A comparative examination of currency risk pricing and market integration in the stock markets of Nigeria and South Africa

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Abstract

We examine the pricing of currency risk and market integration in the equity markets of Nigeria and South Africa. Using the Generalized Method of Moments with a multi-beta asset pricing model and firm-level data, we find that currency risk is partly unconditionally priced in South Africa’s stock market, with this market being largely integrated with the world equity markets. Conversely, currency risk is not priced in Nigeria’s equity market, which also shows no evidence of integration with the world equity markets. Interestingly, a portfolio analysis of firms reveals a size based return sensitivity to both world equity markets and exchange rate volatility across the two countries. Therefore, while general results suggest that Nigeria, rather than South Africa, would provide greater diversification benefits to international investors with little or no worry about hedging unconditional exchange rate risk, that view must be nuanced when considering large size firms which are consistently sensitive to the two factors across both countries.

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1. Introduction

Consistent with these developments, the world has witnessed increased flows of both portfolio and direct investment capital across borders. Most of these flows have been destined to developing countries, including several African countries. Indeed, IMF/World Bank (2008) reports that private capital flows to Sub-Saharan African countries increased almost fivefold from US$11 billion in 2000 to US$53 billion in 2007. Increase in portfolio flows to US$23 billion in 2006 was particularly rapid, reaching about 14 times the 2003 level. Private debt flows also increased rapidly after 2004. The report notes that the bulk of these flows went to South Africa and Nigeria.

In a world in which exchange rates are determined largely by market forces, the acceleration of private capital flows may present a challenge to monetary policy, because substantial inflows could lead to a buildup of balance sheet vulnerabilities and, over time, real exchange rate appreciation (IMF/World Bank, 2008). Appreciating real exchange rates may, in turn, reduce external trade competitiveness and make foreign private investors more vulnerable to diminishing exchange rate-adjusted returns. The prospect of diminishing returns may induce foreign investors to withdraw their portfolio investments, leading to a high demand for foreign currency relative to domestic currency; this may lead to real domestic currency depreciation. Therefore, random fluctuations in inflows and outflows of capital into a market may trigger random order flows in the foreign exchange...
markets that may make foreign exchange rates unstable. For finance managers of corporations with, or anticipating, direct investments in foreign capital markets, exchange rates instability subjects their firms to increased variability in future cash flows. For foreign portfolio investors, unstable exchange rates increase variability in future returns.

If these investors collectively believe that the increased variability in cash flows and returns significantly increases investment uncertainty/risk, they are likely to require a compensation/premium for the increased uncertainty/risk. In this case, foreign exchange risk is said to be priced. Foreign exchange risk may be priced in one or more sub-sectors of the financial markets of a country. As we show in Section 2 of this paper, several researchers have investigated this issue, particularly in the equity and bond sub-sectors, in different settings. However, they have documented mixed findings. Our study is an attempt to address this issue in equity markets in Africa, which have attracted relatively less discourse on the matter, largely due to limited data availability. We use firm-level data from the stock markets of South Africa and Nigeria, the two largest economies in Sub-Saharan Africa with different degrees of capital markets development and/or sophistication. The unconditional multi-factor asset pricing model provides the theoretical framework for our investigation.

The remainder of the paper is structured as follows. Section 2 reviews the literature on unconditional currency risk pricing with a brief mention of conditional foreign exchange risk pricing. Section 3 reviews the unconditional asset pricing model and presents the empirical method used in our investigation. Section 4 discusses the data. Section 5 documents and interprets the key empirical findings. Section 6 concludes and highlights some policy implications.

2. Related literature and contribution

Modern capital market theory views currency risk as the systematic risk associated with a foreign currency denominated return stream and measured by the covariance between the rate of change of the exchange rate and the domestic market return (Jacque, 1981). Currency risk is said to be priced in the stock market if equity investors demand a premium to compensate themselves for the component of stock price fluctuations that is attributable to changes in foreign exchange rates. Although it is one of the most studied issues in international finance, researchers have not been able to resolve the issue of whether or not foreign exchange risk is priced in equity markets. Early studies conducted in developed markets using unconditional asset pricing models (Jorion, 1991; Loudon, 1993) found no evidence to suggest that currency risk is priced in the stock markets. However, some studies have used similar models in different settings and markets to conclude that currency risk appears to command a significant premium in equity markets. For instance, using data from seven major countries, outside of the USA, for the 1981–1989 period, Choi and Rajan (1997) find that currency risk is a significant factor affecting asset returns, in addition to the domestic and world market risk factors. Similarly, Choi et al. (1998) find current risk to be priced in Japanese equity markets when the bilateral yen/US dollar exchange rate exchange rate is used. Other unconditional currency risk studies that have found currency risk to be priced in advanced equity markets include Ferson and Harvey (1994), Vassalou (2000) and Dominguez and Tesar (2001). Conversely, Iorio and Faff (2002) find mixed and inconclusive results for the Australian equity market, where currency risk appears to be priced for the full sample period (1988–1998) but only priced in two sub-periods when the period is partitioned into four, suggesting that currency risk is time-remaining.

Some studies have also been conducted in the emerging markets, many of them in the East Asian and Latin American regions. These studies largely conclude that currency risk is a significant factor affecting equity returns. The hypothesis that currency risk is not priced in emerging equity markets has been rejected by, among others, Claessens et al. (1998), Tai (1999), Glen (2002), and Phylaktis and Ravazzolo (2004). Further, Carrieri and Majorbi (2006) find that currency risk does command a significant unconditional risk premium in emerging stock markets at firm-, portfolio- and market-levels; their results also indicate that the size and sign of exchange risk premiums vary across countries and regions. More recently, Lin (2011) shows that there exist extensive exchange rates exposure in the Asian emerging markets during 1997–2010, with greater significance reported during the 1997 Asian crisis and the 2008 global crisis periods, despite frequent central banks’ interventions during these periods. However, these results contrast Kodongo and Ojah (2011) who fail to reject the hypothesis that currency risk is not priced in six major African equity markets for the period 1997–2009.1

International finance research has also taken a keen interest on the issue of integration of world markets. It is argued that integrated financial markets enable economies to realize their full potential by opening up investment opportunities and expanding the frontiers for accessing financing sources. By taking advantage of such opportunities, firms are presented with the potential for lowering their cost of capital while increasing their returns on invested funds. However, many scholars have argued that the flow of international money is, to a large extent, restricted by various pecuniary and non-pecuniary barriers that constrain investors’ portfolio choice and distort market equilibrium. Barriers to international investment come in the form of taxes and tariff, restrictions on security holdings, capital controls, convertibility of foreign currency as well as sovereign and political risk. Existence of barriers has led to the development of various models of capital markets segmentation (Black, 1974; Stulz, 1981; Errunza and Losq, 1983; Eun and Janakiramian, 1986).

