss the findings on beta and sigma convergence. This is then followed by a discussion of the results on the cointegration analysis: first using the Dow Jones index as benchmark and then using the Sub-Saharan index as benchmark. The usual diagnostic tests are performed first (test for unit roots and optimal lag length) before testing for cointegration.

6.1. Beta and sigma convergence

As can be seen from the table, values of the β coefficient are close to minus one, which means that the leveling of newly arising differences in stock market returns between the relevant national economy and the reference country can be labeled as fast. However, for Zambia, a value much higher than -1 is noted (-1.5). More or less, the same pattern is observed when we exclude the years of the financial crisis. Overall; we see beta convergence over the period examined but given that they are in many cases slightly greater than -1 ; the results tend to indicate an oscillating convergence (Table 3).

We performed a sub-sample analysis over three sample periods to see whether the results are different. No specific pattern is observed except that over the period 2008–2011 the beta values, except for Mauritius, were slightly below -1 . We see slightly decreasing beta convergence over the last sample period. The

Table 4

Beta convergence: sub-samples results.

Beta values sub-sample results			
	Year 2000–2003	Year 2004–2007	Year 2008–2011
Botswana	−1.187333	−1.036326	−0.843579
Malawi	−1.150778	−1.384688	−0.787454
Mauritius	−1.129734	−1.217603	−1.080751
Namibia	−1.136170	−1.028635	−0.899773
South Africa	−1.307002	−1.045034	−0.824202
Tanzania	−1.159297	−1.137243	−0.838836
Zambia	1.018966	−1.355602	−0.905032

**All beta values are significant at the 1% level.

The Sub-Saharan African index is taken as the benchmark index.

results might have been partly affected due to the financial crisis; in crisis situation the law of one price may not hold and price of risk may vary from markets to markets (Table 4).

Overall we tend to see beta convergence (oscillating convergence not monotonic) but not necessarily sigma convergence⁴; for most markets the sigma values are still far from zero. We note though for the following markets (Botswana, South Africa and Tanzania) they are in the range 0.2–0.4. They are falling and moving towards zero; though for most markets the values are still far from zero.

6.2. Cointegration analysis

6.2.1. Unit root tests

When we analysed the ADF statistic on the level forms we see all the series are non-stationary [or $I(1)$] variables. But when the series are first differenced they all become stationary or $I(0)$ at the 1% level. This can also be seen when we compare the ADF statistic with the ADF critical values.

6.2.2. Testing for cointegration among SADC stock markets with the US (Dow Jones) market as benchmark

Before we run the vector autoregression (VAR); it is important to determine the optimal lag length. As per the results [based on the Final Prediction Error (FPE), or the Akaike's Information Criterion (AIC), or the Schwarz's Bayesian information criterion (SBIC) or the Hannan–Quinn information criterion (HQIC)], the optimal lag length is two.⁵

The first part of the co-integration results (see upper half of Table 5), the trace statistic indicates that there exist no cointegrating vectors at the 5% level. The second part of the co-integration results (Table 5, lower half), the maximum Eigen value test, also indicates the same result. Therefore, both tests indicate that the SADC stock markets are not cointegrated with the US stock market, that is, they are not trending together. Overall; therefore we find no co-integration for the SADC stock markets with the US market. This has important policy and non-policy implications. First, this represents an important source of diversification

⁴ Diagrams available on request.⁵ The table is not reported given space limitation but available from the authors upon request.

Table 5
Determining the number of cointegrating vectors.

