Conditional Pricing of Currency Risk in Africa's Equity Market

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AERC Research Paper 354
African Economic Research Consortium, Nairobi
October 2018

THIS RESEARCH STUDY was supported by a grant from the African Economic Research Consortium. The findings, opinions and recommendations are those of the author, however, and do not necessarily reflect the views of the Consortium, its individual members or the AERC Secretariat.

Published by: The African Economic Research Consortium
P.O. Box 62882 - City Square
Nairobi 00200, Kenya

Printed by: Modern Lithographic (K) Ltd
P.O. Box 52810 - City Square
Nairobi 00200, Kenya

ISBN 978-9966-61-047-8

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List of abbreviations and acronyms

AfDB	African Development Bank
APMs	Asset Pricing Models
CAPM	Capital Asset Pricing Model
ICAPM	Intertemporal Capital Asset Pricing Model
IMF	International Monetary Fund
OITP	Other Important Trading Partners
RER	Real Exchange Rate
SDF	Stochastic Discount Factor
SMV	Small Market Variable
WDI	World Development Indicators
WTO	World Trade Organization

Abstract

In this paper, we sought to establish whether Africa's volatile currencies drive equity risk premium. We use the stochastic discount factor (SDF) framework to estimate various conditional specifications of the International Capital Asset Pricing Model through generalized method of moments technique. Our results show strong evidence of conditional, time-varying currency risk premium in equity returns. Currency risk is also perceived by international investors as important in informing the equities pricing kernel. We also find evidence that international investors are worried about Africa's small size equity markets and build anticipated low trading into their pricing calculus.

JEL classification: *G12; G15; F21; F31*
Keywords: *Africa; currency risk; equity markets; stochastic discount factor; GMM.*

1. Introduction

Africa's equity markets have recently attracted increased interest among international investors. According to the African Development Bank (AfDB) (2013), total external financial flows to Africa reached a historic high of an estimated US$186.3 billion in 2012, up from US$158.3 billion in 2011, while the flow of foreign direct investment and portfolio investment has quadrupled since 2001. Although the interest in Africa's equity markets as important investment destinations has been explained by the recent fast pace of growth of Africa's economies (AfDB, 2013), Africa's equity markets are also considered attractive for portfolio diversification purposes because they tend to exhibit low correlations with the rest of the world (Harvey, 1995; Alagidede et al, 2011). Indeed, many of the stock markets in Africa performed better, on a risk-adjusted basis, than most markets around the world during the 2007/8 financial crisis, with some markets actually realizing positive returns (Allen et al, 2011).

In practice, portfolio diversification benefits are evaluated against associated risks. In particular, international investors, whose returns are denominated in foreign currencies, find it necessary to adjust their returns for currency risk. In a fixed exchange rate regime, exchange rate fluctuations are minimal, if any, and governments guarantee the convertibility of their currencies. Thus, if monetary policy can achieve stability in inflation rates, real exchange rates would be stable and foreign investors would worry less about real exchange rate fluctuations.[1] When nominal exchange rates are flexible, monetary policy management becomes more complex, and, real exchange rates typically exhibit volatility.

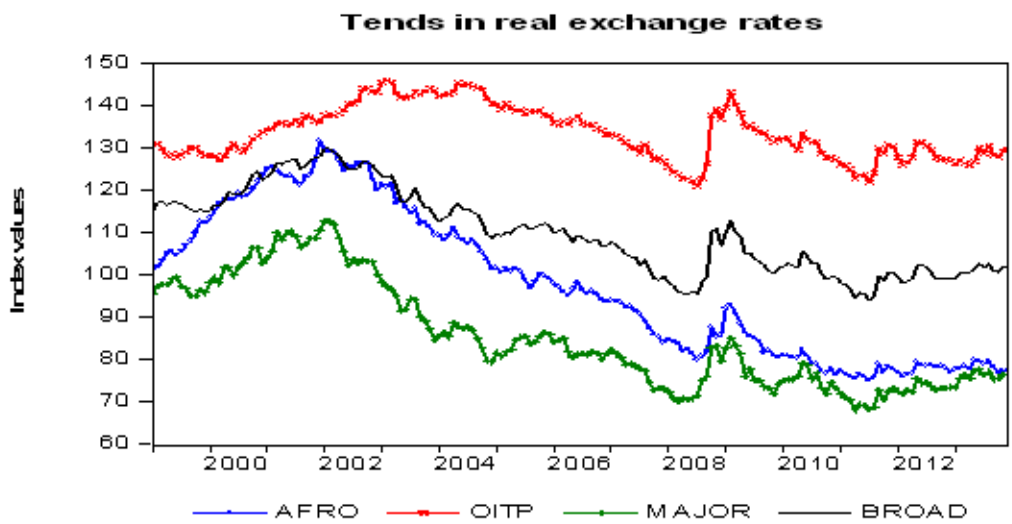
When exchange rates are volatile, international portfolio investors face the prospects of earning negative risk-adjusted returns on the foreign assets in their portfolios. Thus, they might demand a premium commensurate with the perceived risk of excessive exchange rates fluctuations. But, how volatile are real exchange rates in Africa? Kodongo and Ojah (2011) developed a representative trade-weighted real exchange rate index (against the US dollar) for Africa, labelled the "Afro". To make it more comparable with similar indexes, we have slightly modified the Afro index to incorporate time-varying weights.[2] Thus, we now construct the Afro index at time t, I_t, as:

$$I_t = I_{t\text{-}1} \prod_{j=1}^{n} (REER_{j,t}/REER_{j,t\text{-}1})^{w_{jt}} \qquad (1)$$

where, $RER_{j,t}$ and W_{jt} are, respectively, the local currency-US dollar real exchange rate and the weight of country j at time t; $W_{jt} = \frac{X_{jt}}{\sum X_{jt}}$ $(X_{jt} = \varphi_{jt} + \sum_{j=1}^{n} W_{jt} = 1)$, such that $\varphi_{jt} = \frac{\textit{Country j's imports from USA in month t}}{\textit{Country j's total imports in month t}}$; and $\phi_{jt} = \frac{\textit{Country j's exports to USA in month t}}{\textit{Country j's total exports in month t}}$.We obtain the direction of trade data from the International Monetary Fund (IMF) and the World Trade Organization (WTO).

The time series trend of the Afro index, for the period January 1999 through December 2013, is juxtaposed against the OITP (other important trading partners), MAJOR and BROAD indexes of the Reserve Bank of the USA, in Figure 1.[3] The OITP index is constructed from currencies of emerging countries which we believe to be in direct competition with African countries for capital flows. The MAJOR index comprises (the most studied) currencies of major industrial economies and is used here for benchmarking purposes. The graph shows, not only a high correlation amongst the indexes (indicating their comparability), but also that the Afro index had a larger dispersal of values than the other indexes.

Figure 1: Trends in trade-weighted real exchange rates



AFRO is the African real exchange rate index; OITP (other important trading partners) comprises of currencies of several emerging markets economies; MAJOR is an index of currencies from industrial economies; BROAD combines currencies of industrial and emerging countries. Each basket of currencies is set against the US dollar. Source: Constructed by authors.

To scientifically validate our visual observations, we use the standard deviation to measure the variability of real exchange rates and the following commonly used metric of short-run volatility in exchange rates (see, e.g., Chowdhury, 1993; Sun et al, (2002)):

$$V_t^S = \sqrt{\mathrm{m}^{-1} \sum_{i=1}^{m} (\ln R_{t+i-1} - \ln R_{t+i-1})^2} \quad (2)$$

where, R_t is the real exchange rate at time t, and m is the order of moving average (for this analysis, we have set $m = 2$). In the results, presented in Table 1, the standard deviation indicates that the Afro index was the most variable of the four indexes during the period 1999-2013. The volatility metric also shows that the Afro index is highly volatile, even though it is comparatively less volatile than MAJOR, perhaps an indication of greater flexibility of the currencies of industrial countries that comprise the latter. In spite of the high volatility of African exchange rates, foreign direct and portfolio investments to Africa actually increased during this period (AfDB, 2013). Given these observations, it is interesting to ascertain whether international investors, whose portfolio holdings increased during this period, deemed Africa's volatile exchange rates to constitute a significant additional risk to their portfolio positions.

Table 1: Some summary statistics for real exchange rate indexes

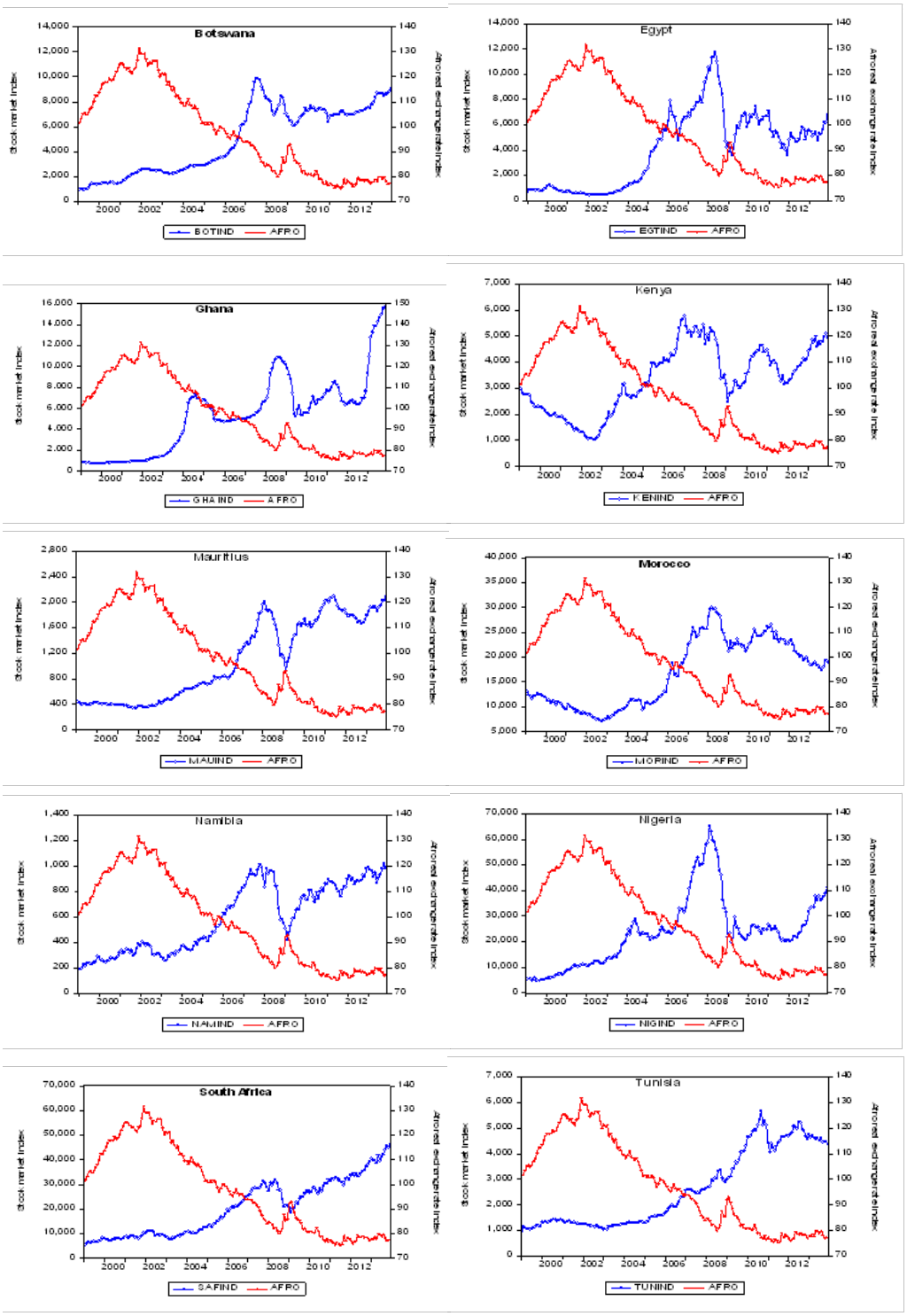
	AFRO	OITP	MAJOR	BROAD
Mean	97.8145	133.5355	85.4994	110.0435
Standard Deviation	17.3724	6.3105	12.4975	9.8420
Volatility	0.2103	0.1645	0.2819	0.2009

The table uses end-of-month indices for the period 1999:1 through 2013:12
Source: Constructed by authors.