Empirical studies in different markets across the world have examined these models and similar ones and reported conflicting results. Whereas many of the empirical findings are in support of partial equity markets integration (Saleem and Vaihekoski, 1998). Notable examples include: Dumas and Solnik (1995), De Santis and Gerard (1998), Doukas et al. (1999), MacDonald (2000), Kolari et al. (2008), Cappiello and Panigirtzoglou (2008) and Bali and Wu (2010).

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1 Although it is not the focus of this study, it is important to point out that researchers using the conditional asset pricing framework largely document that currency risk is priced both in advanced economies and emerging markets. Notable examples include: Dumas and Solnik (1995), De Santis and Gerard (1998), Doukas et al. (1999), MacDonald (2000), Kolari et al. (2008), Cappiello and Panigirtzoglou (2008) and Bali and Wu (2010).
2008; Yu et al., 2010; Mylonidis and Kollias, 2010), others support segmentation for some equity markets. The latter category includes Berger et al. (2011) who find that frontier markets neither show an indication of increasing integration through time nor exhibit consistent rates of changing integration. The authors conclude that frontier markets offer significant diversification benefits to international investors. In contrast, Kodongo and Ojah (2011) find that seven major African markets, majority of which are classified as frontier, exhibited unconditional partial equity market integration during the period 1997–2009.

Our investigation in this paper closely mirrors that of Kodongo and Ojah (2011) in the sense that we use a similar analytical framework. However, Kodongo and Ojah (2011) make use of aggregate market data which may mask important information on the response of stock returns to foreign exchange rate fluctuations and market segmentation that would be better captured through firm-level data. The current study is an attempt to deal with this potential shortcoming by performing a similar analysis using firm-level data. As far as we are aware, ours is the first attempt to jointly investigate the pricing of currency risk and equity markets segmentation with firm-level data from these two major markets of Africa.

3. Empirical procedures

3.1. The model

According to the international asset pricing theory (Solnik, 1983), the return-generating process for a portfolio in terms of a given reference currency, is a linear function of \( k \) international common factors:

\[
\tilde{r} = \tilde{R} + \delta F + \nu \tag{1}
\]

where \( \tilde{r} \), \( \tilde{R} \), and \( \nu \) are \( n \)-dimensional vectors of, respectively, random returns, expected returns and residuals such that \( E(\nu) = 0 \), \( E(\nu, F) = 0 \), \( \delta \) is an \( (n \times k) \) matrix of factor loadings, and \( F \) is a \( k \)-dimensional vector of factors. Eq. (1) assumes that the number of assets, \( n \), is sufficiently large that investors can form well-diversified portfolios and that the number of risk factors, \( k \), is much smaller than \( n \). Ross (1976) shows that the expected return vector must be a linear combination of the constant vector and the coefficient vectors; that is, there must exist a set of \( (k+1) \) coefficients, \( \lambda_0, \lambda_1, \ldots, \lambda_k \), such that:

\[
\tilde{R} = \lambda_0 + \delta \lambda.
\]

\[
\lambda_j(r_j - \lambda_0) \quad \text{are the risk premiums of each of the common factors} \quad j, \quad \text{such that} \quad r_j \quad \text{is the expected return on a security whose beta with respect to factor} \quad j \quad \text{is one, and whose beta with respect to all other factors is zero;} \quad \lambda \quad \text{is an} \quad n \text{-vector of ones.}
\]

The form of the APT presented in Eq. (2) suggests that the expected return is the sum of the risk-free rate plus a compensation for each type of risk that the security bears. Thus, if a risk-free asset with return \( r_f \) exists, we can substitute \( r_f = \lambda_0 \) and re-write Eq. (2) in the form:

\[
\tilde{R} - \nu_f = \beta \lambda.
\]

where \( \beta = \delta - \nu_0 \) are the excess return betas and \( \delta_0 \) is the beta of the risk-free asset. The term on the left hand side of Eq. (3) is the expected excess return on the portfolio. Denoting this term as \( r \) yields the well known multi-beta asset pricing model:

\[
r = \beta \lambda.
\]

It is believed in the asset pricing literature that the model in Eqs. (2) and (3) hold only as an approximation, particularly in a finite economy. In a large economy with infinitely many assets, Dybvig and Ross (1985) explain that the model holds as an exact equality under certain conditions. The magnitude of mispricing due to the approximation should be mitigated in the international context by the fact that there are more assets in the world economy than in any particular national economy (Cho et al., 1986). Solnik (1983) explains that the multi-beta asset pricing structures in (2) and (3) can be applied to the international setting in much the same way as they relate to nominal returns in the domestic setting. He demonstrates that the structure is invariant to the currency chosen and applies to a set of international assets just as it applies to a set of domestic assets. The model can fit in a structure consisting of a few international factors common to all assets, or where the sets of common factors strictly differs across national markets; it can also be applied to a situation with a combination of international factors common to all or specific types of assets plus national factors affecting only domestic markets. For these reasons, the model is popular in the empirical testing of international asset pricing relationships.

3.2. Empirical method

Plugging Eq. (2) into Eq. (1) gives:

\[
\tilde{r} = \nu_0 + \delta \lambda + \delta F + \nu \tag{4}
\]

\[
r = \beta \lambda + \beta F + \varepsilon \tag{4'}
\]

The multi-beta theoretical structures in Eq. (4) do not specify the risk factors, \( F \), that affect security returns. Researchers have traditionally employed two empirical approaches to come up with appropriate factors. The first approach uses statistical techniques such as the asymptotic principal components method of factor analysis to identify factors from a hypothesized set deemed as “priceable” factors as a result of the factors loading statistically significantly (Connor and Korajczyk, 1986). The other approach is to hypothesize the number and identity of factors and then test whether they are priced. Because Purchasing Power Parity may fail to hold exactly, international investors may...
be faced with a priced foreign exchange risk; thus, currency risk is typically included among the hypothesized factors in international versions of the model. We follow the latter approach.

