Integration of the African Stock Markets to the Global Markets: Case Study of South Africa[1]

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Abstract

The paper empirically investigates the extent to which the South African stock market is integrated to other African stock market as well as the developed markets as represented by the US, Japan and German. The study employs the Autoregressive Distributed Lag (ARDL) approach to cointegration because it is a more reliable method than other conventional cointegration approaches and is also applicable even if the series are integrated of different orders, as long as none is of order 2 or more. It is also more robust and performs well for small sample sizes unlike the conventional approaches which are valid for large sample sizes. The results of empirical tests suggest that the South African stock market is fully integrated to the developed markets. However, the South African stock market is not fully integrated to other African stock markets. This suggests that investors can diversify their portfolios by investing in other African stock markets.

Keywords: *Stock market, Integration, Autoregressive Distributed Lag, Cointegration*

1. Introduction

Integration among stock markets has received considerable attention by policy makers as well as finance specialists. There are a number of reasons to support this move. Firstly, it can be argued that it provides opportunities in risk sharing among integrated markets (Marashdeh & Shrestha, 2010). In addition, it contributes to financial stability by enhancing competition and efficiency in allocation of resources, as well as reducing the cost of capital and price volatility among integrated markets (Tai, 2007). Integration of stock markets also plays an important role in promoting domestic savings, investment and could positively affect total factor productivity and economic growth (Levine, 2001). However, there are a number of studies which does not support stock market integration. Most notably those that argue that stock market integration could pose a major risk of contagion as was evidenced during the Asian crisis of 1997 and the global financial crisis.

It is important to note that stock markets in Africa have received little attention due to under development and illiquidity of the markets. However, there has been considerable improvement, rapid growth and liberalisation in a number of African countries stock markets (Allen et al, 2010; Allen, Otchere and Senbet, 2010).

It is behind this background that this study aims at identifying the long-run relationship and linkages of the South

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African stock market proxied by key indices to the developed stock markets; and selected African countries. The choice of South Africa lies in that the market is well developed and liquid relative to other markets in Africa, and an analysis of its integration with different market sizes and from different regions enhances our conclusions adding value to the available literature.

The paper is organised as follows. Section II presents an overview of the performance of African stock markets. Section III reviews the theoretical and empirical literature. Section IV describes the data employed in the study, the methodology for the empirical analysis and the empirical results. Finally, section V presents the Summary and concluding remarks of the study.

2. Overview of the African Stock Markets

Allen, Otchere and Senbet (2010) carried out a comprehensive study on Africa's financial systems. The report indicates that there has been a surge in the establishment of stock exchanges, particularly in Sub-Saharan Africa (SSA). Also, the report indicates that there were 5 stock exchanges in SSA about two decades ago, but now there are about 20 in operation. SSA also witnessed an establishment of a regional stock exchange domiciled in Abidjan, serving mostly the Francophone countries of West Africa. Similar initiatives are underway in Southern and Eastern Africa with the aim to consolidate the thinly capitalized markets into regional markets. This section will provide an analysis of the development of African stock markets.

2.1 Depth of African Stock Markets

African stock markets face serious challenges in terms of depth as measured by market capitalization and listing (Allen *et al*, 2010). Allen et at (2010) further indicates that with the exception of South Africa and Egypt, the stock markets in Africa are the smallest of any region in terms of both listed companies and market capitalization. This is illustrated in table 2.1 and 2.2.

Table 2.1 indicates that the mean capitalization for each period has been on the increase for all regions. Because of South Africa and Egypt, the Southern Africa and Northern Africa markets have relatively higher market capitalization. However, the 2008 financial crisis led to a drop in market capitalization. For South Africa and Egypt, which are the largest markets in Africa, they dropped by about 40 and 50% respectively.

With regards to listing on the African stock markets, table 2.2 indicates that the number of firms on the African stock markets is few. Senbet and Otchere (2009) 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 first listed and 158 companies in Mexico.

2.2 Liquidity of African Stock Markets

Market liquidity is defined as the ability to execute transactions of a representative size cheaply and rapidly without having too much of an effect on price. This element is of great importance to the stock market as it determines the number of participants who will be interested in investing on the market. There are a number of proxy measures of liquidity which include the bid-ask spread, turnover per year and the turnover as a ratio of market capitalisation. As measured by the total value of shares traded scaled by GDP, table 2.3 illustrates that African stock markets are highly illiquid and thin despite the rapid growth of the stock exchanges in Africa over the past 20 years. As indicated in table 2.3, the value of stock traded as a percentage of GDP is small even though it has been increasing. East African markets are the most illiquid as the value of stock traded is less than 1% of GDP (Allen et al, 2010).