This inquiry is important because it is now accepted, in the theory of international investments, that international investors are concerned about foreign exchange rate fluctuations because such fluctuations affect the domestic-currency values of their portfolio returns. To get a better appreciation, we initially sought to understand whether a nexus exists between real exchange rates and equity market indexes in Africa. Figure 2 depicts the time series behaviour of various equity market indexes in Africa plotted side by side with the Afro real exchange rate. The figure shows a "distinct" inverse relationship between the two variables in each of the 10 markets. We verify this negative relationship through correlation analysis (Table 2).Close to perfect negative correlations are obtained between the Afro index and stock market indexes for all countries. With this kind of results, it is natural to wonder whether real exchange rates possess some explanatory power over equity markets indices in Africa. We run an OLS regression of each country's market index against the Afro real exchange rate index and a constant. Our results are presented in Table 2. The results show that the Afro index significantly explains, with negative elasticities, equity market indexes of all 10 countries.

Prodded by this result, we compare local-currency- and dollar-denominated returns on African stock market indexes. Table 3 presents the results of our comparison. When we analyse the variance of returns, we find that, except for Egypt and Tunisia, both of which operated relatively less flexible foreign exchange rate regimes for a good part of the period (see discussion in Section 3), dollar-denominated returns are, statistically speaking, riskier than local-currency-denominated returns (panels A, B and D).

Figure 2: Trends in the "Afro" real exchange rate index and stock market indexes



Source: Constructed by authors.

Table 2: Basic nexus between the "Afro" real exchange rate index and stock market indexes

	Equity market index of country									
	BOT	EGT	GHA	KEN	MAU	MOR	NAM	NIG	ZAF	TUN
Correlation with Afro	-0.87	-0.81	-0.79	-0.81	-0.94	-0.88	-0.87	-0.63	-0.90	-0.88
Regression‡	-137 (0.00)	-138 (0.00)	-167 (0.00)	-59 (0.00)	-34 (0.00)	-341 (0.00)	-13 (0.03)	-494 (0.00)	-580 (0.00)	-75 (0.00)

‡ Regressions of stock indexes on "Afro" index and a constant. The values provided are the coefficients of the "Afro" index and their associated p-values (in brackets). Data is for the period 1999:1 through 2013:12.
Source: Constructed by authors.

Because the higher risk in dollar-denominated returns is introduced by fluctuations in foreign exchange rates, international investors 'should' demand a reward for currency risk on their African equity investments. A currency risk premium commensurate with foreign exchange risk borne should equate dollar-denominated returns to local-currency-denominated returns. Our data seems to support this intuition: the analysis shows that although dollar-denominated average returns appear lower than local-currency-denominated average returns (panels A and B), statistically, we cannot reject the hypothesis (except for Ghana, at 5%) that the difference in the two sets of average returns is zero (panel C).

These preliminary observations motivate our hypothesis that currency risk commands a premium in Africa's equity markets. But, how much risk premium, if any, do the volatile real exchange rates contribute to the overall risk premium in Africa's equity markets? We respond to this question from the perspective of the global investor interested in Africa's equity claims as a foreign investment. We assume that Purchasing Power Parity principle does not hold in the short run so that investors resident in different countries have different investment and consumption opportunity sets. That is, investors evaluate asset returns in their domestic currency terms and pay a keen attention to fluctuations of foreign exchange rates because they might affect the domestic value of their foreign (African) equity investment returns. If they perceive exchange rate volatility to be a significant factor affecting the net returns on their investments in African equities, foreign exchange risk would command a premium that would constitute a part of their overall required rate of return.

Empirical evidence on the pricing of foreign exchange risk has been mixed. Some studies, based on unconditional asset pricing models (APMs), have failed to find any evidence of currency risk pricing in various equity markets (Jorion, 1991; Loudon, 1993; Kodongo and Ojah, 2011); some have reported mixed and inconclusive results (Choi et al, 1998; Iorio and Faff, 2002); while others have reported high degrees of currency risk exposure (Dominguez and Tesar, 2001; Carrieri and Majerbi, 2006). Failure by unconditional asset pricing tests to resolve the issue as to whether currency risk is priced in the equity markets has motivated the search for alternative frameworks. Thus, conditional APMs have become a plausible alternative. According to Dumas and Solnik (1995), it is natural to test any asset pricing model in its conditional form because investors' decisions are informed by conditioning information such as interest rates and past equity prices.

Table 3: Equity returns in local currency units and in US dollars

	Botswana	Egypt	Ghana	Kenya	Mauritius	Morocco	Namibia	Nigeria	S. Africa	Tunisia
A. Local currency market index returns										
Mean	0.013	0.013	0.016	0.003	0.008	0.002	0.010	0.011	0.012	0.009
S. Dev.	0.039	0.098	0.062	0.060	0.045	0.046	0.063	0.073	0.053	0.040
B. Dollar market index returns										
Mean	0.009	0.004	0.003	-0.001	0.007	0.002	0.006	0.000	0.009	0.006
S. Dev.	0.047	0.102	0.068	0.071	0.058	0.053	0.086	0.104	0.075	0.044
C. Are dollar-denominated returns lower?										
p-value[1]	0.19	0.20	0.02	0.31	0.37	0.50	0.30	0.13	0.30	0.26
D. Are dollar-denominated returns riskier?										
p-value[2]	0.01	0.30	0.08	0.01	0.00	0.03	0.00	0.00	0.00	0.11

[1] p-values of the one-tailed t-test for the hypothesis that dollar-denominated returns are, on average, equal to local-currency-denominated returns. The test assumes unequal variances in the distribution of returns.
[2] p-values of the one-tailed F-testfor the hypothesis that the variance of dollar-denominated returns equals the variance of local-currency-denominated returns.
Source: Constructed by authors.

Based on this logic, several studies, using different empirical designs, have found that changes in foreign exchange rates constitute additional sources of risk to equity investors in industrial countries (Dumas and Solnik, 1995; de Santis and Gerard, 1998; Doukas et al, 1999; Tai, 1999; MacDonald, 2000; Kolari et al, 2008) as well as in the emerging markets (Phylaktis and Ravazzolo, 2004; Carrieri et al, 2006; Aysun and Guldi, 2011; Sirr et al, 2011; Antell and Vaihekoski; 2012).

Clearly, if well specified, conditional APMs are better suited, than unconditional APMs, to finding currency risk priced in international equity markets. In Africa, bivariate cointegration tests have not been able to find evidence of a long-run relationship between stock prices and real exchange rates (Ndako, 2013; Kodongo and Ojah, 2013). This probably explains why Kodongo and Ojah (2011) could not find an unconditionally priced currency risk in Africa's equity markets. Yet, when the world equity market (proxied by the US equity market, the apparent transition mechanism between the two financial markets) is introduced, a long-run cointegration is found to exist between equity and stock prices (Kodongo&Ojah, 2013). The latter finding is, in our view, consistent with a conditionally priced currency risk in equity markets. However, the conditional pricing of currency risk has not been investigated in Africa's equity markets. Thus, whether the findings from less exotic emerging markets can be generalized to Africa's nascent stock markets is an open empirical question.

In this study, we employ the stochastic discount factor (SDF) framework with the world equity portfolio and foreign exchange risk as priced risk factors. Later, we add a small market size variable to our risk factors. The SDF approach, a fairly recent development in financial econometrics, has gained widespread usage in asset pricing tests. Several studies employing the SDF approach have demonstrated that currency risk premium are time-varying and account for a significant part of the excess returns on international assets in advanced countries (Zhang, 2006; Cappiello and Panigirtzoglou, 2008)[4] and in the emerging markets (Drobetz et al, 2002; Poghosyan and Kočenda, 2008; Poghosyan, 2010). The SDF approach allows for the modelling of time-variation in the pricing kernel as well as in the risk premium. We assume that a set of information, existing at the beginning of each month, conditions investors' decisions. We proxy the conditioning information by six macroeconomic variables believed by international finance researchers to be able to predict equity returns. The conditioning variables include three worldwide variables, namely, the returns on the MSCI world equity portfolio, dividend yields on the MSCI world equity portfolio, the Eurodollar deposit rate and one foreign variable, the USA term premium. At the local level, we use inflation rates and deposit rates. All conditioning variables are lagged one period and differenced if not stationary in levels. Our study covers 10 equity markets in Africa: Botswana, Egypt, Ghana, Kenya, Mauritius, Morocco, Namibia, Nigeria, South Africa and Tunisia, the choice of which we discuss in Section 3.

Our findings suggest that foreign exchange risk is priced with time-varying premium in the stock markets of African countries. We also find strong evidence that the currency risk factor enters the equity pricing kernel in these stock markets. Our estimates of the zero-beta rate are reasonably close to observed values. These findings suggest that international investors in these markets should hedge their portfolio positions against foreign exchange risk. In this regard, policy makers should either move to avail hedging

instruments or free markets sufficiently to enable investors to avail themselves of the same in offshore markets. The rest of this paper proceeds as follows: Section 2 presents the theoretical model and empirical procedures. Section 3 describes the data and descriptive statistics. Section 4 presents the primary empirical estimates of the baseline models; Section 5 explores additional tests as a way of providing robustness checks for our baseline results. Section 6 concludes.

2. Methodology

The SDF asset pricing framework

The first order conditions for an investor-consumer's portfolio decision problem are[5]:

$$E_{t-1}(M_t R_{it}) = 1 \tag{3}$$

where, $E_t(\cdot)$ is the conditional expectations operator, M_t is the investor-consumer's intertemporal marginal rate of substitution (or the pricing kernel), R_{it} is the gross return on asset *i*, (*i* = 1,2,…,*N*) at time *t*. Ferson (1995) points out that, without more structure, the SDF model in Equation 3 has little empirical content because it is easy to find some random variable M_t for which the equation holds. Equation 3 implies a factor model structure of the form[6]:

$$E_{t-1}(R_{it}) = \lambda_0 + \beta_{i,M}\lambda_M \tag{4}$$

where, λ_0 is the price of the zero-beta asset: it is assumed that λ_0 is uncorrelated with M_t; λ_M is the risk per unit of the expected return (*price of risk*) on *Mt*; $\beta_{i,M}$ is the regression coefficient of R_i on M_t, loosely interpreted as a measure of systematic risk (*quantity of risk*) of asset *i*. The above result can be easily extended to the multi-factor case:

$$E_{t-1}(R_{it}) = \lambda_0 + \beta_{i,1}\lambda_1 + \beta_{i,2}\lambda_2 + \beta_{i,k}\lambda_k \tag{5}$$

It is easy to show (see, e.g., Kodongo, 2011) that Equation 5 is equivalent to:

$$E(R_{it}) = \lambda_0 + \lambda_1 \frac{cov(f_{1t}R_{it})}{var(f_{1t})} + \lambda_2 \frac{cov(f_{2t}R_{it})}{var(f_{1t})} + \ldots + \lambda_k \frac{cov(f_{kt}R_{it})}{var(f_{kt})} \tag{6}$$

Given the factor structure in Equation 5, Cochrane (2000) shows that the pricing kernel can be expressed as a linear combination of k factors (with b_t as a k-vector of factor loadings; F_t as a k-vector of factors):

$$M_t = a_t + b_t' F_t \tag{7}$$

Incorporating conditioning information

We can assume, under the SDF approach, that returns are conditional on the full set of market-wide information, Ω_{t-1}, available to investors at time $t-1$, usually proxied in econometric tests by a set of a few, carefully selected and judiciously transformed, instrumental variables, Z_{t-1} ($\in \Omega_{t-1}$). We use the conditioning information set, Z_(t-1), to scale risk factors. Scaling is done following Cochrane (1996): by modelling the parameters as linear functions of Z_{t-1}: $a_t = a' Z_{t-1}$) and $b_t = b' Z_{t-1}$, where Z_{t-1} is the vector of s instruments. Thus, the model in Equation 7 can be expressed as $M_t = a' Z_{t-1} + b' Z_{t-1})$ F_t. Let $F_t \equiv f_t$, where f represents scaled and unscaled factors; let $a' = (a_0\ a_1)$; $b' = [b_0', b_1']$ and define $Z_{t-1} = (1\ z_{t-1})'$. In this setup, z_{t-1} is, effectively, a scalar, implying that in actual application, one conditioning variable is used at a time (see, e.g., Hodrick and Zhang, 2001 and Iqbal et al, 2010). Thus, the scaled-factor representation becomes:

b_0'

b_1'

$$M_t = a_0 + a_1 z_{t-1} + (b_0' + b_1' z_{t-1}) \otimes f_t \tag{8}$$

where, $\otimes$ is the Kronecker product (i.e., multiply each term in the bracket by every factor). If there are only two risk factors, Equation 8 becomes:

$$M_t = a_0 + a_1 z_{t-1} + b_{01} f_{1t} + b_{02} f_{2t} + b_{11} (f_{1t} z_{t-1}) + b_{12} (f_{2t} z_{t-1}) \tag{9}$$

Thus, instead of a two-factor model with time-varying factor weights, scaling results in a four-factor model (two of which are scaled by conditioning variables) with constant weights. However, parameters b_{11} and b_{12} capture time variation in the risk factors. In our empirical analysis, we drop the second term, following Cochrane (1996). Many other authors (e.g., Lettau and Ludvigson, 2001 and Iqbal et al, 2010) have employed this approach successfully in conditional asset pricing tests in various equity markets.