Ferson and Harvey (1994) present a parsimonious framework for the study of the unconditional multi-beta asset pricing model. Following their work, we investigate the APM as a restricted seemingly unrelated regression. Introducing the time subscript, \( t \), the following model results:

\[
  r_i = (f + \lambda \otimes t) \beta + \epsilon_i \quad t = 1, 2, \ldots, T
\]

where \( f = F - \bar{F} \) are demeaned factors; \( E(f) = 0 \) for each \( j = 1, 2, \ldots, k; \ i \) is a vector of ones; and \( \otimes \) is the Kronecker product. Further, \( E(\epsilon_i) = 0 \), where \( 0 \) is a \( k \)-dimensional vector of zeros. Demeaning the factors ensures that the risk premiums, \( \lambda \), are not related in any way to the means of factors. Accordingly, economic variables, such as exchange rates, can be used in the model as if they were extracted factors. Ferson and Harvey (1994) explain that this obviates the need for mimicking portfolios and makes statistical inferences less complicated. The regression is restricted by imposing the requirement that the intercept term be zero. Following Kodongo and Ojah (2011), Eq. (5) is first tested as a two-factor return-generating process where the \( \text{ith} \) portfolio excess return \( (r_i) \) is a linear function of the demeaned excess return on the world market portfolio \( (r_w) \) and the change in the real exchange rate component \( (r_s) \) orthogonal to the world market portfolio returns. We orthogonalize the variables by regressing real exchange rate changes on excess world market returns, then using the resulting residuals in the model as outlined in Eqs. (9) and (10). Therefore,

\[
  r_{ij} = \lambda_w \beta_{iw} + \lambda_s \beta_{is} + \beta_{iw} r_{wt} + \beta_{is} r_{st} + \epsilon_{it}
\]

The currency risk factor, \( (r_s) \), has zero mean by construction. For each of the two risk factors, the parameters to be estimated are the unconditional betas \( (\beta_{iw}, \beta_{is}) \) and risk premia \( (\lambda_w, \lambda_s) \). Foreign exchange rate risk exposure is said to be priced if the coefficient \( \lambda_s \) is non-zero. The model in Eq. (6) implicitly assumes that world equity markets are fully integrated so that there are no barriers, pecuniary or non-pecuniary, to cross-border investments. South African and Nigerian equity markets, like many of its counterparts in other parts of the world, may not be fully integrated with equity markets in the rest of the world. Thus, the stringent market integration assumptions may be violated so that Eq. (6) may fail to account properly for idiosyncratic risks associated with the market. There is therefore need for a model that can reasonably capture segmentation as well as currency risk in the two equity markets. Because partial integration has been documented in many markets, we employ a partial integration framework akin to those in Choi and Rajan (1997) which assume that idiosyncratic market risk is priced in each country. Accordingly, we also investigate the following two-factor and three-factor models:

\[
  r_{it} = \lambda_w \beta_{iw} + \lambda_m \beta_{im} + \beta_{iw} r_{wt} + \beta_{im} r_{mt} + \epsilon_{it}
\]

\[
  r_{it} = \lambda_w \beta_{iw} + \lambda_m \beta_{im} + \lambda_s \beta_{is} + \beta_{iw} r_{wt} + \beta_{im} r_{mt} + \beta_{is} r_{st} + \epsilon_{it}
\]

To remove possible contemporaneous correlations among factors, we run the following separate regressions and then use the resulting residuals as risk factors:

\[
  r_{Mt} = \gamma_0 + \gamma_1 r_{wt} + \epsilon_{Mt}
\]

\[
  s_t = \gamma_0 + \gamma_1 r_{wt} + \gamma_2 r_{mt} + \epsilon_{st}
\]

where \( r_{Mt} \) is the excess return on the local equity market index; \( s_t \) is the change in real exchange rates; \( \epsilon_{Mt} \), the residual from the first regression, can be interpreted as the pure local market risk factor (henceforth labeled as \( r_{mt} \)); \( \epsilon_{st} \) is the pure currency risk factor (henceforth labeled as \( r_{st} \)). By construction, the residual factors have zero mean. Thus, all the factors in the two models are orthogonal to each other and all returns are stated in excess of the return on the risk-free asset. \( \beta_{im} \) in Eqs. (7) and (8) represents the sensitivity of the portfolio’s returns to the idiosyncratic local market risk factor; \( \lambda_m \) is the corresponding risk premium parameter. The rest of the terms are as defined earlier. The results \( \lambda_w \neq 0 \) and \( \lambda_m = \lambda_s = 0 \) imply that equity markets are fully integrated and foreign exchange risk rate is not priced. Partial integration exists if \( \lambda_w \neq 0 \) and \( \lambda_m \neq 0 \). The model is misspecified if \( \lambda_w = \lambda_m = 0 \).

The coefficients in Eqs. (6)–(8) are jointly estimated using the iterated Generalized Method of Moments (GMM) of Ferson and Foerster (1994). The iterated GMM is an improvement on the GMM of Hansen (1982) and produces estimates with better finite sample properties. Consistent with Ferson and Harvey (1994), we use a constant and the contemporaneous values of factors \( F_{j,t} \) as instruments in the GMM regression. We also assume that the data vector \( \{r_{ij}, f_{ij}; i = 1, 2, \ldots, n; j = 1, 2, \ldots, k\} \) is generated by a strictly stationary and ergodic stochastic process. Orthogonality conditions for the GMM are specified by \( E(\epsilon_{it}) = E(\epsilon_{ij}, F_{j,t}) = 0 \).

4. The data

4.1. Description and measurement of data

We assume an American resident investor seeking to secure better returns by investing in a portfolio of foreign equities. In this sense, South Africa’s and Nigeria’s stock markets are the foreign investment destinations. Our objective is to establish whether fluctuations in the value of the South African rand and the Nigerian naira inform the decisions of the American investor in allocating funds in the South African and Nigerian equity markets; that is, whether changes in the value of the rand and naira affect the ability of the two equity markets to attract foreign (American) capital. We sample observations of both foreign exchange rates and equity market indices/prices at monthly intervals.3 The end-of-period nominal rates of exchange between the US dollar (domestic currency) and the South African rand/Nigerian naira (foreign currencies) are obtained from the International Financial Statistics (IFS).

3 Several studies have ascertained that monthly time-series frequency of asset prices are better at mitigating the effects of infrequent trading and/or thin trading, both of which appear prevalent in most emerging capital markets (e.g., Bekaert and Harvey, 1997; Claessens et al., 1998; Ojah and Karemera, 1999; and others).
National stock market indices and firm level stock market prices are obtained from Datastream for the period between 1994:12 and 2008:12 for South Africa and for the period 1997:1 and 2008:12 for Nigeria, yielding a total of 168 and 143 excess return observations, respectively, for each of the 78 South African firms and 56 Nigerian firms whose data span over the sample period. The elimination of firms whose data do not span over the entire sample period may introduce survivorship bias. However, because we estimate several parameters using the GMM approach, this procedure presents us with a long data series while at the same time preserving a cross-section, over the sample period, which would strengthen the power of our statistical tests. Using market capitalization statistics, we group the firms into four size-based portfolios, the lowest market capitalization firms falling into the first portfolio, and so on. In the database, stock prices and market indices are reported in foreign currency (South African rand and Nigerian naira) terms. Index and stock returns are initially computed in South African rand and in Nigerian naira. We convert the resulting rand and naira returns into US dollar-returns, using the end-of-month nominal exchange rates, as follows:

