

THE CHANGING EFFICIENCY OF AFRICAN STOCK MARKETS

KEITH JEFFERIS AND GRAHAM SMITH†

Abstract

This paper classifies formal African stock markets into four categories and discusses the principal characteristics of the seven markets covered in this study: South Africa, Egypt, Morocco, Nigeria, Zimbabwe, Mauritius and Kenya. Using a GARCH approach with time-varying parameters, a test of evolving efficiency (TEE) is implemented for periods starting in the early 1990s and ending in June 2001. This test detects changes in weak form efficiency through time. The TEE finds that the Johannesburg stock market is weak form efficient throughout the period, and three stock markets become weak form efficient towards the end of the period: Egypt and Morocco from 1999 and Nigeria from early 2001. These contrast with the Kenya and Zimbabwe stock markets which show no tendency towards weak form efficiency and the Mauritius market which displays a slow tendency to eliminate inefficiency. The paper relates weak form efficiency to stock market turnover, capitalisation and institutional characteristics of markets.

JEL Classification: G14, G15, O16 Keywords: African Stock Markets, efficiency, GARCH

WITH THE POSSIBLE EXCEPTION of the JSE Securities Exchange (JSE), there have been relatively few studies of the weak form efficiency of African stock markets. While the evidence for the JSE is mixed, the few studies that have been carried out for other markets find, not surprisingly, that most are inefficient (in a financial sense, meaning that stock prices do not reflect all available information, and that stocks are not therefore being appropriately priced at their equilibrium values).

A variety of empirical tests can be used to assess market efficiency. Thompson and Ward (1995) reviewed a wide range of literature covering empirical tests of the efficiency of the JSE and noted that, with different methodologies for testing efficiency giving different results, no clear conclusion is possible. Jefferis and Okeahalam (1999a) applied unit root tests to stock price indices to assess the efficiency of the stock markets in South Africa, Botswana and Zimbabwe over the period 1989-96, and find that the South African and Zimbabwean markets were efficient during this period, although Botswana was not, at least during the early part of the period. However the unit root test of market efficiency is not a powerful one, and subsequent analysis using different tests provided contrasting results. Jefferis and Okeahalam (1999b) used an event study of the same three markets to test the response of individual stock prices to information announcements, by evaluating the speed and efficiency with which information is incorporated into market prices. They found that the Botswana and Zimbabwe markets are inefficient, while the JSE is weak form efficient. This corresponds with the findings of Smith *et al* (2002), who tested whether eight African stock markets follow a random walk using multiple variance ratio tests. Of the eight markets (South Africa, Egypt, Kenya, Morocco, Nigeria, Zimbabwe, Botswana and

† Bank of Botswana, and Department of Economics, School of Oriental and African Studies, University of London, respectively. This paper represents the personal views of the authors and not necessarily those of their respective institutions. We are grateful to Hyun-Jung Ryoo for helpful comments on an earlier version of the paper.

Mauritius), only the JSE was found to follow a random walk and therefore to be weak form efficient. Magnusson and Wydick (2002) provided three tests of the random walk hypothesis focusing on uncorrelated price changes, independently but not identically distributed (INID) price changes, and IID price changes. Using the test of INID price changes with stock price indices in local currency, they found that Botswana, Ghana, Nigeria and Zimbabwe are inefficient while Côte d'Ivoire, Kenya, Mauritius and South Africa are weak form efficient. Furthermore, the weak form efficiency of the eight African stock markets examined in their study compared favourably with a sample of emerging stock markets in Asia and Latin America.

All of these studies employed tests which lead to the inference that a stock market either is or is not weak-form efficient. Gradual changes in efficiency are not captured. It seems implausible that a relatively new emerging stock market is equally efficient over the whole of its history. When a market first starts trading, it takes time for the price discovery process to become known. As markets operate and market microstructures develop, emerging stock markets are likely to become more efficient (Cornelius, 1993). A test is required that can capture *gradual* changes in efficiency. Such a test has been provided by Emerson *et al* (1997) and Zalewska-Mitura and Hall (1999) who use a GARCH approach with time-varying parameters which can detect gradual changes in weak form efficiency through time. This paper implements this test of evolving efficiency for seven African stock markets. The rest of this paper is organised as follows. Section 1 provides an overview of African stock markets and identifies four categories of formal stock market. Section 2 describes the data and their characteristics. Section 3 discusses the empirical methodology employed. In section 4 the results are presented. Section 5 provides a brief conclusion.

1. AN OVERVIEW OF AFRICAN STOCK MARKETS

At the end of 2003 there were 12 formal stock markets in Africa monitored by the S&P Emerging Markets Database (EMDB) (see Table 1). These can usefully be divided into three categories:

- (i) South Africa, which dominates other African stock markets in terms of both size and sophistication.
- (ii) A group of medium sized markets, many of which have been established for a long time (*e.g.*, Egypt, Morocco, Nigeria, Zimbabwe).
- (iii) Small new markets that have shown rapid growth (*e.g.*, Botswana, Ghana, Mauritius).

A fourth category comprises a number of very small, relatively new markets that are in the embryonic stage and are yet to take off (*e.g.*, Swaziland, Zambia, Malawi, Tanzania, Uganda) and which are not yet included in the EMDB.