Rationale for scaling

An important implication of equations 8 and 9 is that the risk of an equity investment is a function of the covariance of its returns with the risk factor (e.g., foreign exchange

risk) conditional on some variable that reflects time variation in risk premium (Lettau and Ludvigson, 2001). Time variation in risk premium can be explained by changes in the magnitude of risk inherent in the investment or changes in risk aversion among investors. For example, a rise in the Eurodollar deposit rates (indicating an increment in interest rates) may dim investors' return expectations from international fixed income assets in general. The diminished return prospects from fixed income assets may lower investors' aversion to equity risk and hence shift their preference in favour of international equities. Thus, although returns on international equity investments will be subjected to exchange rate fluctuations, the risk introduced by exchange rate changes to equity returns (covariance between equity returns and exchange rate returns) is informed by changes in investors' risk aversion, emanating from changes in Eurodollar deposit rates, over time.

Empirical specification

Estimating the pricing kernel

The scaled factor model can be tested unconditionally by applying the Law of Iterated Expectations[7]. Plugging (8) into (3), the unconditional sample moment conditions, which we evaluate through the Generalized Method of Moments (GMM), are expressed parsimoniously as:

$$g_T(\theta) = \tfrac{1}{T} \sum_{t=1}^{T} \{[a_0 + (b_0' + b'z_{t-1}) \otimes f_t]\, R_{it} - 1\} = 0_i = 1,2,\ldots, n \qquad (10)$$

where, θ is the set of all parameters (a, b) to be estimated and 0 is an n-vector of zeros. Non-zero elements of b indicate the significance of a factor in the pricing kernel. We initially model Equation 10 with two risk factors: the world market risk factor and the currency risk factor.

Estimating factor risk premium

Using the parameterization in Equation 6, and following previous studies (Harvey and Kirby, 1995; Shanken and Zhou, 2007), the sample moment conditions evaluated are:

$$g_T(\theta) = \tfrac{1}{T} \sum_{t=1}^{T} \begin{bmatrix} R_t - \hat{\mu}_r \\ f_t - \hat{\mu}_f \\ (f_t - \hat{\mu}_f)(R_t - \hat{\mu}_r) - \hat{\sigma}^2_f \\ R_t - \iota\lambda_0 - \sum_{t=1}^{T} \lambda_j \dfrac{(R_t - \hat{\mu}_r)(f_t - \hat{\mu}_{jf})}{\hat{\sigma}^2_{jf}} \end{bmatrix} = 0 \qquad (11)$$

where, a circumflex indicates that the parameter is an estimate; ι is an n-vector of ones; R_t is an n-vector of asset returns with mean vector μ_r; f_t is a k-vector of scaled and unscaled factors with mean vector μ_f; and $\sigma^2_{j,f}$ = Var (f_{jt}). There are a total of $2(n + k)$ moment conditions in the system (11). We estimate the system's parameters through the sequential GMM procedure of Ogaki (1993). Accordingly, we first obtain the GMM estimator $\hat{\theta}_1 = (\bar{\mu}'_R, \bar{\mu}'_f, \hat{\sigma}^{2'}_f)'$ from the first $2n + k$ moment conditions in system (11). Since $\hat{\theta}_1$ is a vector of $n + 2k$ parameters consisting of means and variances of returns and factors, the first sub-system is exactly identified and is independent of the weighting matrix. The second (and last) step in the sequence involves plugging $\hat{\theta}_1$ into the last n moment conditions in system (11), then solving for the estimator $\hat{\theta}_2 = \lambda$, a vector of $k + 1$ risk premium. Since $(k + 1) < n$, the second sub-system is over-identified and the weighting matrix used in the GMM estimation matters. We use the inverse of estimates of the variance-covariance matrix of the n moment conditions as the weighting matrix. Harvey and Kirby (1995) demonstrate that the GMM estimator $\hat{\theta}_2$ is fully efficient. Iqbal et al (2010) point out that the estimator is not subject to errors-in-variables problem because there are no generated regressors employed in the estimation of the risk premium; rather, only the means and variances of returns and factors from the first stage of the sequential GMM process are used.

The GMM approach is particularly suitable because of its robustness to heteroskedasticity. Further, Hall (1993) explains that, under the GMM approach, one need not make an explicit specification of the data generating process. This can be contrasted to the traditional techniques, such as maximum likelihood estimation, where a data generating process, informed by an explicitly defined probability density function, necessarily forms a part of the estimation process. If the specified distribution function does not accurately reflect the true data generating process, such traditional techniques produce biased parameter estimates. The GMM does not suffer this shortcoming.

Stability tests

Garcia and Ghysels (1998) document the importance of testing for structural changes in the context of emerging markets, especially given the strong political and economic idiosyncrasies that have disrupted these markets in comparison with developed markets. To check the structural stability in the SDF parameters, we use the sup-LM test of Andrews (1993). The null hypothesis for the sup-LM test is that there are no structural shifts so that parameters are stable. This is tested against the alternative that there is a single structural break at some unknown point in time. We compute the sup-LM statistic as the largest of LM statistics computed at 5% increments between 15% and 85% of the sample. The calculated sup-LM statistics are evaluated against critical values in Table 1 of Andrews (2003).

3. Data and descriptive statistics

We study the pricing of currency risk in 10 African countries' equity markets, sampled by data availability. Although liquidity levels for many of the sampled markets are very low by the standards of equity markets of industrial countries (Allen et al, 2011), foreign investor participation in many of the sampled markets is substantial. Indeed, for some of the markets, the volume of foreign transactions is, often, a substantial proportion of total volume traded in a period: for example, foreign investor participation at the end of 2013 was about 58% at the Nairobi Securities Exchange and about 56% of the total volume at the Nigerian Stock Exchange.[8] The data cover the period 1998:11 through 2013:12. After log differencing and lagging some series, we end up with data for the period 1999:1 through 2013:12 – a total of 180 monthly observations.

Equity market indexes (denominated in domestic currency units),and market capitalization are sourced from Bloomberg[9]. For Ghana, we obtain cedi-denominated market indexes from Ghana Stock Exchange: the indexes were revised in January 2011, with December 31, 2010 as 1000. For consistency in our returns computations, we reconstruct indices from January 2011 using their percentage changes and the "old" index of December 2010. To illustrate, the reconstructed index (RI) for January 2011 is computed as $RI_{Jan11} = OI_{Dec10} \times >1 + \frac{NI_{Jan11} - NI_{Dec10}}{NI_{Dec10}}$, where OI is "Old" index and NI is "New" index, such that $NI_{Dec10} = 1000$. RI_{Jan11} is then used to update the next index, and so on. All the equity indexes do not include dividends but are adjusted for corporate actions such as stock splits. The random rate of return on an equity index (in local currency) is computed as $\tilde{r}_{jt} = \ln I_{jt} - \ln Ij,_{t-1}$, where I_{jt} is the value of African stock market index, j, at time t. We compute US dollar-denominated returns as $\tilde{r}_{USD,t} = \ln (1 + \tilde{r}_{j,t}) - \ln (1 + S_{D,t})$, where $\tilde{r}_j$ is the local currency return and S_D is change in the nominal value of the US dollar.

Panel A of Table 4 presents a summary of stock market index returns and their autocorrelations. Consistent with expectations, the assumption of normality is violated by the distributions of returns for all the national market indexes as well as the MSCI world equity portfolio index. Very high positive first order autocorrelation (above 20%) is observed for five of the 10 countries and the world equity portfolio index. Ghana's index returns exhibit the highest persistent return predictability with its autocorrelation function remaining significant up to the sixth lag. However, high serial correlation is not an issue for us because our GMM estimates are robust to autocorrelation and heteroskedasticity. The market capitalization statistics show that the South African equity market is substantially larger than the rest of the African markets. For this reason, we run some of our tests with South Africa excluded.

Table 4: Descriptive statistics

	Mean	Std dev	Kurt	Skew	Autocorrelations						Market cap. (USD billion)
					ρ_1	ρ_2	ρ_4	ρ_6	ρ_{12}	ρ_{24}	
Panel A: Returns on national stock market indexes											
Botswana	0.009	0.047	1.568	-0.050	0.28a	0.17a	-0.03	0.00	0.05	-0.04	4.868
Egypt	0.004	0.102	3.112	-0.762	0.23a	0.09	0.13	-0.07	0.04	0.10	66.876
Ghana	0.002	0.068	7.696	-1.197	0.56a	0.28a	0.40a	0.14a	-0.01	-0.06	4.505
Kenya	-0.001	0.070	4.223	-1.080	0.24a	0.07	0.21a	0.07	0.04	-0.01	22.456
Mauritius	0.007	0.058	8.226	-1.098	0.26a	0.20a	0.25a	0.07	-0.06	-0.15a	9.649
Morocco	0.002	0.052	0.943	-0.185	0.06	0.09	0.02	0.11	0.10	0.04	55.028
Namibia	0.006	0.086	2.350	-0.879	0.12	0.01	0.04	-0.00	0.01	-0.06	1.807
Nigeria	0.000	0.104	34.093	-4.411	0.11	0.14a	0.01	0.13	-0.05	-0.07	82.000
South Africa	0.009	0.075	1.664	-0.805	0.06	-0.02	0.03	-0.01	0.01	-0.06	480.686
Tunisia	0.006	0.044	2.482	-0.319	0.06	-0.08	-0.01	-0.03	0.02	0.13	7.994
MSCI World	0.002	0.047	1.999	-0.900	0.16a	-0.02	0.13	-0.04	0.03	-0.01	
Panel B: Returns on the Afro real exchange rate index											
Afro	0.004	0.015	4.591	1.377	0.14a	0.11	0.08	0.02	0.06	0.06	
Panel C: Small market variable											
SMV	0.009	0.003	-0.680	-0.715	0.97a	0.94a	0.88a	0.81a	0.64a	0.29a	

[a] indicates that the autocorrelation is significantly different from zero. "Skew" and "Kurt," respectively, stand for skewness and kurtosis. All stock returns are in US dollars and cover the period 1999:1 through 2013:12. Market capitalization data are from Bloomberg, as of end of December 13, 2013. For Namibia, we obtain market capitalization (N$ 18,710 million) from the Namibia Stock Exchange website: http://nsx.com.na/wp-content/uploads/2013/10/Trading-Data-for-the-week-13-Dec-2013.pdf.
Source: Constructed by authors.