\[ r_D = \ln(1 + r_f) - \ln(1 + S_D) \]  

where \( r_f \) is the foreign currency (rand/naira)-measured return, \( r_D \) is the domestic currency (US dollar)-measured return and \( S_D \) is the change in the value of the US dollar. We account for inflation rate differentials, in the GMM estimation, by converting nominal exchange rates to real exchange rates using consumer price indices obtained from the IFS. The real exchange rate of nominal exchange rates to real exchange rates using consumer inflation rate differentials, in the GMM estimation, by converting nominal exchange rates to real exchange rates using consumer price indices obtained from the IFS. The real exchange rate of the rand or naira is calculated as the product of the rand- or naira-price indices obtained from the IFS. The real exchange rate of the rand or naira is calculated as the product of the rand- or naira-price indices obtained from the IFS. The real exchange rate of the rand or naira is calculated as the product of the rand- or naira-price indices obtained from the IFS.

\[ RER_{rand/S} = NER_{rand/S} \times \left( \frac{CPI_{USA}}{CPI_{S.Africa}} \right) \]  

where \( RER \) is the real exchange rate, and \( NER \) is the nominal exchange rate. The relative change in the value of foreign currency, \( s_t \), used in parameter estimation, is then calculated thus:

\[ s_t = \ln S_t - \ln S_{t-1} \]  

where \( S_t \) is the real rate of exchange at time \( t \). The random rate of return is computed as follows:

\[ \tilde{r}_{i,t} = \ln P_{i,t} - \ln P_{i,t-1} \]  

where \( P_{i,t} \) is the value of national stock market index, or price of stock, \( i \) at time \( t \). The excess return is defined as the random rate of return minus the dollar one-month nominal risk-free rate. Since the study looks at the US investor as the domestic investor, the risk free rate is proxied by one-month yield on the three-month US Treasury bill, obtained from the US Federal Reserve Bank website. Because the Bank provides these data as annualized percentages, monthly yields are estimated using the following continuous compounding formula:

\[ r_{f, monthly} = \exp \left( \frac{r_{f, annualized}}{12} \right) - 1 \]  

4. Portfolio-level stock returns and real exchange rate changes

Table 1 displays the summary statistics, in respect of returns of four size-based portfolios, formed from stocks listed at the Johannesburg Securities Exchange and Nigerian Securities Exchange, respectively. The four equal-weighted portfolios are formed and ranked on the basis of market capitalization as at the end of December 2008.

Using the market indexes as the benchmarks, it is clear that all of South Africa’s portfolios underperformed the market significantly over the sample period. Thus, in this market, portfolios formed using market capitalization would be dominated by a naive investment strategy that replicates the market index. However, we also observe that portfolio 1, formed from the smallest market capitalization securities, performs the worst against the market index. Similarly, all of Nigeria’s portfolios underperformed the market index over the investigation period, the worst performer being portfolio 2 (second smallest market capitalization firms).

Use of the Sharpe measure is predicated on the modern portfolio theory, which assumes that returns are normally distributed and can therefore be described adequately by their means and standard deviations. This assumption appears to be violated by the distributions of returns as the Jarque–Bera statistic rejects, at the 1% level, the hypothesis that returns are distributed normally for all the portfolios. Nigeria’s portfolios particularly exhibit excessive leptokurtosis and substantial negative skewness, making them yield very large Jarque–Bera statistics. The violation of the normality assumption conforms to emerging empirical evidence which suggests that the assumption that stock returns follow a normal distribution is frequently violated in asset price returns: Harvey and Siddique (2000) argue that the presence of large positive skewness in the distribution of asset returns may induce investors to hold a portfolio even if it has a negative expected return; Brooks et al. (2005) provide strong evidence for the dependence of asset returns on conditional kurtosis.

In the case of Nigeria’s portfolios, the conspicuous “unusual” behavior may perhaps be explained by the behavior of exchange rates over the study period. An inspection of Nigeria’s nominal exchange rate series reveals what appears to be a devaluation event. The naira-US dollar exchange rate jumps from N21.886

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4 Vaihekoski (2009) points out that this method may produce small errors in the risk-free return series. For US Treasury bills, he proposes the formula:

\[ \ln\left(1(100dpy - R_f^{D dtm} - d)/(100dpy - R_f^{D dtm})\right) \]

Assuming 365 days in a year (dpy), 91 days to maturity (dtm) for the three-month bill, 30 days in a month (d), and annualized three-month rate (\( R_f^{D} \)) of 4.5%, this formula gives a monthly yield of approximately 0.37504% against 0.375070% given by our continuous compounding formula. The resulting computation error of 0.176% (as a percent of 0.37504) is small enough not to significantly affect the key results of our asset pricing tests.
Table 1

| Table 1: Summary statistics. | Mean | Std. Dev. | Sharpe ratio (%) | Skew | Kurt | Jarque–Bera | Autocorrelations
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<tr>
<td></td>
<td>ρ1</td>
<td>ρ2</td>
<td>ρ3</td>
<td>ρ4</td>
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<tr>
<td>Panel A: South Africa</td>
<td>0.042</td>
<td>0.075</td>
<td>-0.34</td>
<td>0.107</td>
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<td></td>
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<tr>
<td>Portfolio 1</td>
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<td>-0.010</td>
<td>-0.034</td>
<td>0.107</td>
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<td></td>
<td></td>
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<tr>
<td>Portfolio 2</td>
<td>0.077</td>
<td>-0.003</td>
<td>-0.021</td>
<td>0.075</td>
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<tr>
<td>Portfolio 3</td>
<td>0.048</td>
<td>-0.002</td>
<td>-0.011</td>
<td>0.075</td>
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<td>Portfolio 4</td>
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<td>-0.009</td>
<td>0.075</td>
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<td>Market</td>
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<td>0.011</td>
<td>0.075</td>
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<td>-1.367</td>
<td>0.075</td>
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<tr>
<td>Portfolio 2</td>
<td>0.0010</td>
<td>0.0852</td>
<td>-1.367</td>
<td>0.075</td>
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<tr>
<td>Portfolio 3</td>
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<td>0.0038</td>
<td>-1.367</td>
<td>0.075</td>
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<tr>
<td>Portfolio 4</td>
<td>0.0067</td>
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<td>-1.367</td>
<td>0.075</td>
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<tr>
<td>Market</td>
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5. Empirical results

5.1. The two-factor currency risk model

The models in Eqs. (6)–(8) are tested at the portfolio level using firm data from the stock markets of South Africa and Nigeria. All returns are expressed in US dollars. Table 2 displays GMM regression results for the two-factor foreign exchange risk model of Eq. (6). Results show that all the beta coefficients for the world equity market factor are positive, significant at the 1 percent level, and have a tendency to increase with market capitalization for South Africa (Panel A). For Nigeria (Panel B), however, the world equity portfolio’s beta coefficients are relatively small in magnitude and, save for the large market capitalization portfolio, which reports a weak significance, none of them is statistically different from zero. The world equity portfolio betas range from 0.5652 and 0.0560 for the low market capitalization portfolios to 0.8545 and 0.2430 for the large market capitalization portfolio, respectively for South Africa and Nigeria. Thus, consistent with expectations, larger firms appear to be more sensitive to changes in the world equity market than do smaller firms. On the average, an increase in return on the world market equity portfolio is associated with an increase in dollar-measured portfolio returns in South Africa’s and Nigeria’s equity markets.