With the exception of South Africa, African stock markets are extremely small by world standards. Together, the fifteen markets apart from South Africa accounted for only 0.2 per cent of world stock market capitalisation at the end of 2003, and 2.0 per cent of emerging market capitalisation. In contrast, South Africa - which accounts for 80 per cent of African stock market capitalisation - is quite large by world standards. With a capitalisation of US \$267 billion at the end of 2003, South Africa was then the fifth largest emerging market (after China, Taiwan, South Korea and India), and the 18th largest equity market in the world. All African markets (including South Africa) tend to lack liquidity, however, and therefore when ranked by turnover rather than market

capitalisation their relative position is diminished. Five of the African markets are included in the S&P Global Emerging Market Index (S&P/IFCG) (South Africa, Egypt, Morocco, Nigeria, and Zimbabwe) although, apart from South Africa, they have very small weights in the S&P index.

Table 1. African Stock Markets, 2003

(Ranked by capitalisation, end of year)					
	Capitalisation	Annual Change %	Turnover	Liquidity	No. of Stocks
	(US\$ million)	1994-2003	(US\$ million)	(%)	
Namibia	308	6.3	2	0.7	13
Ghana	1,426	(3.0)	46	4.1	28
Cote D'Ivoire	1,650	16.2	25	1.6	38
Mauritius	1,955	2.7	99	6.2	40
Botswana	2,131	21.2	87	4.4	19
Tunisia	2,464	(0.4)	164	7.2	46
Kenya	4,178	3.4	209	7.4	51
Zimbabwe	4,975	11.8	1,345	26.1	81
Nigeria	9,494	4.2	78	11.0	200
Morocco	13,152	4.3	114	6.5	53
Egypt	27,073	22.8	3,278	13.7	967
South Africa	267,745	1.9	102,808	44.8	426
TOTAL	336,244		108,252		1,949
Excl. SA	68,499		5,444		1,523
SA as % of total	79.6%		95.0%		21.9%
Emerging Markets	3,656,722				
Africa as %	9.2%				

Note: countries in bold included in present study

Source: Standard & Poors (2004)

Although most African stock markets are relatively small, many have grown rapidly in recent years, and there have been very rapid increases in capitalisation and turnover over the past decade. Turnover, for instance, increased at an average annual rate of 22 per cent (measured in US\$ terms) between 1994 and 2003, compared to 9 per cent a year for emerging markets as a whole. At the same time, many of these markets have performed well in terms of returns for investors. Although in many cases they have also been characterised by high levels of volatility, these markets tend to exhibit relatively low correlations with other stock markets internationally.

A number of factors have contributed to the expansion and growth of African stock markets. Many countries have been undergoing economic reform programmes that have involved a reduction in the role of the state in the economy and a strengthening of the role of the private sector. This has been accompanied by a greater role for market forces in price determination and the allocation of both real and financial resources. Financial sector reforms have often included the establishment of new stock markets, or improving the environment in which existing stock markets operate. Furthermore, privatisation programmes in several countries have involved the listing of shares in formerly nationalised firms, which are often very large in relation to the size of national economies, thus providing a supply of new shares and a further boost to stock market development.

This process has been accompanied by increased attention from international

investors. Their interest reflects the growing size of African markets, along with the potential for high returns accompanied by the diversification benefits resulting from low correlations with other markets. At the same time many of the barriers to entry that have previously restricted the participation of foreign investors in many African markets are being progressively eased. Many countries have liberalised exchange controls on both current and capital account, making entry and exit easier, and direct restrictions on foreign ownership of shares have also been relaxed, although some controls do remain. Standards of market governance have improved, with several countries introducing new or revised legislation and governance structures.

Table 2. African Stock Markets included in this study

Descriptive Statistics 2003								
	Capitalisation (US\$ million) (2003)	Turnover (US\$ million) Average, 2000-2003	Turnover Ratio (%) (Liquidity)	Mkt Cap /GDP %	Number of Stocks	Price- earnings Ratio	Price Index Correlations [a] S&P 500	FTSE 100
Mauritius	1,955	86	6.3	41.1	40	7.7	n/a	n/a
Kenya	4,178	83	4.4	32.3	51	31.9	n/a	n/a
Zimbabwe	4,975	1410	21.9	66.6	81	5.5	(0.07)	(0.13)
Nigeria	9,494	523	9.2	20.8	200	18.5	0.24	0.15
Morocco	13,152	837	8.1	34.7	53	25.2	0.15	0.21
Egypt	27,073	5,213	18.2	28.7	967	11.7	0.26	0.26
South Africa	267,745	82,202	41.4	244.6	426	11.5	0.45	0.50
TOTAL	328,572	90,354	36.3	105.1	1,818	12.4	-	-
Excl. RSA	60,827	8,152	13.6	29.9	1,392	16.4	-	-
IFCG Composite	-	-	-	-	-	21.7	0.74	0.63

Notes: [a] 1998-2003

Source: Standard and Poors (2004)

The lack of liquidity remains a serious problem for African markets, however. Turnover ratios (the ratio of turnover to capitalisation) in liquid markets are typically over 100 per cent; in Africa, however, the most liquid market is South Africa, with a turnover ratio of 44 per cent, while in other markets liquidity is generally well below this (see Table 1)¹. Lack of liquidity can stem from both sides of the market.