Three distinct exchange rate regimes can be identified for the 10 sampled countries. According to IMF (2008), Morocco, Namibia, and Tunisia operate a conventional fixed peg: Namibia has pegged one-for-one against the South African rand while Morocco and Tunisia have pegged against a basket of currencies of key trading partners; Botswana operates a crawling peg (against a basket comprising the South African rand and the Special Drawing Rights); South Africa operates an independent float. The rest of the countries *officially* operated a freely floating exchange rate regime during the study period. However, a country's actual (de facto) exchange rate regime might differ from her officially declared (de jure) exchange rate regime and, in reality, some countries that have declared to have floated their currencies actually only targeted stable exchange rates (Bubula and Ötker-Robe, 2002). Thus, in the new IMF classification that tries to address such discrepancies, the rest of the sampled countries' exchange rate systems fall under "managed floating with no predetermined path for the exchange rate" (IMF, 2008). We use real exchange rates to address apparent low flexibility in the nominal exchange rates of some of the countries. Real exchange rates are also preferred because they capture both inflationary forces and nominal exchange rates, both of which, theoretically, have a mutual relationship with cross-border capital flows. Because it incorporates inflation, which responds to domestic production and income levels, among other time-varying macroeconomic variables, real exchange rates, even for countries that operate a conventional fixed peg, are likely to exhibit a great deal of flexibility. From this perspective, we expect that risk-averse international investors will be concerned about the effect of *real* exchange rate fluctuations on returns from their portfolio investments. The relatively more flexible real exchange rates allow us to explore the pricing of foreign exchange risk in the sampled equity markets. However, to the extent that real exchange rates may not fully address the issue of flexibility of the exchange rate systems, our tests allow us to examine the extent to which foreign exchange restrictions, in pegging countries, are built into overall return requirements demanded by international equity investors.

The exchange rate is defined as the African currency price of the US dollar; thus, a positive change indicates depreciation of the African currency. The real exchange rate (RER) is calculated as the product of the nominal US dollar-African currency exchange rate and the CPI of the USA relative to the CPI of the African country (AC): $RER_{AC/\$} = NER_{AC/\$} \times (CPI_{USA}/CPI_{AC})$. We use the resulting real exchange rates to construct the "Afro" indexes as explained in Section 1. The relative change in the value of foreign currency, s_t, used in parameter estimation, is calculated as $s_t = \ln S_t - \ln S_{t-1}$, where S_t is the "Afro" index at time t. Exchange rates and CPI data are from IMF's International Financial Statistics.[10] We present descriptive statistics for the Afro index in Panel B of Table 4. The real exchange rate index exhibits significantly high serial correlation only in first lag and has a right skewed distribution.

We also develop a small market size variable (SMV) factor to capture the relatively low equity trading activity in most of Africa. The SMV factor is a construct developed from monthly equity market capitalization series reported in Bloomberg.[11] The data are available from September 2003 to December 2013 – a total of 124 observations. The small market size variable (SMV) construct is derived in two steps: we first determine the equity market capitalization of each African country relative to the

US equity market capitalization (proxy for the world equity market capitalization): $MCAP_{AC}/MCAP_{USA}$, where AC means "African country". Surrogating the world equity market with the US equity market is consistent with our usage of the US dollar also as a proxy for the world currency. In the second step, we convert the country-specific relative market capitalizations into a weighted average stock market size construct for Africa using number of stocks listed in each of our 10 countries as weights. We obtain the number of listed companies in each African equity market from the World Bank's World Development Statistics (WDI) up to 2012 and from the respective websites of the Exchanges for 2013. The figures are provided in annual frequencies in WDI. To use them in our empirical analysis, which employs monthly frequencies, we assume that any changes in the number of listed companies in each bourse occur only at year-end. The summary statistics for SMV are shown in Panel C of Table 4.

Conditioning variables

Dumas and Solnik (1995) explain that conditioning variables can be proxied by frequently observed financial and economic variables. The general criteria for inclusion of such variables are that they must be predictors of return or leading indicators of business cycle (Drobetz et al, 2002). Importantly, conditioning variables should approximate the information set used by investors in setting prices. In practice, the selection of conditioning variables can be guided by the literature. In addition to worldwide factors (such as the dividend yield on world market portfolio and the Eurodollar deposit rate) assumed to be able to predict equity returns across countries, Harvey (1991) considers the following country-specific instruments: lagged equity market index returns, dividend yields, short-term interest rates, foreign exchange rate changes, and maturity spreads. Buckberg (1995) reports substantial improvements in return prediction following inclusion of lagged local market instruments: lagged local dividend yield and lagged return on the dollar-local currency exchange rate.

In addition, we use three worldwide variables – MSCI world equity portfolio returns, MSCI world equity portfolio dividend yields and three-month Eurodollar deposit rates, and one foreign country variable – the USA term premium.[12] Now, except the lagged world market portfolio returns and local inflation, the rest of these variables exhibit unit roots. Therefore, using them in the regression might violate the stationarity requirements for GMM estimation. To deal with this problem, we use the first differences of these variables in our estimation, following Dumas and Solnik (1995). We obtain CPI and African deposit rates data from IMF's International Financial Statistics; Eurodollar deposit rates and USA term premium from USA Reserve Bank, and world market equity portfolio dividend yield from Bloomberg.

Having chosen our conditioning variables, we next check whether they are suitable for the equity markets of interest. Table 5 presents results of the Wald tests of the restriction that coefficients of all the selected conditioning variables are zero in the regression $R_{it} = \alpha + \beta' z_{t-1} + \varepsilon_{it}$. The table shows that the Wald statistics are significant in several regressions, demonstrating the variables' suitability for conditioning equity returns in the African markets. The strength of the resulting instrument variables set is that it affords us a direct comparison with the extant literature.

Table 5: Suitability of conditioning variables

	Botswana	Egypt	Ghana	Kenya	Mauritius	Morocco	Namibia	Nigeria	S. Africa	Tunisia
Wald	1.74	9.14	1.38	2.94	4.35	0.83	2.32	1.53	1.84	2.40
p-value	(0.11)	(0.00)	(0.22)	(0.01)	(0.00)	(0.55)	(0.04)	(0.17)	(0.09)	(0.03)

The table reports results for the test of the restriction that coefficients (β) of the regression ($R_{it} = \alpha + \beta' z_{t-1} + \varepsilon_{it}$) of stock market index returns on the set of the conditioning variables are all zero. The conditioning variables are lagged values of world equity index returns (WLR), dividend yield on the world equity portfolio (WDY), three-month Eurodollar deposit rates (UDR), United States term premium (UTP), local deposit rates (ADR), and local inflation (INF). Save for WLR and INF, which are stationary, all conditioning variables are first differenced. Data are for the period 1999:1 through 2013:12.
Source: Constructed by authors.

The key characteristics of the selected conditioning variables and their relationships with equity returns and risk factors are reported in Table 6. Correlations between instruments and factors, and among market index returns, are very low, satisfying our model requirements. Serial correlations are high for some of our conditioning variables. However, as already explained, the GMM takes care of this and so does not affect the results of our empirical tests.

Guided by these studies, we choose conditioning variables from as follows. We first run ordinary least squares regressions of market index returns on pre-specified variables. Debt markets are not very well developed in the majority of our sampled countries; thus, we are unable to obtain enough long-term interest rates to develop local term spreads. Equally, aggregate (market) dividend yields are not available for many of the sampled countries. Thus, we investigate a small set of potential local market instruments, including short-term interest rates (deposit rates), lagged local market index returns, USD-local currency exchange rates and inflation. None of them reports significant coefficients in our predictive regressions. However, the lagged values of local inflation and local deposit rates report fairly low standard errors: we include them among this study's conditioning variables.

Table 6: Additional preliminary statistics

A. Correlations

Factors and Instruments	Stock market indexes for country										Risk factors		
	Bot	Egt	Gha	Ken	Mau	Mor	Nam	Nig	S.Afr	Tun	WLD	CRR	SMV
WLD	0.32	0.25	0.02	0.45	0.46	0.36	0.74	0.20	0.80	-0.42			
CRR	-0.27	-0.07	-0.04	-0.18	-0.27	-0.15	-0.27	-0.67	-0.26	0.29	-0.20		
WLR	0.14	0.44	0.11	0.19	0.27	0.13	0.17	0.08	0.12	0.01	0.16	0.06	-0.05
WDY	-0.20	-0.42	0.02	-0.17	-0.28	-0.12	-0.19	-0.14	-0.14	0.01	-0.19	0.00	-0.05
UDR	-0.04	0.04	-0.06	-0.20	-0.21	-0.09	-0.18	0.01	-0.19	0.18	-0.07	0.02	-0.18
ADR	0.01	-0.19	-0.11	-0.05	-0.07	0.02	-0.11	-0.06	-0.10	-0.05	-0.13	-0.09	0.04
INF	-0.01	0.02	0.11	-0.08	0.00	0.00	0.00	0.08	-0.01	-0.01	-0.05	-0.06	0.12
UTP	0.06	-0.15	0.04	0.01	-0.08	0.01	0.04	0.16	0.03	0.01	-0.04	-0.03	0.14

B. Instrument autocorrelations

	ρ_1	ρ_2	ρ_3	ρ_4	ρ_6	ρ_{12}	ρ_{24}
WLR	0.161a	-0.020	0.159a	0.133a	-0.034	0.037	-0.004
WDY	0.296a	0.035	0.137a	0.204a	-0.187a	0.024	-0.101
UDR	0.126	-0.046	-0.018	0.054	0.041	-0.025	-0.049
ADR	0.066	0.207	0.083	-0.024	-0.004	0.021	-0.030
INF	0.343a	0.179a	0.122	0.010	-0.072	0.244a	0.273a
UTP	0.057	-0.074	0.101	0.073	0.024	0.023	-0.070

This table reports correlation coefficients between national market index returns, risk factors and conditioning variables as well as instrument autocorrelations. WLD is returns on MSCI world equity portfolio, CRR is returns on the Afro index. The rest of the variables are as defined in the legend of Table 4. Data run from 1999:1 to 2013:12. Regressions involving SMV (small markets variable) is done with data for the period 2003:09 through 2013:12.
Source: Constructed by authors.

4. Empirical results

We now present empirical results for the estimates of the SDF models discussed in Section 3. As already explained, each conditioning variable is incorporated separately into the SDF model. Results are presented separately for each of the different specifications. Inferences are based on the J-statistic of Hansen's (1982) optimal iterated GMM.

Parameter estimates

Table 7 contains estimation outputs for parameters of the stochastic discount factor (b) as defined in Equation 10. These parameters provide information on the importance of each factor in the equity pricing kernel. The table also reports estimates of factor risk premium (λ) as presented in Equation 11. These parameters impart information on the relative importance of each factor in influencing expected returns of equity securities in Africa's capital markets.

We present results of tests including, and tests excluding, South Africa. The results show that the real exchange risk factor significantly enters the pricing kernel in the equity markets either in the time-varying form or in the time-invariant form under all specifications. Lettau and Ludvigson (2001) explain that scaling risk factors does not impose the requirement that the betas for the scaled and unscaled risk factor be individually significant; only that they be jointly significant. In this respect, a risk factor's coefficient is the (weighted) average of the "scaled" and "unscaled" coefficients. We use the reported t-statistics as the weighting basis. Therefore, the SDF parameter for the foreign exchange risk factor, in panel A, is the weighted average of 3.015 and 0.674, which is 1.786 (this is the nominal pricing kernel coefficient of the foreign exchange risk factor). For all specifications, excepting panel D, our tests for the restriction that the two foreign exchange risk coefficients in the pricing kernel are jointly zero (Wald1) reject the null. Exclusion of South Africa's equity markets does not, qualitatively, change our results. The pricing kernel is viewed as a single variable that summarizes all of the information about the state of the economy that is relevant for pricing financial assets. Thus, our findings suggest that international investors in Africa's equities regard the real exchange rate as providing important information about the state of the economy and hence the performance of financial claims.

Even more interesting are factor risk premium estimates. The zero-beta asset return is around 0.3% to 0.4% per month. Lettau and Ludvigson (2001) argue that, the zero-beta rate should lie between borrowing rates and lending rates in the economy, in this case the USA, because we have used US dollar-denominated returns in our tests.