2.3 Performance of African Stock markets

African stock markets have performed remarkably well in terms of absolute returns (Allen et al, 2010). This is illustrated in table 2.4.

Table 2.4 illustrates the performance of the African stock markets. The table indicates that the average annual returns for these markets over a period of ten years was 25% with the returns in some other countries such as Egypt and Malawi at times exceeding 100.

3. Theoretical Background and Literature Review

The law of one price (LOOP), pioneered by Augustin Cournot (1927) and Alfred Marshall (1930), constitutes the fundamental principle underlying financial market integration. While the LOOP provides a generalised framework for financial market integration, finance literature provides alternative principles, which establish operational linkages among different financial market segments.

In general, financial/ stock market integration occurs in three dimensions, nationally, regionally and globally (BIS, 2006). From an alternative perspective, stock market integration could take place horizontally and vertically. In the horizontal integration, inter-linkages occur among domestic stock market segments, while vertical integration occurs between domestic markets and international/financial markets (USAID, 1998). This study focuses on vertical integration of African stock markets and the developed economies counterparts, that is, a global dimension.

Stock markets provide an important opportunity for integrating Africa into the global financial market place and attracting global capital, (Senbet and Otchere, 2008).

According to Altin and Sahin (2010), the question of stock market integration had started to rise in the 1970's with the waning of capital market restrictions between developed economies. This dates back to Ripley (1973) study on interdependencies between 19 open markets. Stock market integration and interdependencies have implications for international investors and fund managers because the degree of market integration affects the benefits of international diversification. In essence, better stock market integration is also of interest to policy makers in the sense that events in one market can have significant effects in other markets, as each stock market becomes an integral part of a single global market. The popularity of this area of study is increasing given the economic challenges developed economies can be facing; then how can these be transmitted to African markets.

Informatively, Pretorius (2002) divides the stock market integration literature surveying into three categories: How they are interdependent, possible changes and why they are. This study aim to provide and answer to how African and global markets are interdependent and why is that so, that is answering Pretorius first and third question as in Ripley (1973).

It has been noted in literature that information variables are key in predicting developing market returns than with developed markets. Harvey (1995) founded correlation between developed markets and US, on the other hand concluding that there is no significant correlation between US and emerging markets. The main reason being that local information variables play an important role in predicting emerging market returns.

According to Lovegrove (2007), financial intermediaries and financial systems in Africa suffer from diseconomies caused by small scale. The study further argued that such diseconomies can be overcome by opening financial systems through regional financial integration, for example, to increase scale. The rationale behind the argument is that financial services in small systems tend to be more limited in scope, more expensive, and of poorer quality than services in larger systems. In such instances the case for integration of stock markets flows naturally.

Agyei-Ampomah (2008) considers the nature and extent of linkages between African stock markets and the relationships between these markets and that of regional and global indices between 1998-2007. Monthly returns of S&P/IFC return indices for 10 African countries, establishing that that African stock markets are still segmented from global markets in spite of some structural adjustments and that the local index volatility is largely country-specific which can be diversified away by cross-country diversification. The authors further argue that the structural adjustment of that time and liberalisation policies have not reduced stock market segmentation in Africa. It is imperative to investigate the same problem, with extend time frame and major events having taken place (for example global financial crisis) and advanced estimation techniques. In a time of increasing globalization, the transmission of movements in international financial markets is a central issue for economic policy, especially in episodes where markets are highly volatile.

On the other hand, Alagidebe (2008) investigated the integration of African stock markets into the global financial system and the implications for investment analysis and risk sharing. Using co-integration techniques, the study firstly showed that African stock markets are not well integrated with each other. Furthermore, the study revealed that 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 uncovered present an opportunity to diversify portfolio into African markets, the argument was that risk perception and institutional underdevelopment remain obstacles to the development of Africa's emerging equity markets.