The inverse relationship between foreign exchange rate fluctuations and excess dollar returns on the portfolios is captured by the negative foreign exchange risk factor loadings. Thus, excess dollar returns on South African and Nigerian equity portfolios have a tendency to decline with dollar appreciations. For both at the end of December 1998 to N85,570 at the end of January 1999, a 136 percent change. The time series trend of the change in Nigeria’s exchange rate is presented in Appendix A (see also Kodongo and Ojah, 2012). The influence of this irregular movement is witnessed in the huge overall standard deviation of Nigeria’s exchange rate returns (11.53%, the last entry in column 3 of Table 1). The same is also observed in Nigeria’s equity portfolio returns.

The autocorrelation functions show that exchange rates of the two countries are not serially correlated. However, this is not unexpected since monthly exchange rates are used. Portfolio returns generally show significant serial return dependency at one lag for South Africa. For Nigeria, the autocorrelation function is significant up to the second lag, in general. Thus, monthly portfolio returns predictability persists for approximately two months in Nigeria. In comparison to more advanced equity markets, autocorrelation coefficients of portfolio returns in the two countries are generally high (up to 45% for Nigeria’s portfolio 2), especially at the first lag. This is indicative of high return predictability, an observation that is associated, in the literature, with low levels of markets efficiency. In general, however, both South Africa’s and Nigeria’s data do not bring out any significant seasonal influence on return behavior. This is not surprising given that any such influences are idiosyncratic risk sources, which are expected to be eliminated, or substantially reduced, by blending assets together in portfolios.
countries, factor loadings are generally higher for the exchange rate factor than for the world equity market factor, implying that portfolio returns are more sensitive to changes in foreign exchange rates than to the world equity market factor. Like their world market risk factor counterparts, the absolute magnitude of foreign exchange risk factor betas generally increases with market capitalization for South Africa. All the foreign exchange risk factor loadings are statistically different from zero, mostly at the 1 percent level. Interestingly, the large and highly statistically significant foreign exchange risk factor loadings do not translate to a priced foreign exchange risk factor for Nigeria’s portfolios.

The estimated unconditional monthly risk premium for the exchange risk factor is only 0.017, which is statistically insignificant. The world equity portfolio factor also proves not to be unconditionally priced in Nigeria’s equity market; it has a risk premium of $0.0165$, which is statistically insignificant.

The negative sign of the world market risk premium documented for Nigeria deserves some attention. The equity risk premium is the extra return that equity holders expect to realize, on average, over risk-free assets, such as Treasury bills, in a given investment period. The market efficiency assumption, which underlies asset pricing models such as the one tested here, implicitly rules out risky assets (in this case common stocks) having lower expected returns than risk-free assets; this is the situation implied by the negative risk premium documented here. Negative risk premia have been documented in many empirical investigations of asset pricing models, both in advanced and emerging equity markets (Jorion, 1991; Choi et al., 1998; Carriero and Majorbi, 2006; Kodongo and Ojah, 2011).

Additionally, tests of the positivity restriction in asset pricing models have provided evidence of negative equity risk premia in various markets. For instance, using 188 years of annual data, Boudoukh et al. (1993) find evidence that the expected return on the US market is less than the risk free rate in some periods. Using the same data but a different methodology, Boudoukh et al. (1997) examine the characteristics of the US ex ante risk premium conditioned on the slope of the US term structure and find evidence of negative US ex ante risk premia. Ostleiek (1998) directly assesses the non-negativity restriction in international asset pricing models. The evidence indicates that the ex ante world market (proxied by the MSCI dollar-denominated world portfolio) risk premium can be negative. The results are robust to market proxies that are hedged and unhedged with respect to currency risk. The author also uses a local currency-denominated portfolio as a proxy to allow a test of the risk premium of the underlying market portfolio of risky assets. The evidence again shows that the ex ante risk premium on the market portfolio of risky assets is not always positive.

The estimated monthly risk premia for South Africa are respectively 4.092 and 3.095 for the world equity market factor and the foreign exchange risk factor; both are statistically significant at 10%. Therefore, as well as developments in the world equity markets, currency risk plays a significant role, in the unconditional sense, in influencing stock market returns of foreign investors’ portfolio in South Africa’s stock market. Thus, South African listed firms appear to have justification for hedging costs incurred in a bid to shield investors from foreign currency related fluctuations in earnings and returns. The unconditional pricing of the world equity market could have
implications for equity market integration; we formally test this using the two-factor market integration model (in Section 5.2) and the three-factor model (in Section 5.3).

We conduct diagnostic tests to check the appropriateness of the two-factor currency risk model specification. First, the \( J \)-statistic of Hansen (1982), a test for overidentifying restrictions, is a diagnostic check of the validity of instruments used in the GMM regression. It tests the hypothesis that instrumental variables are uncorrelated with the error term and are therefore suitable for the estimation. The \( J \)-statistic has a chi-square distribution with degrees of freedom equal to the difference between the instrument rank and the number of parameters estimated. It is clear from the reported \( p \)-values (0.7586 for South Africa and 0.8129 for Nigeria) that the \( J \)-statistics fail to reject the hypothesis that the instrumental variables used are valid for both regressions. Next, we compute the average pricing errors (APEs) for each portfolio. For South Africa, the two-factor model appears to overprice (negative pricing errors) low market-size portfolios (1 and 2) while correctly pricing the larger size portfolios (3 and 4); the absolute errors in unexplained monthly returns are not very high (0.15% and 0.18% respectively for portfolios 1 and 2) and almost negligible for the larger size portfolios. For Nigeria, however, all the portfolios appear to be underpriced (positive pricing errors) by the two-factor foreign exchange risk model. Additionally, the extent of mispricing is large, ranging from 1.01% (portfolio 1) to 6.34% (portfolio 4). Clearly, this model appears not to fit dollar returns on Nigeria’s portfolios very well.