Table 7: Parameter estimates for SDF model specifications

A. Risk factors scaled by MSCI world equity portfolio returns

Pricing kernel	**Constant**	b_{WLD}	b_{RXR}	$b_{WLD \cdot WLR}$	$b_{RXR \cdot WLR}$
With S.Africa	0.108*** (7.02)	0.578** (2.57)	3.015*** (3.69)	-1.742*** (-4.42)	0.674*** (4.08)
Without S. Africa	0.122*** (6.42)	0.919*** (2.92)	3.705*** (3.38)	-2.145*** (-3.67)	-0.776*** (-3.54)
Factor Risk premium	**Constant**	λ_{WLD}	λ_{RXR}	$\lambda_{WLD \cdot WLR}$	$\lambda_{RXR \cdot WLR}$
With S.Africa	0.004***(4.08)	0.001 (0.17)	-0.008 (-1.40)	0.011***(-4.21)	0.066** (2.43)
Without S. Africa	0.004*** (3.97)	-0.005 (-1.07)	-0.010* (-1.65)	0.011*** (3.47)	0.072** (2.47)
Model tests		**J-stat**	**Wald1**	**Wald2**	**Sup-LM**
With S. Africa		16.84 [0.33]	17.20 [0.00]	11.44 [0.00]	39.14*
Without S. Africa		14.47 [0.34]	12.63 [0.00]	10.32 [0.01]	32.58*

B. Risk factors scaled by MSCI world portfolio dividend yield

Pricing kernel	**Constant**	b_{WLD}	b_{RXR}	$b_{WLD \cdot WDY}$	$b_{RXR \cdot WDY}$
With S. Africa	0.110*** (5.92)	1.584*** (3.88)	5.413*** (3.62)	5.124 (0.40)	-0.022 (-0.54)
Without S. Africa	0.116*** (5.39)	1.848*** (3.79)	6.018*** (3.39)	0.013 (0.78)	0.007 (0.12)
Factor Risk premium	**Constant**	λ_{WLD}	λ_{RXR}	$\lambda_{WLD \cdot WDY}$	$\lambda_{RXR \cdot WDY}$
With S. Africa	0.004*** (4.26)	-0.021*** (-3.12)	-0.041*** (-3.31)	-0.083 (-1.09)	-0.000 (-0.00)
Without S. Africa	0.004*** (4.27)	-0.028*** (-3.76)	-0.046*** (-3.47)	-0.040 (-0.52)	0.019 (0.51)
Model tests		**J-stat**	**Wald1**	**Wald2**	**Sup-LM**
With S. Africa		13.65 [0.55]	13.89 [0.00]	14.06 [0.00]	8.07
Without S. Africa		10.42 [0.66]	11.85 [0.00]	14.54 [0.00]	14.37

continued next page

Table 7 Continued

C. Risk factors scaled by Eurodollar deposit rates

Pricing kernel	**Constant**	b_{WLD}	b_{RXR}	$b_{WLD \cdot UDR}$	$b_{RXR \cdot UDR}$
With S. Africa	0.144*** (5.39)	-0.130 (-0.40)	2.452*** (2.68)	0.262*** (3.41)	0.970*** (3.71)
Without S. Africa	0.155*** (5.13)	-0.223 (-0.66)	1.883*** (2.24)	0.243*** (3.69)	0.742*** (3.75)
Factor Risk premium	**Constant**	λ_{WLD}	λ_{RXR}	$\lambda_{WLD \cdot UDR}$	$\lambda_{RXR \cdot UDR}$
With S. Africa	0.003*** (3.93)	0.015*** (3.44)	0.005 (1.32)	0.468*** (4.29)	0.046** (2.47)
Without S. Africa	0.003*** (3.92)	0.012*** (2.64)	0.005 (1.36)	0.004*** (3.90)	0.048** (2.53)
Model tests		**J-stat**	**Wald1**	**Wald2**	**Sup-LM**
With S. Africa		12.32 [0.65]	15.59 [0.00]	6.42 [0.04]	14.49
Without S. Africa		11.74 [0.55]	17.81 [0.00]	6.64 [0.04]	13.03

D. Risk factors scaled by local deposit rates

Pricing kernel	**Constant**	b_{WLD}	b_{RXR}	$b_{WLD \cdot ADR}$	$b_{RXR \cdot ADR}$
With S. Africa	0.116*** (6.47)	0.314 (1.48)	1.275* (1.84)	0.147* (1.71)	0.051* (1.83)
Without S. Africa	0.156*** (5.43)	0.701** (2.26)	1.771* (1.77)	0.239** (1.97)	0.076* (1.80)
Factor Risk premium	**Constant**	λ_{WLD}	λ_{RXR}	$\lambda_{WLD \cdot ADR}$	$\lambda_{RXR \cdot ADR}$
With S. Africa	0.003*** (3.44)	-0.001 (-0.28)	-0.011* (-1.86)	-0.035*** (-4.25)	-0.316* (-1.96)
Without S. Africa	0.003*** (3.55)	-0.008* (-1.75)	-0.012* (-1.75)	-0.026*** (-2.96)	-0.033* (-1.83)
Model tests		**J-stat**	**Wald1**	**Wald2**	**Sup-LM**
With S. Africa		12.94 [0.61]	3.54 [0.17]	3.86 [0.15]	26.98*
Without S. Africa		9.83 [0.71]	3.30 [0.19]	3.35 [0.19]	12.41

continued next page

Table 7 Continued

E. Risk factors scaled by local inflation

Pricing kernel	**Constant**	b_{WLD}	b_{RXR}	$b_{WLD \cdot INF}$	$b_{RXR \cdot INF}$
With S. Africa	0.130*** (5.18)	0.945(0.89)	8.934** (2.21)	0.127 (0.80)	-0.038 (-0.072)
Without S. Africa	0.164*** (4.26)	0.070(0.04)	8.372* (1.77)	0.350*** (1.23)	-0.020 (-0.28)
Factor Risk premium	**Constant**	λ_{WLD}	λ_{RXR}	$\lambda_{WLD \cdot INF}$	$\lambda_{RXR \cdot INF}$
With S. Africa	0.003*** (2.78)	0.032***(2.66)	0.040*** (4.56)	-0.002*** (-2.64)	-0.002*** (-4.19)
Without S. Africa	0.003*** (2.90)	0.020 (1.21)	0.027** (2.07)	-0.002 (-1.32)	-0.001** (-2.05)
Model tests		**J-stat**	**Wald1**	**Wald2**	**Sup-LM**
With S. Africa		16.05 [0.38]	11.21 [0.00]	20.76 [0.00]	10.59
Without S. Africa		13.66 [0.40]	9.75 [0.01]	4.35 [0.11]	4.23

F. Risk factors scaled by United States term premium

Pricing kernel	**Constant**	b_{WLD}	b_{RXR}	$b_{WLD \cdot UTP}$	$b_{RXR \cdot UTP}$
With S. Africa	0.165*** (4.83)	0.381 (0.93)	4.084** (2.05)	0.086 (0.89)	1.193*** (3.00)
Without S. Africa	0.183*** (5.28)	-0.311 (-0.68)	0.619 (0.63)	0.215* (1.69)	0.103*** (2.65)
Factor Risk premium	**Constant**	λ_{WLD}	λ_{RXR}	$\lambda_{WLD \cdot UTP}$	$\lambda_{RXR \cdot UTP}$
With S. Africa	0.003*** (3.94)	-0.003 (-0.52)	-0.019 (-1.62)	-0.030 (-1.35)	-0.039*** (-3.89)
Without S. Africa	0.004*** (4.24)	0.003 (0.56)	-0.005 (-0.75)	-0.054** (-2.05)	-0.034*** (-3.30)
Model tests		**J-stat**	**Wald1**	**Wald2**	**Sup-LM**
With S. Africa		9.80 [0.83]	11.21 [0.00]	15.25 [0.00]	6.52
Without S. Africa		7.99 [0.84]	9.75 [0.01]	10.92 [0.00]	8.10

The table reports GMM estimates of parameters of the stochastic discount factor model (b) and factor risk premium (λ). The reported t-statistics (in brackets) are heteroskedasticity and autocorrelation robust. J-statistic is Hansen's (1982) test of over-identifying restrictions; Wald1 and Wald2are the joint testsfor the restriction that both time-invariant and time-varying exchange risk factor coefficients (in the pricing kernel andrisk premium, respectively) equal zero; All conditioning variables are lagged one period and differenced if not stationery in levels. Numbers in square brackets are p-values of the test statistics. Critical values of sup-LM statistics are obtained from Table 1 of Andrews (2003). Sup-LM is Andrews (1993) test of structural stability of the parameters of the SDF model. *, ** and *** indicate statistical significance at 10%, 5%, and 1%, respectively. We use USD-denominated monthly returns for the period from 1999:1 to 2013:12.
Source: Constructed by authors.

During the study period, the average monthly US lending rate was 0.433% – evidence that our estimated zero-beta rates are close to actual values. This finding satisfies one of the criteria prescribed by Lewellen et al. (2010) that conditional asset pricing models must be evaluated against their ability to estimate risk premium that are close to observed values. Findings for the real exchange risk factor risk premium clearly show that currency risk is priced in Africa's equity markets with time-varying premium. Only in one of the specifications – the local deposit rates – does the Wald test fail to reject the hypothesis that the two exchange risk factors are jointly zero. Our pricing results contradict the unconditional pricing results in Kodongo and Ojah (2011) for some of these markets.

In three of our specifications, the weighted average foreign exchange (as well as world equity market) factor risk premium are negative. The negative sign of the factor risk premium deserves some attention. Under the ICAPM, tested here, equilibrium in the capital markets implies a positively sloping equity pricing plane with the zero-beta rate as the intercept. The assumption therefore is that priced factors have positive risk premium so that equity risk premium, in general, are positive. Our significant negative risk premium findings appear to violate this assumption, suggesting the possibility that equities are less risky than the zero-beta asset. First, it is important to point out that negative factor risk premium have been found in several empirical asset pricing tests, both unconditional and conditional, many of which also investigated currency risk pricing (Choi and Rajan, 1997; Choi et al, 1998; Lettau and Ludvigson, 2001; Carrieri and Majerbi, 2006; Zhang, 2006; Iqbal et al, 2010; Kodongo and Ojah, 2011). In this regard, the negative factor risk premium is neither novel nor unique to this study.

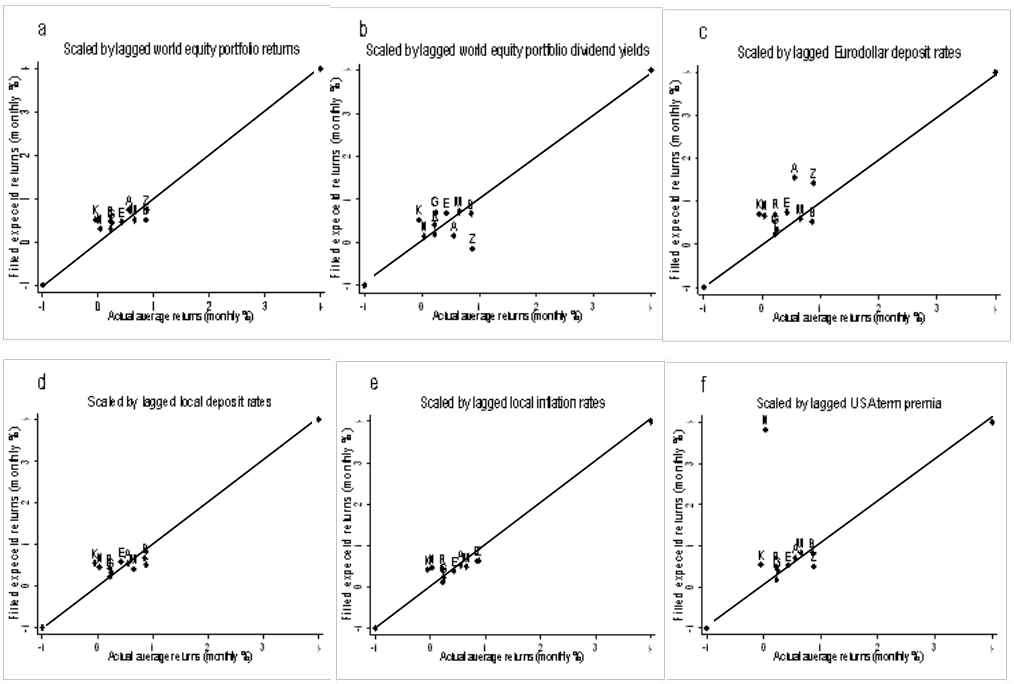
Second, tests of the positivity restriction in asset pricing models have provided evidence of negative equity risk premium in various markets. For example, Boudoukh and Richardson (1993) find evidence of negative equity risk premium, ex-post and ex-ante, respectively, for the US equity markets. Importantly, Ostdiek (1998) directly assesses the non-negativity restriction in international asset pricing models and finds evidence indicating that the ex-ante world market (proxied by the MSCI dollar-denominated world portfolio, which we have also used here) risk premium can be negative: the results are robust to market proxies that are hedged and unhedged with respect to currency risk. Theoretically, negative equity risk premium can be explained by high Treasury bills rates especially during times in which the term structure is downward-sloping (Boudoukh and Richardson, 1993). In this study, three-month US Treasury bills rates (our zero-beta proxy) were relatively high in the early parts of the period – an average monthly rate of return of 0.45% for the period 1999:1 through 2000:12. If the risk premium parameters are stable over time, the negativity may be observed throughout the study period. On this note, we next discuss results of parameter stability and other model diagnostics.

