



# Foreign exchange risk pricing and equity market segmentation in Africa

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## ABSTRACT

This work is the first to investigate simultaneously the occurrence of unconditional currency risk pricing and equity market segmentation in Africa's major stock markets. The multi-factor asset pricing theory provides the theoretical framework for our model. We find strong evidence suggesting that Africa's equity markets are partially segmented. However, we find insufficient evidence to reject the hypothesis that foreign exchange risk is not unconditionally priced in Africa's stock markets. This result is robust to alternative foreign exchange rate-adjusted return measures. These findings suggest that international investors can diversify into Africa's equity markets without worrying about unconditional risks associated with foreign exchange rate fluctuations.

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## 1. Introduction

In the late 1980s and early 1990s, following pressure from the International Monetary Fund, many African countries adopted some form or another of the flexible foreign exchange rate regime. Invariably, the flexible exchange rate regime has been associated with fluctuations, sometimes wild and irregular, in the foreign exchange markets. So unstable have exchange rates been that many international asset pricing models proposed after the collapse of the Bretton Woods system give a role to currency risk as an important systematic factor affecting international asset returns. As if to take a cue, financial and portfolio managers worldwide operate on the notion that foreign exchange risk is non-diversifiable and devote huge amounts of resources to hedging their assets, liabilities and cash flows against perceived exposure to this risk.

A risk source is said to be priced if it commands a premium in the financial markets. The question of whether instability in foreign exchange markets causes foreign exchange risk to be priced in other financial markets has met inconclusive empirical answers. Studies based on unconditional asset pricing models have yielded mixed findings. Using two-factor and seven-factor arbitrage pricing model specifications, Jorion (1991) shows that the relation

between stock returns and the value of foreign currencies vis-à-vis the US dollar differs systematically across industries in the USA. He, however, finds little evidence to suggest that foreign exchange risk is priced in the stock market. Loudon (1993), using only the two-factor model with market return and foreign exchange rate change as risk factors, finds that some 30% of Australian industries exhibit significant positive currency exposure, a fact that provides a case for currency hedging. However, like Jorion (1991), he fails to detect any premium for foreign exchange rate risk in Australian equity returns.

In contrast, some researchers have found currency risk to be unconditionally priced in stock markets. Choi and Rajan (1997) perform a joint test of market segmentation and currency risk pricing using individual stock data from seven major countries, outside of the USA, for the period January 1981 to December 1989. They employ a multifactor model with domestic and world market factors and a currency risk factor. They find results indicating that the factor structure of asset returns is internationally heterogeneous and that many national capital markets can be described as partially segmented. Importantly, they find that currency risk is a significant factor affecting asset returns in addition to the domestic and world market risk factors. Similar results are obtained by Choi et al. (1998) who use the unconditional model to provide evidence that the currency risk is priced, in both weak and strong yen periods, when the bilateral yen/US dollar exchange rate measure is used. Results from their model are sensitive to the choice of

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sub-periods, suggesting that the price of the currency risk is time-varying.

Dominguez and Tesar (2001) using an augmented two-factor CAPM present results that are consistent with high degrees of foreign exchange risk exposure at both firm and industry levels across eight countries. They argue that the absence of, or weak, evidence on the relationship between international stock prices and foreign exchange rates in previous studies may be due to restrictions imposed on empirical specifications used in those studies. Iorio and Faff (2002) obtain mixed and inconclusive results for the Australian equity market. Foreign exchange risk appears to be priced, by their various versions of the two-factor model, for the full sample period (1988–1998). However, when they partition the sample into four sub-periods, they find that currency risk is only priced in two of the sub-periods, both of which coincidentally mark times of relative weakness and uncertainty in the Australian economy and a secularly weak Australian dollar.<sup>1</sup>

The preceding paragraphs suggest that the unconditional pricing of foreign exchange rate risk is associated with: (a) the extent to which the capital market is integrated with or is segmented from the world capital market, (b) the reference currency of the exchange rate determination, and (c) the time period for which the foreign exchange rate risk pricing is examined. Consequently, all else assumed constant, the more a capital market is integrated into world capital markets, the higher the likelihood of significant foreign investors participation in that capital market; in turn, these investors would be concerned about their exposure to exchange rate risk of their investment. Expectedly, the choice of currency by which investment is channeled into a capital market would best reflect investors' concerns about exchange rate risk. Furthermore, an increasingly integrating capital market whose economy progressively correlates with economies of its investors over time, is likely to reveal an evolving perception of investors' exchange rate risk.<sup>2,3</sup> African capital markets seem a fitting natural laboratory for examining these possible linkages.