Finally, the coefficients of determination (Adj-\( R^2 \)) show that the two-factor currency risk model explains between 40.12% (portfolio 1) and 57.11% (portfolio 4) of the returns on the four portfolios from South Africa’s equity markets and only between 12.96% (portfolio 2) and 28.02% (portfolio 1) for Nigeria’s portfolios. In general, from the diagnostic statistics, we infer that the ability of the two-factor model to explain South Africa’s equity returns improves with market capitalization. For Nigeria’s portfolios, it is not clear from the results which one of the sizes of market capitalization portfolios respond better to the two-factor foreign exchange risk model. In both cases, however, the low coefficients of determination suggest that the explanatory power of the unconditional asset pricing model could perhaps be improved by incorporating more explanatory variables. We test the appropriateness of this inference by bringing in the local market factor as an additional variable in a three-factor model setup, the results of which are presented and discussed in Section 5.3.

5.2. The two-factor market integration model

Results for the two-factor market integration model in Eq. (7) are presented in Table 3. The table shows that both the idiosyncratic local market and the world market equity factors significantly influence portfolio returns in South Africa’s stock market. For all the portfolios, all the beta coefficients are significant at the 1% level. In absolute terms, the local market factor has higher beta coefficients (ranging from 0.7406 for portfolio 2 to 0.9572 for portfolio 4) than the world market factor whose beta coefficients range from 0.4688 (portfolio 1) to 0.7582 (portfolio 4). Thus, consistent with expectation, the local market factor appears to have a bigger influence on portfolio returns than the world market factor. The pure local market factor also appears to have the upper hand than the world market portfolio in explaining Nigeria’s portfolio returns with all its factor loadings statistically significant and relatively large in absolute terms. We also observe that Nigeria’s portfolio 4 responds more to the changes in the world equity market when the local market factor is in the model (factor loading significant at 5%) than with the foreign exchange risk as the second factor in the model (factor loading only significant at 10%).

The local market and the world equity market factors are both priced in the South African stock market. The estimated monthly risk premia are respectively 4.037 and −0.030, both of which are significant at the 10% level. This finding suggests that the stock market is unconditionally partially integrated with the world equity markets. These results are consistent with Kabundi and Mouchili (2009) who use a multivariate approach based on Dynamic Factor Model to find moderate synchronization of the South African stock market with the world common equity market between 1997 and 2006. In their study, the world return explains 55 percent of variance of South African stock returns. Our partial integration findings imply that South Africa’s equity markets still provide some diversification opportunities to international investors. However, any benefits of diversification must be weighed against the impact of currency fluctuations on returns since currency risk has also been found to be priced in the same market.

For Nigeria’s portfolios, the results suggest that neither the world market nor the local market factors are priced. The estimated pricing coefficients are respectively −0.013 and −0.013, both of which are statistically insignificant. This result is unusual because it implies neither segmentation nor integration of Nigeria’s stock market with the world stock market. We believe that the apparent misspecification of the model may be explained by the behavior of Nigeria’s foreign exchange rates, which do not appear to be substantially market driven (see Appendix A and Kodongo and Ojah (2012) for a trend analysis of the naira-dollar exchange rates returns). The apparent manipulation of exchange rates by the monetary authorities, especially in the early part of the study period, has the potential of distorting the dollar returns
Table 3
GMM regression results for the two-factor market integration model $r_{it} = \beta_{im}r_{mt} + \beta_{im}r_{mt} + \lambda_m\beta_{im} + \lambda_m\beta_{im} + \epsilon_{it}$.

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>$\beta_m$</th>
<th>$\beta_m$</th>
<th>RMSE</th>
<th>Adj-$R^2$</th>
<th>APE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: South Africa</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portfolio 1</td>
<td>0.4688*** (3.47)</td>
<td>0.7646*** (7.38)</td>
<td>0.0648</td>
<td>0.3442</td>
<td>-0.0069</td>
</tr>
<tr>
<td>Portfolio 2</td>
<td>0.7200*** (4.30)</td>
<td>0.7406*** (4.97)</td>
<td>0.0600</td>
<td>0.3837</td>
<td>-0.0079</td>
</tr>
<tr>
<td>Portfolio 3</td>
<td>0.6612*** (4.46)</td>
<td>0.8449*** (9.36)</td>
<td>0.0558</td>
<td>0.5252</td>
<td>-0.0052</td>
</tr>
<tr>
<td>Portfolio 4</td>
<td>0.7582*** (6.12)</td>
<td>0.9572*** (13.32)</td>
<td>0.0529</td>
<td>0.6143</td>
<td>-0.0040</td>
</tr>
<tr>
<td>B: Nigeria</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portfolio 1</td>
<td>0.0597 (0.44)</td>
<td>0.7756*** (9.94)</td>
<td>0.0900</td>
<td>0.4069</td>
<td>-0.0010</td>
</tr>
<tr>
<td>Portfolio 2</td>
<td>0.1258 (0.80)</td>
<td>0.7125*** (8.46)</td>
<td>0.1013</td>
<td>0.3032</td>
<td>-0.0031</td>
</tr>
<tr>
<td>Portfolio 3</td>
<td>0.1008 (0.83)</td>
<td>0.7072*** (7.66)</td>
<td>0.0916</td>
<td>0.3590</td>
<td>0.0006</td>
</tr>
<tr>
<td>Portfolio 4</td>
<td>0.2429*** (2.09)</td>
<td>0.7141*** (8.12)</td>
<td>0.0862</td>
<td>0.4022</td>
<td>0.0007</td>
</tr>
</tbody>
</table>

The two values reported in the body of the table are, respectively, the coefficient of the explanatory variable and its corresponding $t$-statistic (in parentheses). The $t$-statistics are robust to heteroskedasticity and autocorrelation; the number of lags for the Bartlett kernel was set at 3, which is consistent with the Newey–West 2-lag kernel. Prob-values of the $t$-statistics are robust to heteroskedasticity and autocorrelation; the number of lags for the Bartlett kernel was set at 3, which is consistent with the Newey–West 2-lag kernel. Prob-values of the $t$-statistic are in square brackets. $r_{ij}$ is the excess return on the $i$th country equity market index; $r_{im}$ is the demeaned excess return on the world market equity portfolio; $r_{mt}$ is the pure local market factor, constructed as the excess return on the emerging markets equity portfolio orthogonal to the world market equity portfolio index; $\beta_m$ and $\beta_m$ are, respectively, the sensitivities of portfolio returns to the world portfolio and pure local market factors and $\lambda_m$ and $\lambda_m$ are the respective risk premiums, in percentages, for the two factors. Factor sensitivities and risk premia are estimated jointly for all countries. RMSE is the root mean squared error and Adj-$R^2$ (adjusted $R$-square) is the coefficient of determination; APE is the average pricing error. All index returns are measured in the US dollar and expressed in excess of one-month yields on the US Treasury bills closest to one-month maturity. This table uses monthly returns data the period from 1995:1 to 2008:12 for South Africa and 1997:2 to 2008:12 for Nigeria.