We use the sup-LM statistic of Andrews (1993) to check whether our parameter estimates were stable over time. Results suggest that parameters are generally stable. Parameter instability is, however, found when returns are scaled by lagged returns on the world market equity portfolio (panel A) and when returns are scaled by local deposit rates (with South Africa included, panel D). In the former case, instability could have been introduced by developments in the world markets (such as the 2008/9 global financial crisis) that adversely affected equity returns in major industrial countries, which form the bulk of the MSCI world market equity portfolio. Hansen's (1982) *J*-statistic, the

optimal GMM test for over-identifying restrictions, yields p-values greater than 10% for all the specifications – this indicates that the data do not reject the model specifications at usual significance levels.

We also examine our specifications' pricing errors. We define the pricing error, for this discussion, as the extent to which the fitted expected returns are close to the actual mean returns. The power of ICAPM in explaining the cross section of returns in Africa's equity markets is not too strong, overall. This result is consistent with several studies of the CAPM and other asset pricing theories in various markets (Zhang, 2006; Schrimpf et al, 2007; Iqbal et al, 2010). Figure 3 demonstrates. All correctly priced assets/portfolios should lie along the 45-degree line. Looking at the plots, it is clear that pricing errors are large for some of the specifications. In Section 5, we attempt to establish whether inclusion of a small market variable can help reduce our estimation errors. In general, the distribution of points indicates that the ICAPM tends to under-price Africa's equities. In the context of pricing errors, the "best performing" conditioning variable is the local inflation, followed by local deposit rates. In this regard, our results appear to be in sync with others (e.g., Harvey, 1991; Garcia and Gysels, 1998) that have found local instrumental variables to have stronger equity returns predictive ability than international (and foreign) variables. Except for Nigeria (N), the US term premium also does very well, vindicating Harvey (1991), who finds that USA variables can explain equity returns in other countries.

Figure 3: Actual versus fitted returns for the ICAPM



The figure demonstrates the pricing errors for the various conditioning variables. If the ICAPM accurately explains stock returns, all the points in each figure should lie along the 45-degree line. Fitted expected returns for each country are obtained as $E(R) = \iota\hat{\lambda}_0 + \hat{\beta}'\hat{\lambda}$. The countries are Botswana (B); Egypt (E); Ghana (G); Kenya (K); Mauritius (M); Morocco (R); Namibia (A); Nigeria (N); South Africa (Z); and Tunisia (T).
Source: Constructed by authors.

The dynamic performance of conditional SDF model specifications

Thus far, our discussion has focused on the goodness-of-fit of the SDF model specifications from a cross-sectional perspective. The preceding discussions of pricing errors have also focused largely on risk factor pricing estimates and their associated covariance measure at the neglect of the SDF parameter estimates. In this section, we perform a diagnostic check, proposed by Farnsworth et al. (2002), that focuses on the economic magnitudes of pricing errors for particular assets (countries in this paper) from a time series perspective. The central idea behind the authors' proposal is that if the model works well, then the SDF's pricing errors, $M_t(\hat{b})R_{t-1}$, should not be predictable using any information available at the investors' disposal at time t, proxied by the set of conditioning variables, Z_t. Consistent with Equation 9, we define the estimated pricing kernel, $M_t(\hat{b})$, as:

$$M_t(\hat{b}) = \hat{b}_0 + \hat{b}_{WLD} R_{WLD} + \hat{b}_{RXR} R_{RXR} + \hat{b}_{WLD.CON} R_{WLD.CON} + \hat{b}_{RXR.CON} R_{RXR.CON} \qquad (12)$$

where,*WLD* represents change in the returns on the world market equity portfolio; *RXR* denotes the change in the Afro real exchange rate; and *CON* is a conditioning variable, lagged one period; a circumflex denotes the GMM estimate of the coefficient. Farnsworth et al. (2002) argue that the standard deviations of the fitted values of a regression of the model pricing errors, $M_t(\hat{b})R_t - 1$, on instrumental variables set, Z_{t-1}, should explain how well a particular model specification accounts for predictable variation in returns. The smaller the sample standard deviation, the better is the model specification's ability to "explain" return variation. The one strength of this diagnostic check is that standard deviation measure does not place any penalty on model specifications that get the average return wrong.

Table 8: The dynamic performance of the SDF model specifications

Risk factors scaled by	Average standard deviation
WLR	1.375
WDY	0.986
UDR	2.979
ADR	0.689
INF	2.045
UTP	1.091

The table reports results of the tests for dynamic model specification performance following Farnsworth et al. (2002). The model pricing errors, $M_{t+1}(\hat{b})R_{t+1} - 1$, for each model specification are regressed against the relevant conditioning variable. The standard deviations of the resulting fitted values are then obtained. The conditioning variables used are the gross returns on the MSCI world equity portfolio (WLR), dividend yields on the MSCI world equity portfolio (WDY); the Eurodollar deposit rates (UDR), local deposit rates (ADR); local inflation rates (INF) and the USA term premium (UTP). All conditioning variables are lagged one period. We use monthly returns, denominated in US dollars, for the period 1999:1 through 2013:12.
Source: Constructed by authors.

We perform this test for each of the 10 countries in the sample; results are presented in Table 8. In terms of the average standard deviation, the table shows that the specification with ADR as the conditioning variable appears to perform the best in capturing the time series predictability of gross returns on national equity indexes under the ICAPM. It is worth noting that the specification with the best cross-sectional performance, local inflation (*INF*), turns out to be one of the "worst performers" from a time-series perspective. The latter observation confirms that the Farnsworth et al. (2002) methodology is not biased by the ability of a model specification to correctly capture average returns. In general, however, the standard deviations are large, consistent with Farnsworth et al. (2002), and thus indicating that conditional asset pricing models struggle to capture time-varying predictability of stock returns.

5. Additional tests

Market-size-augmented ICAPM

Skeptics would reason that the ICAPM, developed and, so far, largely tested, with equity markets in industrial countries, might not be suitable to explain stock returns in the relatively small and illiquid stock markets in Africa. Indeed, in comparison to equity markets in more advanced economies, Africa's equity markets generally exhibit very thin trading and low market capitalization and have very few listed stocks (Allen et al, 2011). We illustrate this with some facts: Data from World Development Indicators show that in 2012, the value of stocks traded as a proportion of GDP for South Africa, the largest equity market in the continent, was only 58.92% compared to, say, 84.04% for the UK and 131.58% for the USA; the average value of stocks traded as a percentage of GDP for the 10 countries in this study in 2012 was only 13.92%. Importantly, the *total* number of domestic firms listed in *all* the 10 markets, arguably Africa's largest, was just 1,118 compared with 2,179 for the UK and 4,102 for the USA in 2012. Given these asymmetrical comparative statistics, one expects that international investors would be concerned about the low trading levels in these markets. That is, relatively low trading activity in Africa's equity markets can be perceived as a form of market segmentation that can act as a disincentive to international investors. In this respect, international investors would probably build equity market size into their pricing calculus.

Thus, in this section, we try to understand whether *small market size* is a priced factor in Africa's equity markets. We achieve this through a market-size -augmented ICAPM. We derive the new pricing kernel by extending Equation 9 into the following seven-factor constant-weights model:

$$M_t = a_0 + b_{01} f_{1,t} + b_{02} f_{2,t} + b_{03} f_{3,t} + b_{11} (f_{1,t} z_{t-1}) + b_{12} (f_{2,t} z_{t-1}) + b_{13} (f_{3,t} z_{t-1}) \qquad (13)$$

We run regressions with the same conditioning variables as before. However, as Equation 13 shows, the new estimations make use of three risk factors: returns on the world equity portfolio, real exchange rate changes and a market size variable. As before, we use the GMM technique to evaluate the sample moment conditions in equations 10 and 11.

The results are reported in Table 9. Due to space considerations, we report only the Wald tests for joint significance. In all specifications, results show that the currency risk

factor enters the equity pricing kernel in Africa. Similarly, currency risk factor remains priced even when market size is taken into consideration. That is, currency risk remains an important concern to international investors even if they incorporate Africa's small markets (and potential relative illiquidity) into their pricing calculus.

Table 9: Tests results for market-size-augmented ICAPM

	Pricing kernel			Factor risk premium			
Risk factors	**WLD**	**RXR**	**SMV**	**WLD**	**RXR**	**SMV**	
Risk factors scaled by							**J-statistic**
WLR	26.01	24.06	2.68	29.71	26.75	5.92	7.83
	[0.00]	[0.00]	[0.26]	[0.00]	[0.00]	[0.05]	[0.85]
WDY	29.30	36.09	15.34	40.72	46.45	4.06	9.80
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.13]	[0.71]
UDR	7.76	13.36	4.47	6.92	17.28	24.90	7.58
	[0.02]	[0.00]	[0.09]	[0.03]	[0.00]	[0.00]	[0.87]
ADR	8.82	7.44	15.15	7.84	8.35	17.40	8.12
	[0.01]	[0.02]	[0.00]	[0.02]	[0.02]	[0.00]	[0.84]
INF	19.06	20.61	0.97	17.61	25.16	1.18	7.96
	[0.00]	[0.00]	[0.62]	[0.00]	[0.00]	[0.55]	[0.85]
UTP	18.20	14.25	3.90	34.69	11.85	17.02	10.03
	[0.00]	[0.00]	[0.14]	[0.00]	[0.02]	[0.00]	[0.69]

The table reports the Wald tests results for the restrictions that both scaled and unscaled risk factors are zero in the iterated GMM regressions. The risk factors are, respectively, MSCI world market equity portfolio returns (WLD), returns on real exchange rates (RXR), and the small markets variable (SMV), constructed as the weighted average of equity markets capitalization of African countries relative to the US equity market capitalization. The conditioning (scaling) variables are lagged values of: gross returns on the world market equity portfolio returns (WLR), world market equity portfolio dividend yields (WDY), Eurodollar deposit rates (UDR), local deposit rates (ADR), local inflation (INF) and USA term premium (UTP). Data are for the period 2003:09 through 2013:12.
Source: Constructed by authors.