Aponsah (2009) presented a critical review of the foundational policies that should be in place to enable the full and deep regional integration of African countries. While, Jeferis and Smith (2005) note that, with the exception of the Johannesburg Stock Exchange, most of the SSA markets are relatively small in terms of capitalization and turnover and

number of stocks. Most, including Johannesburg, are also illiquid by global standards; this has implications for market efficiency because liquidity has been found to be one of the most important links between stock markets and economic growth. The study finds that there is evidence of linkage between the BSE and the JSE, but little evidence of linkage between the ZSE and the other two. This empirical evidence supports the historical record of relationships among the countries. Botswana and South Africa have a highly open economic relationship; they are partners in the Southern Africa Customs Union (SACU) and are important trading partners (75% of Botswana's imports come from South Africa). A second conclusion is that the southern African markets, both individually and as a group, are not closely linked either to the two major developed country stock markets (the USA and the UK) or to other emerging stock markets. In terms of short-term relationships, the JSE appears to be more closely linked that the BSE or ZSE to the emerging and developed markets, likely because of the larger size and more efficient operation of the JSE. The lack of linkages between southern African and other international markets suggests that the region will continue to experience capital inflows, as fund managers seek the international diversification of risk that these markets appear to offer. However, the relationship between the JSE and the BSE suggests that there may be little diversification benefit between the two markets, which will tend to work against Botswana.

Altin and Sahin (2010) argue that globalization is the main topic of social sciences and stock market linkage has become one of the most important issue of financial and economic studies. The study focused on testifying the stock market linkage in regional context, considering 31 behaviours of stock markets. Employing con integration and granger causality tests, among others, the study utilised 2005 – 2010 daily data of all the stock markets and examines the short and long – run relationships between intra – regional movements. Those regions are Europe, Asia/Pacific and America.

4. Data, Descriptive Statistics and Methodology for Empirical Analysis

The study employed monthly stock price indices for a period ranging from January 2000 to December 2010. These indices are for South Africa, Nigeria, Botswana, Egypt and Mauritius. The five countries were chosen on the basis of data availability. Monthly stock price indices for the US, Germany and Japan represented the developed markets. The stock price data for the African stock markets and the US, German and Japan was collected from Bloomberg. The rationale for using monthly data lies in that it avoids distortions which are common in weekly and daily data which arise because of non-trading and non-synchronous trading (Marashdeh and Shrestha, 2010).

We estimated a model in which the Johannesburg Stock market (JSE) is the dependent variable while the, Nigerian stock market, Botswana stock market, Egypt Stock market and Mauritius stock market, USA stock market, Germany and Japan Stock markets.

To analyse the relationship between South Africa's stock market and the selected African stock markets as well as the developed markets the study relied on a model developed by Marashdeh and Shrestha (2010). The model employed is based on the following general model:

$$y = \alpha + \beta_i X_i + u \qquad 4.1$$

where,

y-Stock market as dependent variable

X_i – Stock markets as independent variables

The Error Correction representation of the model can be represented as follows:

$$\Delta y_t = \beta_0 + \sum_{i=1}^{p} \chi_i \Delta y_{t-i} + \sum_{i=1}^{p} \delta_i \Delta X1_{t-1} + \sum_{i=1}^{p} \varphi_i \Delta X2_{t-1} \sum_{i=1}^{p} \phi_i \Delta X3_{t-i} + \lambda_1 X1_t + \lambda_2 X2_t + \lambda_3 X3_t + \lambda_4 t + u_t \ldots 4.2$$

Our empirical analysis was based on establishing the long-term relationship between the South African stock market with the developed markets as well as the few selected African markets.

However, before conducting cointegration tests, it is imperative to test for unit root in order to determine the order of integration of the variables. To determine the time series properties of the variables the Augmented Dickey Fuller (ADF) and the Phillips Peron (PP) tests will were employed. The two tests were employed to obtain robust results.

Having established the order of integration of the variables, cointegration tests were conducted by applying the autoregressive distributed lag (ARDL) approach developed by Pesaran et al (1996, 2001). This approach has a number of advantages over the conventional cointegration tests like the Johansen test or the Engle Granger approach. This approach is applicable irrespective of the order of integration of the time series, as long as none is of a second order or more. Also, the ARDL approach is more robust and performs well even for small sample sizes. The ARDL approach also allows the estimation of the long-run and the short-run components of the model simultaneously.