Table 3. Market Characteristics

	Foreign Investment Ceilings (in general) %	Withholding Taxes on Foreign Investors			Status of Entry and Exit for Foreign Investors	Trading System
		Interest	Dividends	Capital Gains		
South Africa	100	0	0	0	Free	Electronic (1996)
Egypt	100	15	0	40	Free	Electronic (2000)
Morocco	100	10	10	0	Free	Electronic (1997)
Nigeria	100	10	10	0	Free	Electronic (1999)
Zimbabwe	40	10	20	0	Relatively free	Open outcry
Mauritius	100	0	0	0	Relatively free	Electronic (2001)
Kenya	40	15	10	0	Relatively free	Open outcry

Source: Standard & Poors (2004); Stock Exchanges

On the supply side, many shares in listed companies are held by controlling interests -

¹ Although low liquidity also characterises smaller emerging markets elsewhere in the world.

often foreign parent companies - leaving relatively small proportions of shares available for public trading. This can have implications on the demand side, especially in small markets, where local and foreign institutional investors know that “the costs of trading in and out of African equities are high and that positions once sold may not be easily re-established” (Flemings, 1997 p.2).

The present study covers seven African stock markets: South Africa, Egypt, Morocco, Nigeria, Zimbabwe, Mauritius and Kenya. These represent seven of the nine largest stock markets in Africa, and account for 97.5 per cent of total capitalisation. Summary statistics for these markets are reported in Table 2 and market characteristics in Table 3. More information is provided on each of these markets in Appendix 1.

2. THE DATA AND THEIR PROPERTIES

The stock price indices used in this paper are broadly-based and representative of the market as a whole. The series are: the EFG Price Index for Egypt, the Nairobi Stock Exchange Index, the Stock Exchange of Mauritius Index (SEMDEX), the Casablanca Finance Group CFG 25, the S&P/IFC Global Index for Nigeria and the Johannesburg Securities Exchange JSE-Actuaries All Share Index. A composite index is not produced by the Zimbabwe Stock Exchange – only separate indices for the industrial and mining sectors. Since the stock market is dominated by the industrial sector, this index is used. All indices have value weights and are in local currency. The data are weekly starting in the third week of January 1990 and ending in the last week of June 2001 (598 observations), except for Egypt for which the series starts in the first week of January 1993 (443 observations) and Morocco and Nigeria where the data begin in the first week of January 1994 (391 observations). All observations are closing prices and refer to Wednesdays to minimise any day-of-the-week effects. The source is *Datastream*.

Table 4. Summary Statistics for Weekly Returns

	Egypt	Kenya	Mauritius	Morocco	Nigeria	South Africa	Zimbabwe
Mean	0.0023	0.0012	0.0019	0.0023	0.0063	0.0018	0.0063
Median	0.0003	0.0000	0.0009	0.0009	0.0046	0.0031	0.0056
Standard Deviation	0.0312	0.0251	0.016	0.0152	0.0223	0.0254	0.0374
Skewness	0.3695	4.3152	0.3888	0.5165	0.4512	-0.9794	-0.0691
	<i>0.117</i>	<i>0.100</i>	<i>0.100</i>	<i>0.124</i>	<i>0.124</i>	<i>0.100</i>	<i>0.100</i>
Excess Kurtosis	2.0519	40.0703	3.3112	3.424	5.1737	4.4178	9.481
	<i>0.233</i>	<i>0.201</i>	<i>0.201</i>	<i>0.248</i>	<i>0.248</i>	<i>0.201</i>	<i>0.201</i>
Jarque-Bera	87.59	41792.8	287.77	207.84	448.2	580.93	2236.5
ARCH(1)	50.96	97.67	38.48	22.92	23.19	28.39	67.93

Notes: [1] The numbers in italics are standard errors of the coefficients of skewness and excess kurtosis under the hypothesis of normality.

[2] The .05 critical value for the Jarque-Bera test is 5.99.

[3] The .05 critical value for ARCH(1) is 3.84.

[4] For all markets, Phillips-Perron unit root tests (not reported here) find that logarithms of the indices are I(1) and weekly returns are I(0). Unit root tests are not tests of the random walk hypothesis (Campbell *et al*, 1997, pp 64-5).

Table 4 reports descriptive statistics for weekly returns. For all of these stock markets, average returns are positive. Under the hypothesis of normality, the distribution of the coefficient of skewness is asymptotically normal with mean zero and variance $6/T$ where T is the sample size. The distribution of returns on the Zimbabwe stock market is not significantly skewed at the .05 significance level. However, for the JSE the

distribution of returns is skewed to the left and for the other five markets the distributions are positively skewed. Under normality, the distribution of the coefficient of excess kurtosis is asymptotically normal with zero mean and variance $24/T$. For all seven markets, the distributions of weekly returns are leptokurtic, that is, they have higher peaks about the mean and thicker tails than the normal distribution. For all of these stock markets, the Jarque-Bera joint test of symmetry and mesokurtosis provides further evidence that weekly returns are not normally distributed. The null hypothesis of no autoregressive conditional heteroscedasticity (ARCH) is clearly rejected for returns in all seven markets. In summary, returns in these seven stock markets are not white noise. They show clear departures from normality and time-varying volatility. For returns having these characteristics, a test of evolving efficiency can be used and this is discussed in the next section.