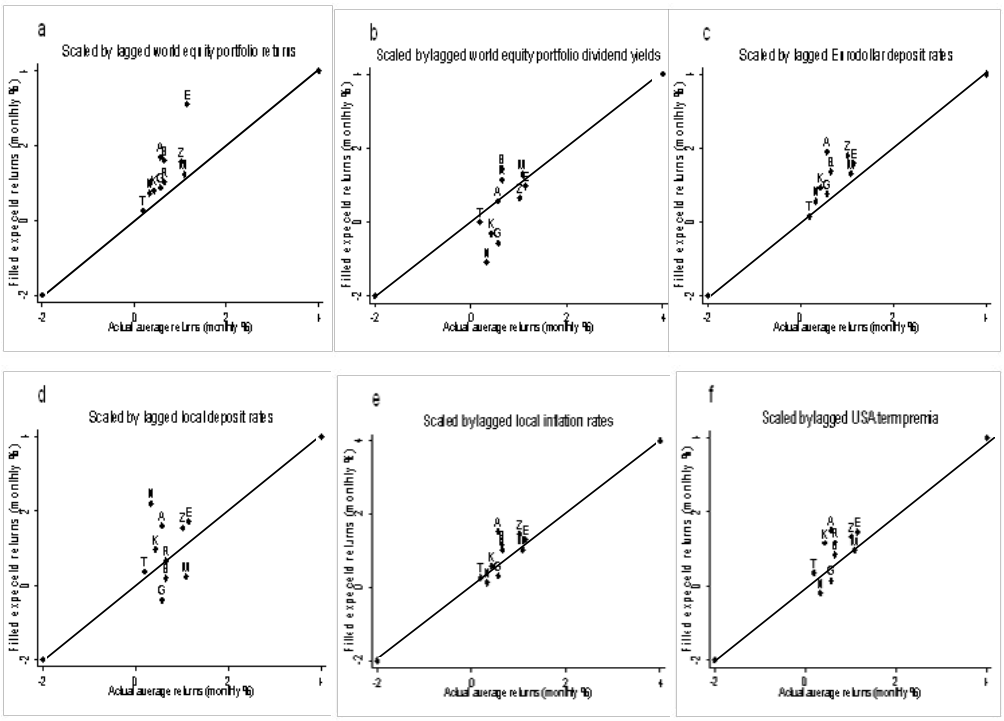
Secondly, in three of the six specifications (i.e., when risk factors are scaled by lagged values of MSCI world dividend yield, Eurodollar deposit rates, and local deposit rates), the results show that the small market variable (SMV) enters the pricing kernel; similarly, SMV is priced in four specifications implying that it is an important factor considered by international investors. If we consider SMV as a segmentation variable, our results show, in general, that Africa's equity markets are only partially integrated with equity markets in the rest of the world. This inference is consistent with that in Kodongo and Ojah (2011).

Is the market-size-augmented ICAPM suitable for Africa's equity markets?

We next try to address the question as to whether the standard two-factor (world market and currency risk factors) ICAPM is suitable as a model for pricing Africa's equities. The

above discussion shows that investors are worried about small equity markets in Africa and actually attach a premium to it when evaluating Africa's investments. But do we need to make adjustments for size and/or liquidity to work with the ICAPM in Africa's equity markets? We use average pricing errors in an attempt to address this question. Pricing errors for the size-augmented ICAPM are plotted in Figure 4. The plots show that the model's average pricing errors are quite large, especially when compared to the average pricing errors of the standard ICAPM, reported in Figure 3. One can easily confirm this by comparing the dispersion of plots around the 45-degree line.

Figure 4: Size-augmented ICAPM pricing errors



The figure demonstrates the pricing errors for the various conditioning variables. If the size-augmented ICAPM accurately explains stock returns, all the points in each figure should lie along the 45-degree line. Fitted expected returns for each country are obtained as $E(R) = \iota\hat{\lambda}_0 + \hat{\beta}'\hat{\lambda}$. The countries are Botswana (B); Egypt (E) Ghana (G); Kenya (K); Mauritius (M); Morocco (R); Namibia (A); Nigeria (N); South Africa (Z); and Tunisia (T). Source: Constructed by authors.

To aid this comparison, we compute the average pricing errors for each model specification. The figures reported in the table are the averages of the differences between the actual mean rate of return and the fitted expected rate of return for each country's equity market index. Results are presented in Table 10. The results show clearly that the monthly percentage deviations of fitted from actual returns are much smaller for the standard ICAPM than for the size-augmented ICAPM. We conclude that the standard ICAPM is more suitable for modelling Africa's equity returns. A potential drawback of this inference is that the number of observations of returns used for the two models is different. However, the differences are so conspicuous that we do not anticipate a

radical change in results even with a similar number of observations. It is also clear from Table 10 that both the standard ICAPM and the augmented ICAPM have the tendency to under-price equities in Africa.

Table 10: Average pricing errors

Conditioning variable	WLR	WDY	UDR	ADR	INF	UTP
Standard ICAPM	0.095	0.001	0.347	0.066	0.020	0.477
Size-augmented ICAPM	0.631	-0.257	0.511	0.245	0.214	0.208

The table reports average pricing errors (monthly percentage) for each of the SDF model specifications under the standard ICAPM and the size-augmented ICAPM. Pricing errors for each country are computed as the difference between the actual average returns and fitted expected returns, $E(R) = \iota\hat{\lambda}_0 + \hat{\beta}'\hat{\lambda}$. These are then averaged across countries. The conditioning variables are lagged values of: returns on the MSCI world equity portfolio (WLR); MSCI world equity portfolio dividend yields (WDY); three-month Eurodollar deposit rates (UDR), local deposit rates (ADR); local inflation rates (INF) and United States term premium (UTP). Data are for the period 2009:1 through 2013:12 for the standard ICAPM and from 2003:9 to 2013:12 for the augmented ICAPM. Source: Constructed by authors.

The unconditional ICAPM

Does the conditional asset specification perform better than the unconditional ICAPM? We start by noting that Kodongo and Ojah (2011) did not find currency risk priced in seven of the 10 equity markets we have studied in this paper. Their work used the GMM technique to estimate a multifactor asset pricing model in the Seemingly Unrelated Regression (SUR) framework.

Table 11: Unconditional ICAPM estimates

Pricing kernel	Constant	b_{WLD}	b_{RXR}	
With S. Africa	0.182*** (4.70)	-0.405 (-0.85)	0.690 (0.58)	
Without S. Africa	0.241*** (3.85)	-0.074 (-0.14)	-0.078* (-0.09)	
Factor Risk premium	**Constant**	λ_{WLD}	λ_{RXR}	
With S. Africa	0.004*** (3.74)	0.006 (1.25)	0.000 (0.02)	
Without S. Africa	0.003*** (3.34)	0.001 (0.18)	0.002 (0.54)	
Model tests	**J-stat**	**Wald1**	**Wald2**	**Sup-LM**
With S. Africa	6.43 [0.49]	3.18 [0.20]	1.99 [0.37]	6.11
Without S. Africa	3.19 [0.79]	0.02 [0.99]	0.30 [0.86]	5.57

The table reports unconditional GMM estimates of parameters (b) and factor risk premium (λ) of the stochastic discount factor approach. The reported t-statistics (in brackets) are heteroskedasticity and autocorrelation robust. J-statistic is Hansen's (1982) test of over-identifying restrictions; Wald1 and Wald2 are the joint tests for the restriction that both world equity market and exchange risk factor coefficients (in the pricing kernel and risk premium, respectively) equal zero. Numbers in square brackets are p-values of the test statistics. Sup-LM is Andrews (1993) test of structural stability of the parameters of the SDF model. Critical values of sup-LM statistics are obtained from Table 1 of Andrews (2003). *, ** and *** indicate statistical significance at 10%, 5%, and 1%, respectively. We use USD-denominated monthly returns for the period 1999:1 through 2013:12. Source: Constructed by authors.

In this paper, we use the SDF approach, not only to test the robustness of their result, but also to check whether the conditional specifications that we have employed

in this paper provide 'superior' asset pricing results to those that can be obtained in the unconditional setting. Results for the unconditional specification are presented in Table 11. The results show that, (i) neither the currency risk factor nor the world market factor enters the equity pricing kernel for these countries; and (ii) that neither risk factor is unconditionally priced in the equity markets. Further, Wald tests show that the risk factors are not significant even when acting jointly. Hansen's (1982) J-statistic does not find the instruments unsuitable and the sup-LM test shows that the unconditional parameters are stable over time. It is clear from these results that we owe our priced-factors results to the conditional specification and that the unconditional ICAPM does not perform very well in these equity markets.

6. Conclusion

This paper sought to establish whether Africa's volatile currencies actually drive equity risk premium in the corresponding national equity markets. We use the SDF framework to test six conditional asset pricing specifications with the world market equity portfolio and real foreign exchange rate changes as risk factors. The risk factors are scaled by six conditioning variables, informed by past studies: the returns on the MSCI world equity portfolio, MSCI world equity portfolio dividend yields, monthly observations of the three-month Eurodollar deposit rates, local (African) deposit rates, local inflation rates, and the USA term premium. Scaling factors enable us to capture time variation. We find strong evidence suggesting that foreign exchange risk has significant conditional time-varying premium in equity returns and enters the equities' pricing kernel.

Our findings suggest important implications. First, foreign investors keen to diversify their portfolios in the better performing African equity markets should understand that their returns are exposed to currency risk and would be wise to consider hedging against currency fluctuations. However, it is important to appreciate the pricing of currency risk within the context of the particular currency system in each country. Thus, for fixed peg regimes such as Namibia and Tunisia, international equity investors demand a currency premium to compensate for unexpected currency devaluations and revaluations in the destination market. The premium may also be justified on the grounds that restrictions on exchange rate fluctuations may prevent investors from realizing above average returns from favourable currency movements. For Botswana's crawling peg regime, patterns of exchange rate movements are still unpredictable as they depend largely on movements in the South African rand and the US dollar, which float freely. However, for international investors whose domestic returns are denominated in the two currencies in the basket, investing in Botswana pula-denominated assets would be less risky and hedging may not be that necessary.

For the remaining countries in the sample, exchange rate regimes are sufficiently flexible such that their movements are largely random. Many of these countries also frequently suffer inadequate foreign currency reserves further exposing their currencies to irregular fluctuations which may be harmful to investors' unhedged portfolio positions. Similarly, most of the countries, perhaps except South Africa, have very thin currency trading, relative to developed countries, which increase the possibility of relatively high currency volatility. As Bubula and Ötker-Robe (2002) explain, the depth and size of foreign exchange markets may affect exchange rate volatility. These observations point to a compelling need for portfolio hedging against currency fluctuations by international investors.

As a robustness check, we also run a three-factor model with the small equity markets variable (SMV) as an additional factor. We call this model the size-augmented ICAPM. Results suggest that international investors are equally worried about the size of Africa's equity markets and impound this concern into their pricing calculus. Market size is also so important that it enters the equity pricing kernel. In this regard, our results therefore suggest that Africa's equity markets are only partially integrated with equity markets in the rest of the world. To encourage a vibrant foreign investor participation and foster integration, therefore, it appears important for African countries to encourage the use of equity markets as a means to raising capital. This would increase the market size, encourage trading, improve liquidity and, therefore, reduce the size premium. Benefits would accrue to Africa's economies in the form of lower cost of capital.

Notes

1. However, investors will still be concerned about unexpected currency devaluations/ revaluations.

2. The resulting series has a correlation of 99.8% with the series constructed following Kodongo and Ojah (2011).

3. The countries whose currencies are included in each index are as follows: AFRO – Botswana, Egypt, Ghana, Kenya, Mauritius, Morocco, Namibia, Nigeria, South Africa, and Tunisia; OITP – Mexico, China, Taiwan, Korea, Singapore, Hong Kong, Malaysia, Brazil, Thailand, Philippines, Indonesia, India, Israel, Saudi Arabia, Russia, Argentina, Venezuela, Chile, and Colombia; MAJOR – Euro Area, Canada, Japan, United Kingdom, Switzerland, Australia, and Sweden; BROAD – all MAJOR and all OITP currencies. Monthly trade data are not available for Botswana and Namibia; we use annual data assuming that trade is evenly spread throughout each year.

4. Time variation in equity risk premium has been attributed to many factors. Jagannathan and Wang (1996) argue that during a recession, financial leverage of troubled firms increases, causing their systematic risk to increase. Brooks et al (1992) also point out that the maturity and growth of firms tend to change the riskiness of the firm over time. Zhang (2006) observes that the sensitivity to changes in macroeconomic conditions by financially constrained firms may cause their betas to vary over time. Therefore, the market risk premium should be higher at economic downturns to compensate for the adverse risk exposure.