The existence of an error-correction term among a number of cointegrated variables implies that changes in the

dependent variable are a function of both the level of disequilibrium in the cointegration relationship and the changes in other explanatory variables. As in Masih and Masih (2002), any deviation from the long-run equilibrium will feed back to the changes in the dependent variable in order to force the movement towards the long-run equilibrium.

In the model, the null hypothesis of no cointegration for the dependent variables is:

(H_0: $\lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = 0$) , it was tested against the alternative hypothesis (H_1: $\lambda_1 = \lambda_2 = \lambda_3 = \lambda_4$). The hypothesis was examined using the standard F-statistic test as suggested by Pesaran and Pesaran (1997).

Pesaran and Pesaran (1997) and Pesaran et al (2001) provided two sets of asymptotic critical values. The first set assumes that all variables are I(0) while the second category assumes that all variables are I(1). In the event that the computed F-statistic is greater than the upper bound critical values, the null hypothesis of no cointegration is rejected suggesting that there exists a long-term relationship between the variables of interest. However, if the computed F-statistic is less than the lower bound critical value, then the null hypothesis of no cointegration will not to be rejected. In the event that the F-statistic falls within the lower and upper bound critical values, the result is inconclusive.

4.1 Empirical Results

The empirical results begin with an analysis of the group descriptive statistics.

The descriptive statistics in table 4.1 indicates that on the selected African stock markets Nigeria has the highest mean value whilst Namibia has the lowest. As for the standard deviation the results indicates that the Nigerian stock market is the most volatile whilst Namibia is least volatile. In addition, the results indicate that all African stock markets are skewed to the right indicating that there are greater chances of positive returns.

The time series properties of the data indicate that all other variables except Japan are non-stationary at level series as reported by both the ADF and the PP. However, at first differences all variables are stationary. This therefore justifies the use of the ARDL approach to cointegration unlike the other convention approaches which require that the variables be integrated of order one I(1).

The results of the ARDL estimation are shown in table 4.2:

The results as reported in table 4.2 show that the calculated F-statistic (2.458338) is lower than the upper bound but greater than the lower bound indicating that the result is inconclusive. In this case, Kremers *et al* (1992), state that the error correction term needs to be analysed to establish a cointegrating equation.

The long-run coefficients and error correction terms of the ARDL model revel that Botswana, , German, Japan and USA are highly significant impact positively on the South African Stock market. This is consistent with Aponsah (2009) who discovered that there is evidence of linkage between the Botswana Stock Exchange and the Johannesburg Stock Exchange. However, Namibia, Egypt and Nigeria are insignificant and impact negatively on the South African stock market. The Mauritius stock market also impacts negatively on the South African stock market, however it is highly significant. The results also indicate that the South African stock market is integrated in the global market as indicated by high levels of significances for Germany, Japan and USA.

The error correction term (ECM) is statistically significant at 99 percent confidence level with a negative sign. This therefore confirms the existence of a stable long-run relationship and points to a long-run cointegration between variables. The ECM represents the speed of adjustment to restore equilibrium in the dynamic model following a disturbance. The coefficient of the ECM for South Africa is -0.5643, implying that about 56 percent of deviation from the long-run equilibrium following a short-run shock is corrected in one month.

4.2 Granger Causality Test

The empirical results show evidence of lead-lag interaction between our series except for Nigeria and Mauritius where there is evidence of bi-directional causality. For the other African markets the results indicate that the South African stock market leads, thus any innovations which occur in the South African stock market will be transferred to other stock markets on the continent. However, as for developed stock markets there is bi-directional causality between South Africa and German, whilst for Japan and the USA there is uni-directional causality running from the USA and Japan to South Africa. This suggests that the South African stock market is well integrated into the global market.

5. Conclusion and Recommendations

The paper investigated the long-run relationship of the South African stock market with a few selected African stock

market as well as its linkages with the developed markets represented by USA, Japan and German. The empirical results show that the South African stock market is not fully integrated with other African stock markets. It only moves in the same direction with the Botswana stock market attesting that potential gains from portfolio diversification between the two markets are limited since systematic risk cannot be diversified away and arbitrage opportunities among them are not possible. However, the South African stock market moves in different directions with the Namibian, Egypt, Nigeria and Mauritius stock markets. This indicates that within the African region portfolio diversification is possible to some extent. Also, the error correction term is significantly high (56 percent) suggesting that the speed of adjustment back to equilibrium following a disturbance is rapid and there are less possibilities of achieving arbitrage opportunities in the short-run.