Series: LBOT LMAL LMAU LNAM LSA LTAN LZAM LDJI				
Lags interval (in first differences): 1–2				
Unrestricted Cointegration Rank Test (trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical value	Prob.**
None	0.029536	145.2969	159.5297	0.2275
At most 1	0.023563	104.7032	125.6154	0.4528
At most 2	0.016968	72.41659	95.75366	0.6385
At most 3	0.014922	49.24532	69.81889	0.6702
At most 4	0.008266	28.88905	47.85613	0.7736
At most 5	0.006825	17.65061	29.79707	0.5919
At most 6	0.004032	8.378244	15.49471	0.4259
At most 7	0.002145	2.907903	3.841466	0.0881
Unrestricted Cointegration Rank Test (maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical value	Prob.**
None	0.029536	40.59374	52.36261	0.4591
At most 1	0.023563	32.28662	46.23142	0.6387
At most 2	0.016968	23.17127	40.07757	0.8684
At most 3	0.014922	20.35627	33.87687	0.7315
At most 4	0.008266	11.23845	27.58434	0.9589
At most 5	0.006825	9.272362	21.13162	0.8099
At most 6	0.004032	5.470341	14.26460	0.6817
At most 7	0.002145	2.907903	3.841466	0.0881

Source: Author's computations.

Trace test indicates no cointegration at the 0.05 level.

Max-eigenvalue test indicates no cointegration at the 0.05 level.

* Denotes rejection of the hypothesis at the 0.05 level.

** MacKinnon–Haug–Michelis (1999) p-values.

Table 6
Determining the number of cointegrating vectors.

Series: LBOT LMAL LMAU LNAM LSA LTAN LZAM LSSA				
Lags interval (in first differences): 1–2				
Unrestricted Cointegration Rank Test (trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical value	Prob.**
None*	0.033568	169.7992	159.5297	0.0122
At most 1	0.032105	123.5673	125.6154	0.0662
At most 2	0.022056	79.38395	95.75366	0.3854
At most 3	0.015357	49.18609	69.81889	0.6727
At most 4	0.008302	28.23091	47.85613	0.8036
At most 5	0.006074	16.94368	29.79707	0.6442
At most 6	0.004094	8.694813	15.49471	0.3944
At most 7	0.002317	3.140199	3.841466	0.0764
Unrestricted Cointegration Rank Test (maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical value	Prob.**
None	0.033568	46.23186	52.36261	0.1852
At most 1	0.032105	44.18339	46.23142	0.0817
At most 2	0.022056	30.19786	40.07757	0.4110
At most 3	0.015357	20.95518	33.87687	0.6875
At most 4	0.008302	11.28723	27.58434	0.9575
At most 5	0.006074	8.248866	21.13162	0.8878
At most 6	0.004094	5.554615	14.26460	0.6708
At most 7	0.002317	3.140199	3.841466	0.0764

Source: Author's computations.

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

Max-eigenvalue test indicates no cointegration at the 0.05 level.

* Denotes rejection of the hypothesis at the 0.05 level.

** MacKinnon–Haug–Michelis (1999) p-values.

benefits for the US market. Investors in the US can invest in the SADC markets with the view to diversify their portfolio. But the empirical evidence has shown that portfolio flows can be volatile and de-stabilising for the recipient countries. It is therefore important for policy makers to improve integration of SADC stock markets whereby this can attract more long term investment both FDI flows and portfolio flows. This should be the objective and not just attract yoyo portfolio flows. These more permanent flows (corporate finance flows and FDI) will help to promote both the financial and economic development of the SADC countries.

6.2.3. Testing for cointegration among SADC stock markets with the US market as benchmark and including the years of the financial crisis period

The cointegration test is this time performed including the years of the financial crisis. This time both the trace statistic and maximum eigen value indicate two cointegrating vectors. This result is not surprising. When there is crisis the stock markets in SADC are cointegrated with the US market, possibly due to the magnitude and contagion effects. However, under normal conditions the markets are not cointegrated with the US market.⁶

6.2.4. Testing for cointegration among SADC markets with SSA index as benchmark

Next we consider whether the SADC markets are cointegrated using the Sub-Saharan African Index (SSA) as the benchmark. First we must determine the optimal lag length for the VAR. The FPE, AIC, SC and HQ all confirm an optimal lag length of two. When we determine the number of co-integrating vectors as per the [Johansen Juselius procedure \(1990\)](#) of testing for multiple cointegrating vectors; the trace statistic indicates one co-integrating vector at the 5% level. On the other hand, the max-eigen statistic indicates no co-integrating vectors at the 5% level (see [Table 6](#)). According to the test, all the SADC stock markets are cointegrated with each other. However, their level of interdependence varies and is influenced by other various factors like trend in international stock market. If there is a cointegrating relationship among a vector of variables then this immediately implies that there must exist an error correction representation.