5. See Kodongo (2011) for a detailed derivation of these conditions. Empirical tests of asset pricing models often work directly with Equation 3 plus the relevant definition M_t.M_t can be interpreted as a (benchmark) variable containing all systematic information that impact on the risk and hence price of financial assets in an economy.

6. Define the conditional covariance at time t: $Cov_{t\text{-}1}\,(M_t,R_{it}) = E_{t-1}\,(M_tR_{it}) - E_{t-1}\,(M_t)E_{t-1}\,(R_{it})$. Thus, Equation 3 can be expressed as $E_{t-1}\,(R_{it}) = \frac{1}{E_{t-1}\,(M_t)} - \frac{Cov_{t-1}\,(R_{it},M_t)}{E_{t-1}\,(M_t)}$. Multiplying and dividing through by $Var_{t-1}\,(M_t)$ yields $E_{t-1}(R_{it}) = \frac{1}{E_{t-1}\,(M_t)} + > \frac{Cov_{t-1}\,(R_{it},M_t)}{var_{t-1}\,(M_t)} \text{H} > - \frac{var_{t-1}\,(M_t)}{E_t\,(M_t)} \text{H}$.

7. The law states that, taking an expected value using less information of an expected value that is formed on more information, gives the expected value using less information (Cochrane, 2000). For example, $E[E_t(X)] = E(X)$.

8. Accessed from http://connectnigeria.com/articles/2013/01/21/foreign-investments-in-the-nigerian-stock-exchange-was-56-at-n733-billion-in-2012/and Nairobi Securities Exchange website.

9. A part of Tunisia stock index data, missing on Bloomberg, is obtained from CEIC global database. Both Bloomberg and CEIC reported indexes are constructed by local exchanges so the data are exactly similar.

10. For Namibia, the CPI data are from http://www.tradingeconomics.com/namibia/consumer-price-index-cpi. A correlation analysis with the available series in IFS yields a coefficient of 98.7%.

11. Stock market data for Namibia are not reported in Bloomberg, so we work with only nine countries to develop the market size construct.

12. The USA term premium is the difference between monthly returns on 10-year US Treasury bonds and monthly returns on three-month US Treasury bills. Inclusion of this variable is motivated by Harvey (1991) who reports that US variables have good ability to predict returns in markets outside the USA because US economic cycles typically coincide with or lead economic cycles of other countries.

References

AfDB (African Development Bank). 2013. "Promoting structural transformation and better use of natural resources". African Economic Outlook, 2013. African Development Bank, Tunis.

Alagidede, P., T. Panagiotidis and X. Zhang. 2011. "Why a diversified portfolio should include African assets". *Applied Economics Letters*, 18: 1333–40.

Allen, F., I. Otchere and L.W. Senbet. 2011. "African financial systems: A review". *Review of Development Finance,* 1: 79−113.

Andrews, D.W.K. 1993. "Tests for parameter instability and structural change with unknown change point". *Econometrica,* 61: 821–56.

Andrews, D.W.K., 2003. "Tests for parameter instability and structural change with unknown change point: A corringedum". *Econometrica,* 71: 395–97.

Antell, J. and M. Vaihekoski. 2012. "Pricing currency risk in the stock market: Evidence from Finland and Sweden 1970–2009". *Journal of International Financial Markets, Institutions and Money,* 22: 120−36.

Aysun, U. and M. Guldi. 2011. "Exchange rate exposure: A nonparametric approach". *Emerging Markets Review,* 12: 321−37.

Boudoukh, J. and M. Richardson. 1993. "Is the ex ante risk premium always positive? A new approach to testing conditional asset pricing models". *Journal of Financial Economics,* 34: 387– 408.

Brooks, R.D., R.W. Faff and J.H. Lee. 1992. "The form of time variation of systematic risk: Some Australian evidence". *Applied Financial Economics,* 2: 190–98.

Buckberg, E. 1995. "Emerging stock markets and international asset pricing". *World Bank Economic Review,* 9: 51–74.

Bubula, A. and I. Ötker-Robe. 2002. "The evolution of exchange rate regimes since 1990: Evidence from de facto Policies". IMF Working Paper No. WP/02/155. International Monetary Fund, Washington, D.C.

Cappiello, L. and N. Panigirtzoglou. 2008. "Estimates of foreign exchange risk premia: A pricing kernel approach". *Empirical Economics,* 35: 475–95.

Carrieri, F., V. Errunza and B. Majerbi. 2006. "Local risk factors in emerging markets: Are they separately priced?" *Journal of Empirical Finance,* 13: 444–61.

Carrieri, F. and B. Majerbi. 2006. "The pricing of exchange risk in emerging stock markets". *Journal of International Business Studies,* 37: 372–91.

Choi, J.J. and M. Rajan. 1997. "A joint test of market segmentation and exchange risk factor in international capital markets". *Journal of International Business Studies,* 28: 29–49.

Choi, J.J., T. Hiraki and N. Takezawa. 1998. "Is foreign exchange risk priced in the international capital markets?" *Journal of Financial and Quantitative Analysis,* 33: 361–82.

Chowdhury, A. 1993. "Does exchange rate variability depress trade flows? Evidence from error correction models". *Review of Economics and Statistics,* 75: 700 – 706.

Cochrane, J.H. 1996. "A cross-sectional test of an investment-based asset pricing model". *Journal of Political Economy,* 104: 572–621.

Cochrane, J.H. 2000. "Asset pricing". At http://www-gsb.uchicago.edu/fac/john.cochrane/research/papers

De Santis, G. and B. Gerard. 1998. "How big is the premium for currency risk?" *Journal of Financial Economics,* 49: 375–412.

Dominguez, K.M.E. and L.L. Tesar. 2001. "A re-examination of exchange rate exposure". *American Economic Review,* 91: 396–99.

Doukas, J., H.H. Patricia and L.H.P. Lang. 1999. "The pricing of currency risk in Japan". *Journal of Banking and Finance,* 23: 1–20.

Drobetz, W. S. Stürmer and H. Zimmermann. 2002. "Conditional asset pricing in emerging stock markets". *Swiss Journal of Economics and Statistics,* 138:107–526.

Dumas, B. and B. Solnik. 1995. "The world price of foreign exchange risk". *Journal of Finance,* 50: 445–70.

Farnsworth, H., W. Ferson and S. Todd. 2002. "Performance evaluation with stochastic discount factors". *Journal of Business,* 75: 473–503.

Ferson, W.E. 1995. "Theory and empirical testing of asset pricing models". In R.A. Jarrow, V. Maksimovic and W.T. Ziemba, eds., *Handbooks in Operations Research and Management Science, Vol 9*. Amsterdam: Elsevier

Garcia, R. and E. Ghysels. 1998. "Structural change and asset pricing in emerging markets". *Journal of International Money and Finance,* 15: 455–73.

Hall, A. 1993. "Some aspects of generalized method of moments estimation". In G.S. Maddala, C.R. Rao and H.D. Vinod, eds., *Handbook of Statistics, Vol. 11.* Amsterdam: Elsevier Science Publishers.

Hansen, L.P. 1982. "Large sample properties of the generalized method of moments estimators". *Econometrica,* 50: 1029–54.

Harvey, C.R. 1991. "The world price of covariance risk". *Journal of Finance,* 46: 111–57.

Harvey, C.R. 1995. "Predictable risk and return in emerging markets". *Review of Financial Studies,* 8: 773−816.

Harvey, C.R. and C.M. Kirby. 1995. "Analytical tests of factor pricing models". Duke University Working Paper. Durham, NC.

Hodrick, R. and X. Zhang. 2001. "Evaluating the specification errors of asset pricing models". *Journal of Financial Economics,* 62: 327–76.

IMF (International Monetary Fund). 2008. "De facto classification of exchange rate regimes and monetary policy frameworks". At http://www.imf.org/external/np/mfd/er/2008/eng/0408.htm

Iorio, A.D. and R. Faff. 2002. "The pricing of foreign exchange risk in the Australian equities market". Pacific-Basin Finance Journal, 10:77–95.

Iqbal, J., R.D. Brooks and D.U.A. Galagedera. 2010. "Testing conditional asset pricing models: An emerging market perspective". *Journal of International Money and Finance,* 29: 897–918.

Jagannathan, R. and Z. Wang. 1996. "The conditional CAPM and the cross-section of expected returns". *Journal of Finance,* 51: 3–53.

Jorion, P. 1991. "The pricing of exchange rate risk in the stock market". *Journal of Financial and Quantitative Analysis,* 26: 363–76.

Kodongo, O. 2011. "Foreign exchange risk and the flow of international portfolio capital: Evidence from Africa's capital markets". PhD Thesis, University of the Witwatersrand. At http://hdl.handle.net/10539/11429

Kodongo, O. and K. Ojah. 2011. "Foreign exchange risk pricing and equity markets segmentation in Africa". *Journal of Banking and Finance,* 35: 2295–2310.

Kodongo, O. and K. Ojah. 2013. "Foreign exchange rates and stock prices: Evidence from major African markets". In M. Bahmani-Oskooee, ed., *Exchange Rates in Developed and Emerging Markets: Practices, Challenges and Economic Implications.* New York: Nova Scientific Publishers.

Kolari, J.W., T.C. Moorman and S.M. Sorescu. 2008. "Foreign exchange risk and the cross-section of stock returns". *Journal of International Money and Finance*, 27: 1074–97.

Lettau, M. and S. Ludvigson. 2001. "Resurrecting the C-CAPM: A cross-sectional test when risk premia are time-varying". *Journal of Political Economy,* 109: 1238–87.

Lewellen, J., S. Nagel and J. Shanken. 2010. "A skeptical appraisal of asset pricing tests". *Journal of Financial Economics,* 96: 175–94.

Loudon, G.F. 1993. "Foreign exchange exposure and the pricing of currency risk in equity returns: Some Australian evidence". *Pacific-Basin Finance Journal,* 1: 335–54.

MacDonald, R. 2000. "Is the foreign exchange market 'risky'? Some new survey-based results". *Journal of Multinational Financial Management,* 10: 1–14.

Ndako, U.B. 2013. "Dynamics of stock prices and exchange rates relationship: Evidence from five sub-Saharan African financial markets". *Journal of African Business,* 14: 47–57.

Ogaki, M. 1993. "Generalized method of moments: Econometric applications". In Maddala et al, eds., *Handbook of Statistics, Vol. 11*. Amsterdam: North-Holland

Ostdiek, B. 1998. "The world ex-ante risk premium: An empirical investigation". Journal of International Money and Finance,17: 967–99.

Phylaktis, K. and F. Ravazzolo. 2004. "Currency risk in emerging equity markets". *Emerging Markets Review,* 5: 317–39.

Poghosyan, T. 2010. "Determinants of the foreign exchange risk premium in the Gulf Cooperation Council countries". IMF Working Paper No. WP/10/255. International Monetary Fund, Washington, D.C.

Poghosyan, T. and E. Kočenda. 2008. "Macroeconomic sources of foreign exchange risk in new EU members". IPC Working Paper Series No. 62. University of Michigan.

Schrimpf, A., M. Schroder and R. Stehle. 2007. "Cross-sectional tests of conditional asset pricing models: Evidence from the German stock market". *European Financial Management,* 13: 880–907.

Shanken, J. and Z. Zhou. 2007. "Estimating and testing beta pricing models: Alternative methods and their performance in simulations". *Journal of Financial Economics*, 84: 40–86.

Sirr, G., J. Garvey and L. Gallagher. 2011. "Emerging markets and portfolio foreign exchange risk: An empirical investigation using a value-at-risk decomposition technique". *Journal of International Money and Finance,* 30: 1749−72.

Sun, C., M. Kim, W. Koo, G. Cho and H. Jin. 2002. "The effect of exchange rate volatility on wheat trade worldwide". Agribusiness and Applied Economics Report No. 488, Centre for Agricultural Policy and Trade Studies, North Dakota State University.

Tai, Chu-Sheng. 1999. "Time-varying risk premia in foreign exchange and equity markets: Evidence from Asia–Pacific countries". *Journal of Multinational Financial Management,* 9:291–316.

Zhang, X. 2006. "Specification tests of international asset pricing models". *Journal of International Money and Finance,* 25: 275–307.

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