The empirical results also indicate that the South African stock market is integrated with the developed markets represented by the US, German and Japan. This shows that there are less opportunities for international investors to diversify their portfolio and obtain long-run gains through investing in South Africa. This also indicates that the South African stock market is affected by the movement in the developed markets in the long-run.

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Table 2.1: Market capitalization of listed companies (% of GDP)

Region	Country	Market Capitalization as a percentage of GDP					
		2003	2004	2005	2006	2007	2008
Eastern Africa	Kenya	28	24	34	51	50	32
	Tanzania	7	6	4	4	-	6
	Uganda	1	1	1.12	1.17	-	-
	Average	12	10	13	19	50	19
Northern Africa	Egypt	33	49	89	87	107	53
	Morocco	26	44	46	75	101	76
	Tunisia	10	9	10	14	15	16
	Average	23	34	48	59	74	49
Southern Africa	Botswana	26	26	23	36	48	27
	Malawi	4	6	8	19	-	42
	Mauritius	37	39	41	56	83	40
	Namibia	6	7	6	6	8	7
	South Africa	161	211	233	277	294	178
	Swaziland	10	10	8	7	7	-
	Zambia	17	8	14	11	21	-
	Zimbabwe	67	41	70	-	-	-
	Average	41	44	50	59	77	59
Western Africa	Cote d'Ivoire	12	13	14	24	42	30
	Ghana	19	30	16	25	16	21
	Nigeria	14	16	17	22	52	23
	Average	15	20	16	24	37	25

Source: World Development Indicators

Table 2.2: Number of Listed Domestic Companies

Region	Country	**Number of Listed Companies**					
		2003	2004	2005	2006	2007	2008
Eastern Africa	Kenya	51	47	47	51	51	53
	Tanzania	6	6	6	6	7	7
	Uganda	3	5	5	5	-	6
	Subtotal	20	19	19	21	29	22
Northern Africa	Egypt	967	792	744	603	435	373
	Morocco	53	52	56	65	74	77
	Tunisia	46	44	46	48	50	49
	Subtotal	355	296	284	239	186	166
Southern Africa	Botswana	19	18	18	18	18	19
	Malawi	40	41	42	41	90	41
	Mauritius	8	8	9	10	9	14
	Namibia	13	13	13	9	9	7
	South Africa	426	403	388	401	422	425
	Swaziland	5	6	6	6	6	7
	Zambia	12	13	15	14	15	-
	Zimbabwe	81	79	79	80	82	81
	Subtotal	76	73	71	72	81	85
Western Africa	Cote d'Ivoire	38	39	39	40	38	38
	Ghana	25	29	30	32	32	35
	Nigeria	200	207	214	202	212	213
	Subtotal	88	92	94	91	95	95

Source: World Development Indicators

Table 2.3: Stocks Traded, Total value (% of GDP)

Region	Country	Stocks traded, total value (% of GDP)											
		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Average	Average excluding 2008
EA	Kenya	-22.20	-16.92	-29.18	0.58	100.87	7.60	34.88	42.10	-3.56	-35.33	7.88	12.68
	Tanzania	-	-	-	-	-	-	-	-	-	21.26	21.26	-
	Uganda	-	-	-	-	-	-	-	-	-	-25.07	-25.07	-
	Average	-22.20	-16.92	-29.18	0.58	100.87	7.60	34.88	42.10	-3.56	-13.04	10.11	12.68
NA	Egypt	43.80	-37.65	-37.95	3.50	152.13	110.98	127.36	11.47	51.85	-55.10	37.04	47.28
	Morocco	-5.20	-19.51	-13.07	-14.87	27.64	13.95	18.76	78.84	52.46	-15.52	11.35	14.33
	Tunisia	74.40	75.87	-30.09	-21.40	20.04	3.72	17.20	39.96	21.12	1.78	20.26	22.31
	Average	37.67	6.24	-27.03	-10.92	66.60	42.88	54.44	43.42	38.48	-22.94	22.88	27.97
SA	Botswana	47.80	3.87	68.93	1.53	0.23	15.61	23.21	74.07	44.43	-21.38	25.83	31.08
	Malawi	-	53.56	-11.51	-31.68	45.91	27.60	55.42	154.80	109.89	25.60	47.73	50.50
	Mauritius	-6.40	-10.47	-12.61	17.13	37.64	29.33	13.11	49.81	51.94	-35.38	13.41	18.83
	Namibia	48.10	-41.40	-35.87	-20.34	23.83	14.26	7.82	27.06	44.68	19.88	8.80	7.57
	S.Africa	57.30	-2.54	25.41	-11.15	11.96	21.85	42.98	37.68	16.23	-25.72	17.40	22.19
	Swaziland	-	-	-	-	-	-	-	11.83	14.98	3.92	10.24	13.40
	Zambia	20.03	56.16	-0.55	10.33	29.04	77.27	61.96	48.17	92.29	-29.08	36.56	43.86
	Average	33.37	9.87	5.63	-5.70	24.77	30.99	34.08	57.63	53.49	-8.88	23.52	27.13
W.A	Ivory Coast	-6.80	-18.07	3.61	-4.26	0.81	17.11	28.31	0.27	77.02	-10.68	8.73	10.89
	Ghana	-15.20	16.54	11.42	45.95	154.67	91.32	-29.85	4.97	31.84	58.06	36.97	34.63
	Nigeria	-7.20	54.01	35.16	10.71	65.84	18.46	1.01	37.80	74.73	-45.77	24.48	32.28
	Average	-9.73	17.50	16.73	17.47	73.77	42.30	-0.18	14.34	61.19	0.54	23.39	25.93