3. METHODOLOGY: A TEST OF EVOLVING EFFICIENCY

If a stock market follows a random walk it is weak form efficient. That is, prices fully reflect the information contained in past price changes. In these circumstances, historical price information provides no profit opportunities; an efficient market is unpredictable. In principle, this can be tested using a simple model of the form

$$r_t = \beta_0 + \beta_1 r_{t-1} + u_t \quad (1)$$

where $r_t = p_t - p_{t-1}$ and p_t is the natural logarithm of a stock price index (or stock price). If the stock price index follows a random walk, $\beta_1 = 0$ and so

$$p_t = \beta_0 + p_{t-1} + u_t. \quad (2)$$

Campbell *et al* (1997) distinguished three successively weaker versions, depending on the assumptions made about the increments $\{u_t\}$. With Random Walk 1 model, RW1, increments are independently and identically distributed with zero mean and constant variance, denoted by $u_t \sim \text{IID}(0, \sigma^2)$. Under RW2, they are independently but not identically distributed, which allows for unconditional heteroscedasticity in the $\{u_t\}$, and with RW3, increments are uncorrelated but not independently and not identically distributed. This paper focuses on RW3, with volatilities changing over time.

Equation (1) has constant parameters and the disturbance is assumed to satisfy the usual classical assumptions. With emerging markets, the assumption of constant parameters may be inappropriate because as these markets develop and become more mature the parameters are expected to change. Also, empirical evidence frequently finds that returns in stock markets have a variance which changes systematically. This may affect the required rate of return and may also have an autoregressive component. Using a GARCH approach with time-varying parameters, Emerson *et al* (1997) and Zalewska-Mitura and Hall (1999) have developed a test for evolving efficiency (TEE) which detects changes in weak form efficiency through time where the error process does not have a full set of NID properties.

Consider the following model in which returns depend on past returns and the conditional variance

$$r_t = \beta_{0t} + \beta_{1t} r_{t-1} + \delta h_t + u_t. \quad (3)$$

$$u_t | \psi_{t-1} \sim N(0, h_t) \tag{4}$$

$$h_t = \alpha_0 + \alpha_1 u_{t-1}^2 + \gamma_1 h_{t-1} \tag{5}$$

$$\text{and } \beta_{it} = \beta_{i,t-1} + v_{it} \quad i = 0,1 \quad v_{it} \sim N(0, \sigma_i^2) \tag{6}$$

in which h_t is the conditional variance of the error term and ψ_t is the information set available at time t . This model differs from the basic model given by equation (1) in two important respects. First, the intercept, β_{0t} , and slope coefficient, β_{1t} , can change through time. Secondly, this model incorporates an error process in which the variance changes systematically over time. A maximum likelihood search procedure with a standard Kalman filter is used to estimate the model with equation (3) the measurement equation and the set of equations given by (5) and (6) the state equations.² The Kalman filter sequentially updates coefficient estimates and generates the set of $\hat{\beta}_{it}$ s, $i = 0,1$ and $t = 1..T$ and their standard errors. Graphs of $\hat{\beta}_{1t}$ illustrate the evolution of weak form efficiency through time.

Conventional tests of the random walk hypothesis, for example the Lo and MacKinlay (1988) variance ratio test, lead to the inference that a stock price or stock price index does or does not follow a random walk at a predetermined significance level. Although such tests can be applied to successive time periods, they cannot readily capture *gradual* changes in efficiency over successive observations.

4. RESULTS

Fig. 1 to 7 present the results of the TEE. They show the time-paths of the estimated β_{1t} coefficients together with their 95 per cent confidence intervals. Consider Fig. 1 which presents the results for the Johannesburg stock market.

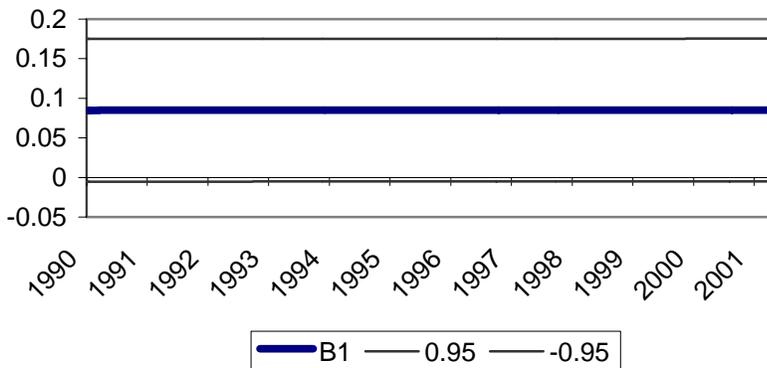


Figure 1. South Africa

These results are different from those for all of the other stock markets,

² We are grateful to Ania Zalewska-Mitura for providing a copy of her Gauss code.

$\hat{\beta}_{1t} = 0.085$ and constant. The upper and lower bounds of the .95 confidence interval are 0.175 and -0.005 respectively.

These span $\beta = 0$; this market is weak form efficient and shows no tendency to change. This is a characteristic of many developed markets and similar to the results for the London Stock Exchange reported in Zalewska-Mitura and Hall (1999). Fig. 2 illustrates the results for the Egyptian market. The estimate $\hat{\beta}_{1t}$ has an initial value of 0.346 and is significantly different from zero at the .05 level. The magnitude of the estimated parameter gradually declines and first becomes insignificantly different from zero in 1999. This stock market gradually became weak form efficient.