* The reported coefficients are statistically significant at 10% level.
** The reported coefficients are statistically significant at 5% level.
*** The reported coefficients are statistically significant at 1% level.

(obtained by translating domestic returns by the exchange rate). This distortion may have been carried through to the estimates.

The $J$-statistic has a $p$-value of 0.3651 for South Africa and 0.8362 for Nigeria, both indicating that the validity of instruments used in the regressions is not questionable. The average pricing errors (APEs) are all negative (ranging from $-0.40\%$ for portfolio 4 to $-0.79\%$ for portfolio 2) for South Africa, implying that this model has a tendency to overprice portfolios. Further, the APEs are larger than those obtained from the two-factor foreign exchange risk model, indication that the combination of foreign exchange risk and world equity market explains portfolio returns in South Africa better than does the combination of local equity market and world equity market factors. The Root Mean Square Errors are also relatively large, ranging from 0.0529 (portfolio 4) to 0.0680 (portfolio 2), indicating large variations in estimation errors across observations. Finally, the coefficients of determination show that only between 34.42% (portfolio 1) and 61.43% (portfolio 4) of portfolio returns are explained by the two factors.

The results are very different for Nigeria. The model appears to correctly price the larger market capitalization portfolios while overpricing portfolio 1 by 0.1\% and portfolio 2 by 0.31\%. These very substantial improvements over the two-factor foreign exchange risk model imply that portfolio returns respond more to the local market conditions than exchange rate movements, which at any rate, appear distorted. Compared to the results in Table 2, we also document substantial improvements in other diagnostics: the proportion of portfolio returns explained by the two factors now ranges from 30.32\% (portfolio 2) to 40.69\% (portfolio 1) while the variation in estimation errors also improves marginally.

5.3. The three-factor exchange rate model

Our next task is to check whether the explanatory power of the unconditional asset pricing model can be improved by allowing all the three risk factors to explain portfolio returns. Further, we seek to find out whether the pricing results obtained in the last two sections can still hold when all the three risk factors are considered together. Thus, this section also serves as a robustness check for the last two sets of results.

Results for the three-factor model of Eq. (8) are presented in Table 4. The model includes both the local market risk and foreign exchange risk factors in addition to the world equity market factor. The result of the three-factor model appears to highlight the importance of the world equity market factor in explaining portfolio returns in South Africa (compared to the first two cases where either foreign exchange risk or the local market factors are separately tested with the world market factor). The world market factor coefficient estimates show a remarkable increment for all the four portfolios. The importance of the foreign exchange risk in return prediction diminishes but the inverse relationship is maintained. The absolute magnitudes of the foreign exchange risk factor betas decline for all the portfolios but the decline is more pronounced for portfolio 4. The foreign exchange risk factor betas are all negative and statistically significant at 1\%. The importance of the local market factor in explaining returns also diminishes but the positive relationship is maintained. All
Table 4
GMM regression results for the three-factor model $r_{it} = \beta_{lw} r_{mt} + \beta_{im} r_{it} + \beta_{s} r_{st} + \lambda_{w} \beta_{im} + \lambda_{s} \beta_{st} + \lambda_{m} + \epsilon_{it}$. 

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>$\beta_{lw}$</th>
<th>$\beta_{im}$</th>
<th>$\beta_{s}$</th>
<th>$\lambda_{w}$</th>
<th>$\lambda_{s}$</th>
<th>$\lambda_{m}$</th>
<th>RMSE</th>
<th>$\text{Adj-R}^2$</th>
<th>APE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.5710*** (5.99)</td>
<td>$-0.7312^{**} (-6.33)$</td>
<td>0.7092*** (6.85)</td>
<td>0.0095</td>
<td>0.4466</td>
<td>$-0.0010$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.8584*** (7.11)</td>
<td>$-0.8189^{**} (-5.61)$</td>
<td>0.6716*** (6.01)</td>
<td>0.0617</td>
<td>0.4935</td>
<td>$-0.0012$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.7907*** (7.49)</td>
<td>$-0.7787^{**} (-7.58)$</td>
<td>0.8159*** (10.35)</td>
<td>0.0485</td>
<td>0.6410</td>
<td>$-0.0003$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.8553*** (9.38)</td>
<td>$-0.6962^{**} (-5.55)$</td>
<td>0.9453*** (14.39)</td>
<td>0.0472</td>
<td>0.6930</td>
<td>$-0.0004$</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The two values reported in the body of the table are, respectively, the coefficient of the explanatory variable and its corresponding t-statistic (in parentheses). The t-statistics are robust to heteroskedasticity and autocorrelation; the number of lags for the Bartlett kernel was set at 3, which is consistent with the Newey–West 2-lag kernel. Prob-values of the J-statistic are in square braces. $r_{mt}$ is the excess return on the ith portfolio; $r_{it}$ is the demeaned excess return on the world market equity portfolio; $r_{st}$ is the change in the South African rand-US dollar real exchange rate, orthogonal to the world portfolio index and the pure local market factor; $r_{mt}$ is the pure local market factor, constructed as the excess return on the South African equity market index orthogonal to the excess return on the world portfolio index. $\beta_{lm}, \beta_{im}$ and $\beta_{s}$ are, respectively, the sensitivities of portfolio returns to the world market portfolio index, foreign exchange rate changes and pure local market factor. $\lambda_{w}, \lambda_{s}$ and $\lambda_{m}$ are the respective risk premia, in percentages, for the three factors. RMSE is the root mean squared error and $\text{Adj-R}^2$ is the coefficient of determination; APE is the average pricing error. All index returns are measured in the US dollars and expressed in excess of one-month yields on US Treasury bills closest to one-month maturity. This table uses monthly returns data period from 1995:1 to 2008:12 for South Africa and 1997:2 to 2008:12 for Nigeria.

The reported coefficients are statistically significant at 10% level. The reported coefficients are statistically significant at 5% level. The reported coefficients are statistically significant at 1% level.

The betas for the local market factor are positive and statistically significant at the 1% level. They range from 0.6716 for portfolio 2 to 0.9453 for portfolio 4. This confirms the earlier finding that large firms appear to be more exposed to idiosyncratic factors within the local equity market than their counterparts in the smaller-firms category.