[Table 7](#) below gives the coefficient of the error correction term and its statistical significance. We find they are all negative indicating there is a correction towards the long run equilibrium. This can be seen from the ect 1 term in table below. However, they are statistically significant at the 5% level or better for Botswana, Malawi, Mauritius, Namibia, Tanzania and Zambia. Surprisingly, it is not significant for South Africa.

⁶ Results are available upon request due to space limitation.

Table 7

Error correction coefficient and statistical significance.

	D(LBOT)	D(LMAL)	D(LMAU)	D(LNAM)	DLSA	DLTAN	DLZAM	DSSA
ect 1	−0.015672	−0.013047	−0.005582	−0.002766	−0.003172	−0.009851	−0.012806	−0.004870
s.e	(0.00759)	(0.00323)	(0.00241)	(0.00124)	(0.00515)	(0.00439)	(0.00575)	(0.00595)
t.ratio	[−2.06396]	[−4.04165]	[−2.31711]	[−2.23868]	[−0.61632]	[−2.24269]	[−2.22880]	[−0.81834]

Source: Author's computations based on Eviews.

7. Conclusion and policy implications

The main objective of this research project is to argue that stock market integration is very important for SADC countries. We first analysed the characteristics of African stock markets: low market capitalization, poor market liquidity, not sufficiently developed market infrastructure and so on. When we do a synthesis of all that, we cannot continue to rest on our laurels and lament on the possible adverse effects of greater stock market integration for SADC and Africa. Do Nothing Is Not An Option. In fact, eminent researchers in the field like [Senbet and Otchere \(2008\)](#) among others have argued that stock markets provide an important opportunity for integrating Africa into the global financial market place and attracting global capital. Similarly, others have postulated that it is the sequencing which is important together with other sound macroeconomic and governance measures. The project then takes stock of the extent of stock market integration in SADC. Lately, a lot has happened and these have been reviewed. But there is still a lot more to be done. The empirical investigation analyses the extent of stock market integration in SADC by first analyzing beta and sigma convergence using the Sub-Saharan African index as benchmark. Then we performed cointegration analyses using the US market as the benchmark and second using the SSA index as benchmark. Initially, we excluded the years of the recent financial crisis in order not to contaminate the results.

We find beta converge but not sigma convergence; though for some markets the sigma values are falling and are around 0.4 or below. However; sub-sample analyses reveal deceasing beta convergence over the sub-sample period 2008–2011. No cointegrating vector was identified when using the US market as benchmark. This means that the SADC markets are not cointegrated with the US market. When we include the years of the financial crisis, two cointegrating vectors are observed. Therefore, during the financial crisis the markets were cointegrated, which is not surprising, otherwise not. When using the SSA index as benchmark one cointegrating vector was identified. However, one cointegrating vector shows weak cointegration.

The stock exchanges must therefore work towards greater integration so that they can attract more sustained portfolio flows (corporate finance flows) rather than volatile portfolio flows and also greater FDI flows which are much needed for the financial and economic development of the SADC countries and Africa. Increased economic integration is also very important. SADC countries cannot be complacent that with the fact that no cointegration or weak cointegration, the SADC stock markets offer good diversification benefits to US investors and elsewhere and are therefore good targets for round trip transactions. This is

short-termism. They must focus long term where capital flows are tapped to contribute to economic development and improve welfare. There is also a need to consolidate and reduce the number of exchanges with the view to improve market capitalization, liquidity, market infrastructure, governance amongst others but most importantly to increase the visibility, robustness and reputation of SADC stock markets at the international level.

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