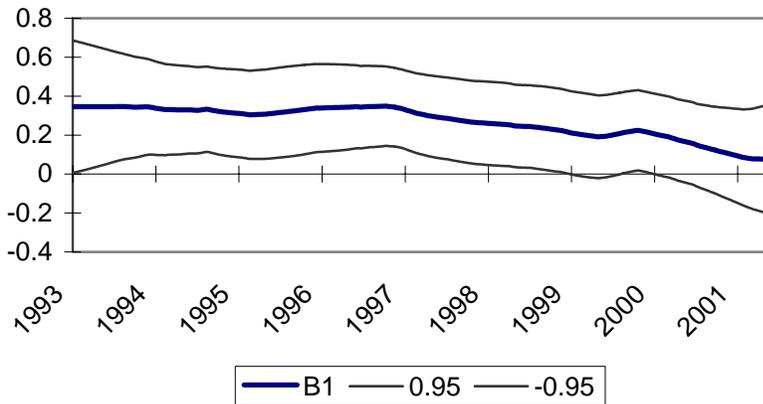


Figure 2. Egypt

The results for the Casablanca index are reported in Fig. 3. The estimated autocorrelation coefficient of weekly returns increases to a maximum value of 0.568 in January/February 1997 and then decreases. It is significantly different from zero at the .05 level over the period from November 1995 until August 1999. Following this, the market is weak form efficient. Fig. 4 is generated from returns on the Nigerian stock market and shows changing levels of inefficiency followed by changes towards weak form efficiency.

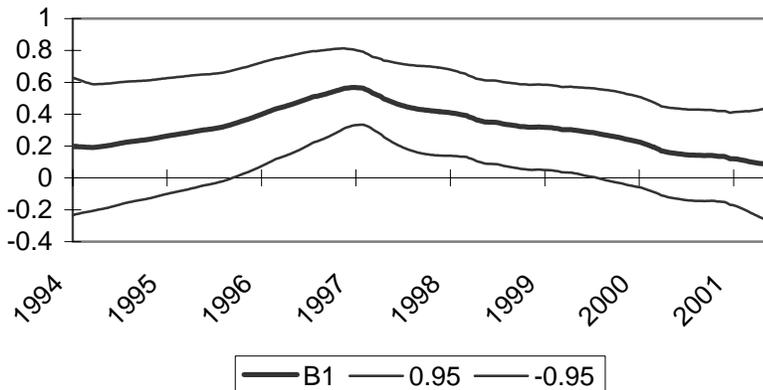


Figure 3. Morocco

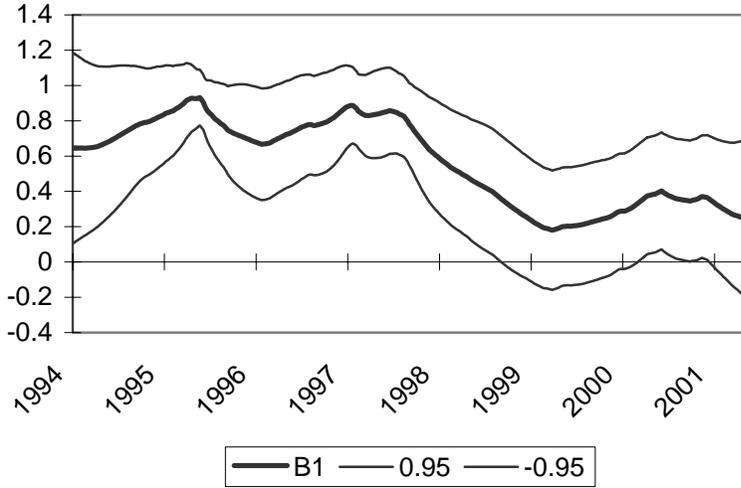


Figure 4. Nigeria

This contrasts with the results for the Zimbabwe stock market reported in Fig. 5. The estimated autocorrelation coefficient of weekly returns fluctuates with no sign of stabilisation and no tendency towards weak form efficiency. The results for Zimbabwe and Mauritius (Fig. 5 and 6) both reject the hypothesis of weak form efficiency with time-varying $\hat{\beta}_{1t}$. For the period 1994-99, the Zimbabwe market gradually becomes less inefficient but more recently the trend towards eliminating inefficiency has reversed. The Mauritius market displays a very slow tendency to eliminate inefficiency.

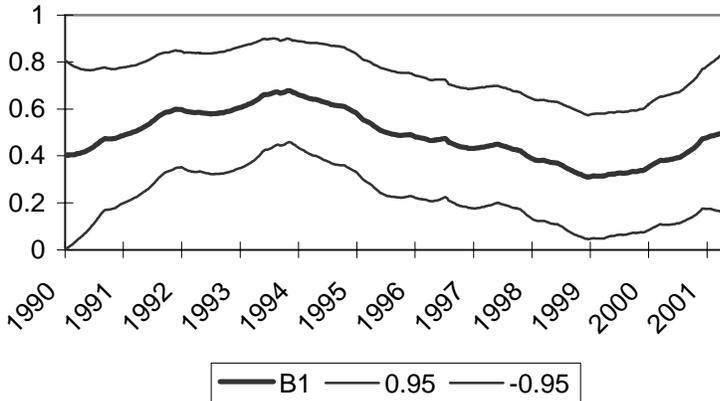


Figure 5. Zimbabwe

The results for the Nairobi Stock Exchange index are illustrated in Fig. 7. In contrast to the previous case, the estimated parameter, $\hat{\beta}_{1t}$, is approximately constant with an average value of 0.379 and significantly different from zero. This market is not weak form efficient and shows no tendency towards efficiency. In summary, the TEE finds that the Johannesburg stock market is weak form efficient throughout the period, and

three stock markets become weak form efficient towards the end of the period: Egypt and Morocco from 1999 and Nigeria from early 2001.