Source: Allen, Otchere and Senbet (2010)

Table 2.4: African Countries Annual Stock return (%)

Region	Country	African Countries Annual Stock return (%)											
		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
EA	Kenya	0.81	0.56	0.57	0.37	0.31	0.28	1.40	2.14	2.69	5.78	4.89	4.17
	Tanzania	-	-	0.08	0.44	0.08	0.19	0.19	0.15	0.10	0.08	-	-
	Uganda	-	-	-	-	-	0.01	-	-	0.03	0.06	-	-
	Average	0.18	0.28	0.33	0.41	0.13	0.16	0.53	0.76	0.94	1.97	4.89	4.17
NA	Egypt	7.47	5.93	9.96	11.14	3.99	2.91	3.95	7.11	28.31	44.16	40.68	42.77
	Morocco	3.14	3.47	6.37	2.95	2.58	1.45	1.39	2.95	6.97	20.57	34.98	25.40
	Tunisia	1.38	0.95	2.02	3.22	1.58	1.05	0.66	0.80	1.57	1.69	1.86	3.72
	Average	3.99	3.45	6.12	5.77	2.72	1.80	2.00	3.62	12.28	22.14	25.84	23.96
SA	Botswana	1.14	1.35	0.67	0.77	1.08	0.93	1.05	0.51	0.43	0.66	0.89	1.11
	Malawi	3.08	2.44	1.80	1.69	2.46	1.25	1.89	1.57	2.40	2.14	5.44	4.66
	Mauritius	-	-	-	-	-	0.34	0.24	0.34	0.28	0.45	-	1.40
	Namibia	0.66	0.38	0.66	0.56	0.22	0.04	0.03	0.27	0.09	0.23	0.26	0.22
	S.Africa	30.05	43.45	54.75	58.32	58.81	71.10	61.69	75.38	82.67	121.23	150.05	145.07
	Swaziland	0.01	0.01	0.01	0.01	0.02	0.77	0.02	0.00	0.00	0.00	0.00	0.00
	Zimbabwe	6.40	3.07	3.80	3.80	3.77	14.91	11.35	18.18	2.88	9.70	-	-
	Zambia	0.20	0.08	0.38	0.25	1.46	0.05	0.25	0.12	0.20	0.21	0.63	-
	Average	5.93	7.25	8.87	9.34	11.39	12.11	10.43	10.12	11.97	17.85	31.45	30.49
W.A	Ivory Coast	0.20	0.31	0.68	0.32	0.08	0.14	0.18	0.30	0.19	0.62	0.80	1.35
	Ghana	0.71	0.80	0.32	0.20	0.25	0.18	0.60	0.74	0.63	0.41	0.73	0.93
	Nigeria	0.36	0.50	0.42	0.57	1.03	0.80	1.27	1.90	1.73	2.42	10.11	9.41
	Average	0.43	0.54	0.47	0.36	0.45	0.38	0.68	0.98	0.85	1.15	3.88	3.89

