Cointegration of Equity Returns in Brazil, Russia, India, China and South Africa (BRICS)

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Introduction and Literature Review

Improvements in technology have reduced informational barriers that formerly restrained investment in international markets (Bekaert et al. 1995). An overall movement towards fewer capital controls and reducing other market inefficiencies (e.g. poor credit ratings, high and variable inflation, exchange rate controls, etc) due to globalization implies that equity markets are converging towards financial and economic integration over time (Bekaert, Harvey, Lundblad, Siegel 2011). Integration of emerging market economies into the world financial markets is generally followed by: a significantly larger and more liquid equity market, returns which are more volatile and more correlated with world market returns, a lower cost of capital (and thus lower risk premiums and increased investment), improved credit ratings, real exchange rate appreciation, and increased economic growth (Bekaert, Harvey, Lumsdaine).

Research Question

Over the next decade, the importance of the BRICS, and especially China, in world GDP will grow vastly. The IMF predicts that they will account for as much as 61% of global growth by 2016. This invites pertinent questions about the economic impact of fiscal and monetary policies in these countries, not only on the global economy, but also on the other members of the BRICS. We examine the cointegration of these countries’ market returns over time, their response to economic shocks, and their intertwined Granger Causalities.

Theoretical Model

Take a one-period forward, forming a competitive market.

We will use the profit-maximizing firm function

\[ P = P(C, F, y) = y - C(y) \]

where \( y \) is the net cost of capital with \( y_i \) being the interest rate and \( C \) being the depreciation rate.

By taking the first-order condition with respect to capital, we obtain

\[ r = \frac{\partial P}{\partial C} = \frac{\partial P}{\partial y} \]

in a balanced growth path, \( F = F^c \), and constant over time. Therefore, in the balanced-growth path, \( r \) is constant over time meaning, \( \beta \) is the net interest rate constant over time.

With increased liquidity in addition to capital flows and liberalization, the equity premium decreases, which reduces the cost of capital. The marginal product of capital of all firms will decrease to reflect the new cost of capital, which means, private investment and stock market returns increase. With newly liberalized financial markets, investors will be able to take advantage of cross-market arbitrages, and thus cross-market returns will converge.

Hypothesis

The loosening of capital controls in the 1980s and 1990s, along with increased availability of financial information, has caused the price of risk to be equalized across assets. We therefore expect to see diminishing differentials in BRICS equity returns over time as different markets now demand the same compensation (i.e. returns should be converging).

Data

MSCI Emerging Markets Index (1993-2013, monthly)

Methodology

(1) Testing for stationarity

- Unit root, Dickey-Fuller Test

(2) Testing for Cointegration

- Extracting long run component variable from level model

- Testing the significance of long-run component in the Error Correction Model.

(3) Granger Causality Test

- Testing the joint significance test of lagged variables.

(4) Graphical Viewing of Impulse Response Functions (IRF)

Models

Error correction model (ECM)

\[ \Delta y_t = \alpha_0 + \alpha_1 y_{1,t-1} + \alpha_2 y_{2,t-1} + \alpha_3 y_{3,t-1} + \epsilon_t \]

Vector Auto-regression Model (VAR) (Optimal Lag=1)

Graphical Results

MSCI Equity Returns of the BRICS

Graphical Results

MSCI Equity Returns of the BRICS

Numerical Results

Granger Causality Matrix

Brazil - China Yes***

China - Russia Yes***

Russia - India Yes***

India - South Africa No

South Africa - Yes***

P-Values: ***=1%, **=5%, *=10%

Cointegration between Brazil, India, & South Africa

Cointegration between China & Russia

Discussion

The test for stationarity confirmed that MSCI returns in the BRICS are following a trend, and we needed to adjust for this non-stationarity (by differencing) in our model. The Error Correction Model suggest that the returns to equity in the BRICS follow a long-term trend. This result implies that if a shock drives any of these returns away from the current trend, in equilibrium, these returns will revert back to the trend.

Our Granger Causality tests suggest that beyond cointegration, some of these markets Granger-cause each other. For example, equity market returns in South Africa, Granger-causes returns in all the other BRICS at the 1% significance level. In other words, one can use the results from the returns of one country to predict the returns from another.

Because we orthogonalized the errors in the impulse response function, we can guarantee the consistency of the impulse response functions (IRF). With these functions, we can predict the impact that a shock on one country’s returns will have on another.

Conclusion and Further Research

Our analysis of equity returns in the BRICS showed evidence of co-integration between returns in the BRICS, and that some of the returns Granger-cause each other. Further, we note that shocks in some markets’ returns will affect others. Therefore, our study leaves room for forecasting the future extent of correlation, and investigating the underlying force of the co-integration.

We suspect that the driving force behind the cointegration is globalization. Further research will employ structural VAR modeling techniques to tease out multi-directional influences.

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References