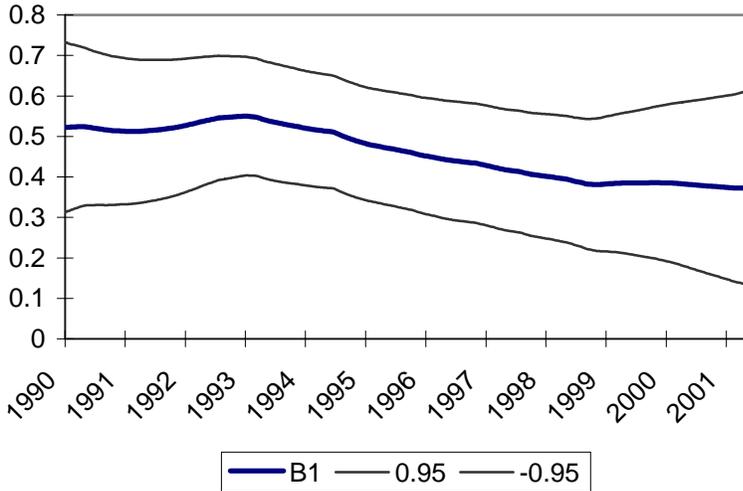


Figure 6. Mauritius

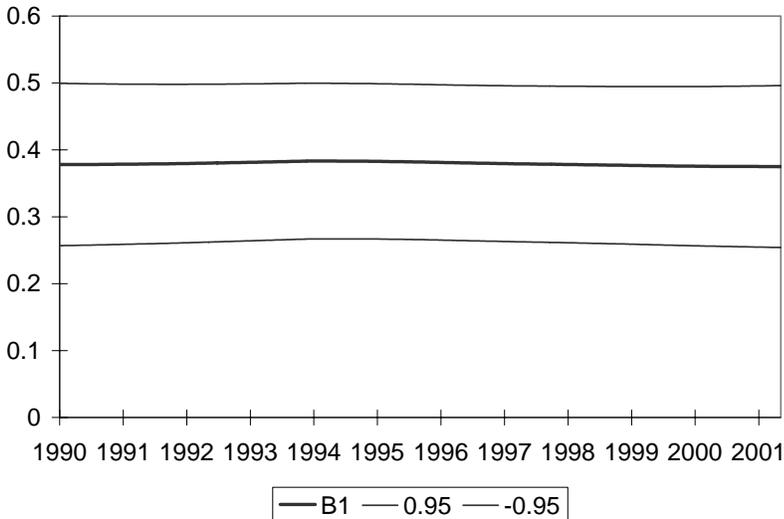


Figure 7. Kenya

The results can be interpreted with respect to the quantitative and institutional characteristics of the respective markets. The most important quantitative characteristics appear to be those related to the size of the market, in terms of capitalisation and turnover. The South African stock market, which is weak form efficient throughout, is by far the largest of the markets studied. The Egyptian market, which became less inefficient from late 1996/early 1997 and became weak form efficient from 1999 is the second largest market measured by turnover and capitalisation (see Table 2). The South African and Egyptian markets also demonstrate relatively high levels of liquidity. The Moroccan and Nigerian markets, which became

less inefficient from 1997 onwards and eventually weak form efficient, are the third and fourth largest market by capitalisation and have comparable levels of liquidity. Kenya and Mauritius, which at no point become weak form efficient, are the smallest and least liquid of the seven markets.

The key results, that is, South Africa being weak form efficient throughout the period; Egypt, Morocco and Nigeria experiencing reduced inefficiency during the later part of the period and becoming weak form efficient towards the end; and Zimbabwe, Mauritius and Kenya remaining weak-form inefficient throughout, can also be related to broader economic factors and the institutional characteristics of markets. The Zimbabwean market, while demonstrating relatively high levels of turnover and liquidity, is hampered by chronic economic instability. All markets except Zimbabwe and Kenya had, by the end of the period, adopted an electronic trading system that transforms the price formation process. Zimbabwe and Kenya also retain restrictions on foreign ownership of shares, which inhibit the activities of foreign participants in the market and the efficiencies that their presence can bring. The most efficient market, South Africa, benefits from the trading of some of its shares on major international markets where they are cross-listed. It is also the only African market that approximates a developed market in size, and availability of information and analysis.

The focus of this paper is on providing a quantitative assessment of weak-form efficiency trends in the most important African stock markets and this is carried out using a test of evolving efficiency. While it is not the intention to provide a quantitative analysis of the factors causing these efficiency trends - this remains a topic for future research - it is possible nonetheless to provide indications of what these factors might be. Interpreting the results in the context of the institutional characteristics of the various stock exchanges and the economies in which they operate indicates that absolute size (in terms of capitalisation and turnover) and the rate of growth of market liquidity seem to be important in supporting weak form efficiency (or movement towards it). In addition, an automated (electronic) stock market trading system helps. Macroeconomic instability and policies that inhibit the operations of markets more generally are negative factors. While these results are not conclusive, they are consistent with arguments that activity levels and market micro-structures are important factors determining efficiency. For markets to be weak-form efficient, current prices must fully reflect all historical information. This in turn requires that accurate information is quickly made available to market participants; that market participants are sufficient in number for there to be effective competition between them; and that there is sufficient trading taking place for prices to adjust and reflect new information. Larger markets may benefit from economies of scale, thus lowering transactions costs, hence encouraging trading. High levels of turnover and liquidity mean that more transactions are taking place, thus providing more opportunities for prices to change in response to new information. Trading systems also help the price formation process, and are more generally associated with more efficient, automated information dissemination. Finally, an adverse macro-economic environment makes interpretation of information, and its impact on corporate profitability, more complicated.