The currency pricing literature on emerging markets is not extensive. Claessens et al. (1998) are among early researchers to have found evidence suggesting that currency risk is a significant factor in explaining stock returns in many emerging markets countries. Tai (1999), in a study covering five Asia-Pacific countries and the USA finds support for the idea that the predictable component in deviations from uncovered interest parity is due to a time-varying foreign exchange risk premium and not irrationality among market participants. He rejects the idea that foreign exchange risk is diversifiable and suggests that investors should be compensated for bearing it. Glen (2002) investigates stock market performance over a sample of 24 devaluation events covering eighteen emerging market countries during 1980–1999. He finds that, on average, stock returns are reduced in the period leading up to a devaluation event, but the period after the event is characterized by normal

return behavior. More recently, Phylaktis and Ravazzolo (2004) use a parsimonious multivariate GARCH-in-Mean process to find that currency risk premium is substantial and forms a big part of the total risk premium, and is bigger and more variable when markets are segmented. They find that risk premiums vary significantly over time and across markets. Similarly, Carrieri and Majerbi (2006) conduct tests at the market-, portfolio- and firm-level using a real exchange rate index, and reject the hypothesis that currency risk does not command a significant unconditional risk premium in emerging stock markets. Their estimated exchange risk pricing coefficients are generally higher than those estimated in similar frameworks for developed markets and, with cross-sectional data at the firm level, there is indication that the size and sign of exchange risk premiums vary across countries and regions.

Overall, empirical evidence suggests that, unlike in developed markets where weak significance is largely reported, currency risk pricing appears to be important in emerging stock markets. Stock markets in Africa are relatively less developed than their counterparts in Latin America and South East Asia, where many emerging markets currency risk pricing investigations have been based. Many of the African stock markets are still regarded as nascent and peripheral to the major world markets and are characterized by few listed securities with low turnover. Foreign investor participation in these markets is sometimes limited by such barriers as restrictive trading rules, poor regulatory enforcement, weak accounting and disclosure standards, information asymmetries, and fear of political uncertainties. Clearly, whether the findings from emerging markets external to Africa can be generalized to Africa's largely evolving stock markets is an open empirical question. We endeavor to answer this significant research question. We use the unconditional multi-factor asset pricing model to examine whether Africa's major equity markets (i) are unconditionally segmented/integrated and (ii) price foreign exchange rate risk.

The remainder of the paper is structured as follows. Section 2 presents the model and empirical method used to estimate it. Section 3 describes the data and provides some summary information on the sampled African stock markets. Section 4 presents the primary empirical estimates of the models. Section 5 explores additional tests as a way of providing robustness checks for the baseline tests. Section 6 concludes the study by summarizing the key findings, and pointing to possible areas needing future research intervention.

## 2. The model and empirical method

### 2.1. The model

The Arbitrage Pricing Theory (APT), proposed by Ross (1976) and later extended to the international framework by Solnik (1983), provides the theoretical foundation for the unconditional empirical models used in this study. According to the model, the return-generating process for a portfolio in terms of a given reference currency, is a linear function of  $k$  international common factors:

$$\tilde{r} = \bar{R} + \delta F + \nu \quad (1)$$

where  $\tilde{r}$ ,  $\bar{R}$ , 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

<sup>1</sup> Other studies that give a role to foreign exchange risk in the unconditional multi-beta setting include Ferson and Harvey (1994), Vassalou (2000) and Hsin et al. (2007). The first two find that currency risk is among factors that command a risk premium in major world economies. The latter reveals a vital role by lagged currency effects: inclusion of lagged effects into the exposure proxy alters the significance of currency risk for individual stocks.

<sup>2</sup> In this scenario, one would expect investor's expectation of foreign exchange rate risk to be on the decline over time, all else assumed constant. Where the economy of the integrating capital market remains less correlated with its investors' economy, these investors' perception of exchange rate risk would rationally be significant.

<sup>3</sup> It is worth noting at this point that in the conditional asset pricing framework, which is not the focus of the current study, researchers largely document that currency risk is priced both in advanced economies and emerging markets. See Dumas and Solnik (1995), De Santis and Gerard (1998), Doukas et al. (1999), MacDonald (2000), Kolari et al. (2008) and Capiello and Panigirtzoglou (2008). Other researchers, notably Kocenda and Poghosyan (2009) have investigated the macro-economic sources of foreign exchange risk and provided interesting results.

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