Source: Allen, Otchere and Senbet (2010)

Table: 4.1 Group Descriptive Statistics

	South Africa	Botswana	Namibia	Egypt	Mauritius	Japan	German	Nigigeria	Usa
Mean	11391.66	2534.964	109.2077	1056.227	536.7011	12338.95	4855.049	16444.96	1162.380
Median	10108.61	2485.930	102.6200	987.6000	454.4600	11492.54	4818.300	13962.04	1156.850
Maximum	21953.80	4501.530	161.6000	1846.890	871.3400	20337.32	7644.550	33096.37	1517.680
Minimum	7364.171	1389.020	59.51000	643.0700	340.9200	7831.420	2423.870	5892.790	815.2800
Std. Dev.	3919.225	748.0475	39.03024	288.0261	172.5271	2868.592	1336.865	7185.834	165.3675
Skewness	1.370473	0.429631	0.117623	0.995250	0.566072	0.737323	0.280206	0.214466	-0.039301
Kurtosis	3.797880	2.920956	1.299925	3.511535	1.772875	2.872675	2.207013	1.714748	2.596379
Jarque-Bera	26.82509	2.450903	9.695923	13.90320	9.175799	7.211357	3.103684	6.043023	0.556581
Probability	0.000001	0.293625	0.007844	0.000957	0.010174	0.027169	0.211857	0.048728	0.757077
Sum	899940.9	200262.2	8627.410	83441.91	42399.39	974777.0	393548.9	1299152.	91828.01
Sum Sq. Dev	1.20E+09	43646849	118822.0	6470805.	2321717	6.42E08	1.39E+08	4.03E+09	2133019
Observations	79	79	79	79	79	79	79	79	79

Table 4.1: Unit Root Test Results

Variables	ADF Test Results		Philips Peron	
	t-statistic	Inference	t-statistic	Inference
SA	-0.741762	Nonstationary	-0.853248	Nonstationary
Botswana	-1.219130	Nonstationary	-1.166598	Nonstationary
Namibia	1.912389	Nonstationary	1.771341	Nonstationary
Nigeria	-1.770815	Nonstationary	-2.120665	Nonstationary
Egypt	-2.196183	Nonstationary	-2.037818	Nonstationary
Mauritania	-0.952408	Nonstationary	-1.486608	Nonstationary
US	-1.950373	Nonstationary	-2.094554	Nonstationary
German	-1.730227	Nonstationary	-1.906906	Nonstationary
Japan	-2.750545*	Stationary	-2.584050*	Stationary

Notes: *** Significant at 1% level; ** Significant at 5% level and Significant at 10% level

Table 4.2: F-statistic for testing the Existence of a Long-run Relationship

Wald Test:
Equation: Untitled

Test Statistic	Value	Df	Probability
F-statistic	2.458338	(9, 60)	0.0445**
Chi-square	13.12504	9	0.0570

Null Hypothesis: C(1)=0, C(3)=0, C(5)=0, C(7)=0, C(9)=0, C(11)=0, C(13)=0, C(15)=0, C(17)=0

Notes:

- The relevant critical value bounds are obtained from Pesaran and Pesaran (1997)
- The critical values in the case of 9 regressors with intercept and trend are 2.192 – 3.285 at a 10% level and 2.467 – 3.614 at a 5% significance level.
- denotes that the F-statistic falls above the 90% upper bound, while ** denotes that the F-statistic falls above the 95% upper bound.
- The ARDL model is based on the Akaike Information Criteria (AIC) as it employs the maximum relevant lags.

Table 4.3: Estimated Long-run Coefficients and Error Correction terms for the ARDL Model

Dependent Variable: South Africa	
Regressors:	
Botswana	1.026375 [2.792906]**
Namibia	-8.440770 [-0.665720]

Egypt	-0.045304 [-1.453435]
Mauritius	-8.593770 [-2.356453]**
German	1.539464 [4.267102]***
Japan	0.018200 [2.025012]**
USA	2.311554 [3.215012]***
Constant	-2.4567 [-0.3697]
Trend	0.10392 [4.4534]***
ECM(-1)	-0.564340 [-5.277988]***
R-Squared	0.665958
Adjusted R-Squared	0.578340

Note: t-statistics are represented in squared brackets. ***, **, * represents 1%, 5% and 10% significant levels respectively