5. CONCLUSIONS

This paper classifies formal African stock markets into four categories: South Africa, medium-sized markets, small new markets which have experienced rapid growth, and

small new markets which have yet to take off. Using a GARCH approach with time-varying parameters, a test of evolving efficiency is implemented for the seven markets covered in this study: South Africa, Egypt, Morocco, Nigeria, Zimbabwe, Mauritius and Kenya, for periods starting in the early 1990s and ending in June 2001. This test, which can detect changes in weak form efficiency through time, finds that the Johannesburg stock market is weak form efficient throughout the period, and three stock markets become weak form efficient towards the end of the period: Egypt and Morocco from 1999 and Nigeria from early 2001. These contrast with the results for the Kenya and Zimbabwe stock markets which show no tendency towards weak form efficiency, and the Mauritius market which displays a *very* slow tendency to eliminate inefficiency. Differences in stock market efficiency can be related to turnover, capitalisation and the institutional characteristics of markets.

A number of policy implications can be drawn from this analysis. First, the results show that the size of the market is important, in that the larger markets are efficient for some or all of the period examined, while the smaller markets are not. While there is nothing that can be done immediately to make markets larger, the results suggest that policies to grow stock markets are important. Such policies can include encouraging new listings by ensuring that listing requirements are prudent without being unnecessarily onerous, and encouraging the development of pension funds and other forms of institutional investors who will have a demand for listed equities. These will help not just to enlarge the securities segment of capital markets but to make that market more efficient, which would in turn encourage further listings and investment - a virtuous circle.

For some countries, however, small size will always be a problem, bearing in mind the small size of many African economies. This suggests that regional stock markets may be a way forward, not just to benefit from economies of scale but also to improve pricing efficiency. As examples of such developments, there is already a regional stock exchange in West Africa (based in Abidjan) and there have been discussions in Southern Africa of the Johannesburg Stock Exchange acting as the hub of a regional exchange.

In addition to policies aimed at increasing the size of stock markets, other institutional reforms can help to improve efficiency. These include innovations such as electronic trading systems, allowing free access to foreign investors (to improve liquidity), improving the dissemination of information relating to listed companies, improving the speed and efficiency of settlement, and changing the legal framework where necessary to ensure adherence to the best international standards. All of these developments will help to boost confidence in the market and encourage the additional trading activity that will support market efficiency.

APPENDIX

Markets Examined in this Study

South Africa: the Johannesburg Stock Exchange dates back to the 19th century and although very large in terms of capitalisation, liquidity was historically low due to the domination of share ownership by a few large conglomerates linked either to mining companies or financial holding companies. This concentration of ownership was partly a result of strict exchange controls on the capital account, which restricted South African firms from exporting capital and left them with little choice but to take over other domestic firms.

Extensive changes during the past decade have, however, led to a sharp rise in turnover and

liquidity. These changes stem from both the broader political changes that have taken place in South Africa, as well as considerable institutional reforms in the market itself. The JSE has benefited from substantial inflows of foreign portfolio investment since the ending of apartheid and the lifting of sanctions in 1994. There are no restrictions on the ownership of shares by foreigners, although prior to March 1995 transactions had to be carried out using the financial rand, the dual exchange rate applied to capital transactions. Since the abolition of the dual exchange rate regime, foreign investors have not been subject to any exchange control regulations, although domestic investors remain restricted in their ability to export capital. The domination of the JSE by the conglomerates has declined since 1994, as a result of inflows of foreign capital and moves towards unbundling the often complex ownership and control structures of major companies.

There have also been considerable institutional reforms of the JSE. In 1995 membership rules were changed to permit foreign owned members and limited liability corporate membership for the first time. In 1996, fixed commissions were abolished in favour of fully negotiated brokerage fees, the tax rate on securities trading was halved, and a fully automated electronic trading system was introduced to replace the old open outcry trading floor. In 1997 the Stock Exchange News Service (SENS) was introduced, through which listed companies are obliged to release price-sensitive information which is then disseminated on a real time basis to market participants. Finally, starting in 1999, the transition to a fully dematerialised central securities depository commenced, enabling faster and more secure settlement of trades. As a result of these changes, the JSE is now one of the most technologically advanced emerging markets. Furthermore, it operates as part of a relatively sophisticated financial sector characterised by a wide range of financial institutions, markets, and information flows that in many respects is more representative of a developed than a developing country.

Egypt: The Egyptian stock exchange is the second largest in Africa by both capitalisation and turnover, and is also the oldest in the continent, pre-dating the JSE by four years. For much of its existence however its role has been stifled by excessive bureaucracy and regulation, and a large proportion of the listed shares have been illiquid. Nevertheless, recent moves towards deregulation and privatisation have given the market a boost. Recent changes include revised listing requirements and exchange membership rules; and the introduction of new systems for information dissemination, settlement of transactions and automated trading.