The consistency of the data with restrictions imposed by the model, as illustrated by the J-statistic ($p$-value of 0.5507), is still upheld for the three-factor structure. Under this specification, the global risk factor has a monthly premium of 4.093% which is significantly different from zero at the 10% level. The foreign exchange rate factor yields a large monthly risk premium of 2.732%, which is however not statistically significant. The local market factor yields a monthly risk premium of $-1.875\%$, which is also not significantly different from zero. Thus, the South African equity market appears to be fully integrated under the assumptions of the three-factor model – a change from the two-factor market integration structure, which gives a verdict of partial integration. Failure of the three-factor model to find either the local market or foreign exchange risk priced in the unconditional sense may be explained by the fact that both factors capture some element of changes in local macroeconomic conditions. Thus, they draw from the same set of underlying fundamentals and therefore contain largely the same information signals.

When jointly used as explanatory factors, the pricing signals are shared between them making them separately less important than the world market factor in explaining security returns. This gives the misleading impression that the South African market is fully integrated with the world markets and that currency risk is not priced in those markets.

The average pricing errors are to a large extent lower for the three-factor model than either of the two-factor structures; they are mostly negative, suggesting that the three-factor model, like the two-factor models, has a tendency to overprice portfolios in South Africa’s equity market. The same applies to the Root Mean Square Errors (RMSE), which now range between 0.0472 (portfolio 4) and 0.0617 (portfolio 2). Overall, both the two-factor and the three-factor models account for more of the return variation associated with the large-firm portfolio than the smaller-firm portfolios. However, the three-factor structure generally explains more of the portfolio returns than either of the two-factor structures: under the three-factor structure, the coefficients of determination, adjusted for degrees of freedom, range from 44.66% for portfolio 1 to 69.30% for portfolio 4.

For Nigeria’s portfolios, the absolute magnitudes of the local market factor loadings improve (in comparison to results reported in Table 3) when all the three factors are included in the model. However, there is no remarkable change (compared to Table 2) in the coefficient estimates of the foreign exchange risk factor. All the beta coefficients of the two factors remain significant at 1% whereas, for the world market factor, like in Tables 2 and 3, only the large market capitalization portfolio significantly responds to changes in the world market portfolio. The monthly foreign exchange risk premium is very small (0.013) and statistically insignificant confirming further that
foreign exchange risk is not priced in Nigeria’s stock market. Similarly, neither the local market factor nor the world stock factor commands a significant risk premium in Nigeria’s portfolio returns; thus, we are unable to draw any conclusions in respect of Nigerian stock market integration, or lack of it, with markets elsewhere in the world.

Notwithstanding the not-so-clear pricing results for Nigeria’s portfolios, the diagnostic statistics are quite clear: the \( J \)-statistic reports a \( p \)-value of 0.5541, indicating that the instruments used are valid for the regression. And, with the exception of portfolio 2, which appears to be overpriced by 0.33\% by the model, the Average Pricing Errors show that Nigeria’s portfolios are generally correctly priced by the three-factor model. However, compared to the two-factor market segmentation model, there is no remarkable improvement in both the adjusted coefficients of determination and the root mean squared errors, implying, once again, that the exchange rate factor may not be explaining much of portfolio return fluctuations beyond the explanation already provided by the local market factor. Thus, of the three factors examined, developments in the local stock market, as a whole, appear to be the single most important information source for dollar returns on Nigeria’s equity portfolios.

6. Conclusions

The pricing of foreign exchange risk has been a contentious subject in international financial economics since the 1970s when the world ushered in a new era of floating foreign exchange rates system of the Bretton Woods accords. Since fluctuations in exchange rates affect the reported earnings of multinational firms as well as the present values of their cash flows, researchers and financial managers have argued that the market price of these firms ought to reflect this fact. Consequently, financial managers have, over the years, used expensive hedging techniques to protect their firms and shareholder wealth from value erosion that may arise from fluctuations in exchange rates. Yet studies using unconditional asset pricing models continued to show that foreign exchange risk was not priced in the stock markets, particularly in advanced economies. However, recent evidence now tends to show that foreign exchange risk is time-varying and priced in many markets.

Our study contributes to this stock of knowledge by analyzing this issue in two of the most vibrant stock markets in Africa: South African and Nigeria. Our findings show that currency risk is unconditionally priced in South Africa’s stock market under the two-factor structure but shows no pricing under the three-factor structure. For Nigeria’s stock market, we find no evidence of foreign exchange risk pricing under any of the two model specifications. We also investigate the market integration hypothesis and find that South Africa’s stock market is largely integrated with the world equity market. Surprisingly, we document neither integration nor segmentation in Nigeria’s stock markets. We attribute this unusual result to the “unusual” behavior of Nigeria’s foreign exchange rates over the investigation period.

Diagnostic statistics show that the three-factor structure prices South Africa’s equity portfolios better than the two-factor structures. Similarly, pricing errors for Nigeria’s portfolios are almost eliminated under the three-factor structure. However, the proportion of portfolio returns explained by the three factors is not substantially different from the proportion explained by the two-factor market segmentation model, suggesting information emanating from the foreign exchange markets are either ignored by or do not provide a strong signal to Nigeria’s stock market traders.

Some important implications can be gleaned from these results. First, that South Africa’s stock market is partially integrated with world stock markets is an indication that international portfolio investors can realize diversification benefits by taking a position in South Africa’s stocks in addition to stocks of other countries, particularly the more advanced markets like Japan and USA which feature prominently in the MSCI world equity portfolio. However, the returns expected from such geographical diversification must be carefully weighed against fluctuating foreign currency values. Alternatively, the anticipated foreign exchange risk exposure can be hedged against foreign exchange risk. Similarly, multinationals with direct investment interests in South Africa, must design hedging strategies to cover their currency risk exposure.

For Nigeria, the lack of unconditional foreign exchange risk pricing implies that firms should find no reasonable justification for their hedging activities. However, in light of the inconclusive market segmentation results, we find it difficult to proffer informed policy guides. Rather, we recommend further investigation of these issues in Nigeria’s stock market, especially with higher frequency data and/or extended time-series which covers more of the period outside of the heavy government management of the naira-dollar exchange rates.

Appendix A. The behavior of Nigeria’s foreign exchange rate returns

See Fig. A1.

Fig. A1. Time series trend of Nigeria’s real exchange rate changes. The figure reports Nigeria’s real exchange rate changes, \( \text{ln}(S_t) - \text{ln}(S_{t-1}) \), where \( S_t \) is the real exchange rate at time \( t \), for the period 1997:2 through 2008:12. Notice the spike at month 24, representing a sudden devaluation of the nominal exchange rate by Nigeria’s monetary authorities. The spike is deemed responsible for the “abnormal” behavior of Nigeria’s portfolio returns data.