Morocco: Like Egypt, Morocco has a relatively old stock exchange, established in 1929, although it has been inactive for long periods. The exchange has been transformed by developments during the 1990s, with an extensive series of reforms including a new legal framework, reduction of commission rates, introduction of an electronic trading system, and the establishment of a (paperless) central securities depository. The broader process of deregulation and privatisation has also boosted the market in recent years. Although there are no restrictions on foreign ownership, foreign participation in the market is low. This is partly a result of exchange control restrictions on domestic investors who have few domestic or foreign investment alternatives to the stock exchange.

Nigeria: established in 1960, the Nigerian Stock Exchange was, until the early 1990s, primarily a forum for trading government bonds rather than equities, and trade was highly regulated. Extensive deregulation took place in 1993 with the removal of price and other direct controls. Restrictions on foreign participation were removed in 1995, since when foreign-owned brokerages have been permitted and controls on foreign participation in the ownership of Nigerian companies have been removed. An automated trading system was introduced in 1999. Turnover and liquidity have increased significantly since 1995, although both remain relatively low. Alongside these reforms, and despite the inconsistent implementation of economic reform programmes, privatisation has been quite widespread and this has helped the stock market.

Zimbabwe: dating from 1946, the Zimbabwe Stock Exchange was characterised as “a dozy club with two dozen members” (Cazenove, 1997 p. 44) prior to the advent of Zimbabwe’s IMF-inspired Economic Structural Adjustment Programme (ESAP) in 1991. The most important

boost to the market came with the opening of the exchange to foreign investors in May 1993, along with a major relaxation of exchange controls. Nevertheless, foreign ownership is still restricted, with individual foreign investors limited to 10 per cent of a company's shares, and foreign investors collectively to 40 per cent. Continued economic and political problems, and inconsistent implementation of structural adjustment and economic reform policies have, however, made the market highly volatile, especially for foreign investors, reflecting strict exchange controls on residents and a highly unstable macroeconomic environment.

Mauritius: the Stock Exchange of Mauritius (SEM) has developed rapidly in since its establishment 1989 In addition to 40 listed companies, another 80 companies are traded on the Over-The-Counter (OTC) market. Although the market remains small and not all that liquid, it is helped by the absence of restrictions on foreign ownership (since 1994) and foreign investors play an active role in the market. Major reforms include the establishment of a Central Depository System in 1997 and the introduction of a fully automated electronic trading system in 2001.

Kenya: the Nairobi Stock Exchange was established in 1954. The Kenyan market has had a similar history to that of Zimbabwe, with an upsurge in activity since 1993 due to economic reform, privatisation, and relaxation of restrictions on foreign investors and of exchange controls. More recently however, implementation of the economic reform programme has been inconsistent and political problems remain, leading to market volatility, especially in dollar terms. Liquidity has remained low throughout.

REFERENCES

- CAMPBELL, J.Y., A.W. LO AND A.C. MACKINLAY (1997). *The Econometrics of Financial Markets*, Princeton, Princeton University Press.
- CAZENOVE (1997). *Sub-Saharan Africa Stock Markets*, London: Cazenove & Co.
- CORNELIUS, P. K. (1993). "A note on the informational efficiency of emerging stock markets", *Weltwirtschaftliches Archiv*, 129 820-828.
- EMERSON, R., HALL S.G. AND ZALEWSKA-MITURA, A. (1997). "Evolving Market Efficiency with an application to some Bulgarian shares", *Economics of Planning*, Vol. 30, No. 1, pp. 75-90.
- FLEMINGS RESEARCH (1997). *Global Emerging Markets: Africa on Top*, London: Robert Fleming.
- JEFFERIS, K. AND OKEAHALAM C. (1999A). "International Stock Market Linkages in Southern Africa", *South African Journal of Accounting Research*, Vol. 13, No. 2, pp. 1-25.
- JEFFERIS, K. AND OKEAHALAM C. (1999B). "An Event Study of the Botswana, Zimbabwe and Johannesburg Stock Exchanges", *South African Journal of Business Management*, Vol. 30, No. 4, pp. 131-140.
- LO, A. AND MACKINLAY, A C. (1988). "Stock Market Prices Do Not Follow Random Walks. Evidence from a Simple Specification Test", *Review of Financial Studies*, Vol. 1, No. 1, pp. 41-66.
- MAGNUSSON, M.A. AND B. WYDICK (2002). "How Efficient are Africa's Emerging Stock Markets?", *The Journal of Development Studies*, Vol. 38, No.4, pp. 141-156.
- SMITH, G., JEFFERIS, K. AND RYOO, H-J. (2002). "African stock markets: multiple variance ratio tests of random walks", *Applied Financial Economics*, Vol. 12, No. 7, pp. 475-484.
- STANDARD AND POORS (2004). *Global Stock Markets Factbook*, New York. Standard & Poors.
- THOMPSON, A. R. AND WARD, M.J.D. (1995). "The Johannesburg Stock Exchange as an Efficient Market: a Review", *Studies in Economics and Econometrics*, Vol. 19, No. 3, pp. 33-63.
- ZALEWSKA-MITURA, A. AND HALL S.G. (1999). "Examining the first stages of market performance: a test for evolving market efficiency", *Economics Letters*, Vol. 64, No. 1, pp. 1-12.