Article

Assessing Financial Integration of BRICS Equity Markets: An Empirical Analysis

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Abstract

This article examines the degree of financial integration among the equity markets of Brazil, Russia, India, China, and South Africa (BRICS) by using monthly data collected for the period 2005–2014. The study employs Johansen cointegration test, vector error correction model (VECM), and Granger causality test which confirm the existence of relationship in the short and long run among the equity markets of BRICS. Further results exhibit that there exists cointegration or a long-run relationship among the equity markets, but weak cointegration, though the results of Granger causality test do not display existence of any causality among market pairs such as China–Brazil, Russia–Brazil, South Africa–Brazil, Russia–China, and South Africa–India. The results indicate that even though the financial integration among the equity markets of BRICS is on ascendance, it is yet incomplete. This work suggests harmonization of laws, regulations, and operations based on international principles and appropriate regulatory supervision among BRICS nations in order to minimize the risk of financial integration, besides further relaxing restrictions on capital account for expedited financial integration.

Keywords

Financial integration, BRICS, Johansen cointegration test, equity market

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Introduction

The economic liberalization in most of the Third-World countries during the 1980s and 1990s led to greater integration of their domestic financial markets with the global one, paving the way for enhanced flow of capital. It may be noted that financial integration refers to the extent the domestic financial markets are connected to each other at the domestic, regional, or international levels (Agénor, 2003; Ayuso & Blanco, 2001; Fahami, 2011; Worthington & Higgs, 2010). There are two approaches to measure the level of financial integration, namely de jure and de facto. The de jure approach measures financial integration by counting the relaxed number of legal restrictions that otherwise constrain the flows of capital, though mere this action does not indicate actual degree of integration, as only removal of restrictions on capital flows may not ensure a growth in capital flows. The de facto approach, on the other hand, measures the actual financial integration either by measuring the actual cross-border capital flows or by measuring the convergence of prices of financial assets. The "law of one price" is used as the theoretical background to measure financial integration in price-based measures. Under this law, given the risk, greater financial integration leads to greater convergence of prices of assets of similar nature. Thus, convergence of asset prices between countries can be used to measure the degree of financial integration, while quantity-based measures use actual financial flows and cross-border assets holding to measure financial integration (Park, 2014).

The present article uses price-based de facto measures of financial integration for measuring the financial integration among the equity markets of Brazil, Russia, India, China, and South Africa (BRICS). Interestingly, a financial market is a very huge and highly heterogeneous domain involving variety of components such as bond markets, equity markets, and money markets which vary from one to another in terms of risk and liquidity. With this heterogeneity, it is very difficult to measure financial integration by taking the entire financial market and estimating the convergence of asset prices of various segments (RBI, 2007). The present study, therefore, measures only the convergence of asset prices of equity markets of BRICS as representative to the whole financial markets of BRICS.

Capital Account Liberalization Policies Adopted by BRICS

One of the important benefits of financial integration is the flow of capital from capital surplus countries to capital deficient countries (Agénor, 2003; Gourinchas & Jeanne, 2006; Prasad, Rajan, & Subramanian, 2006). Hence, without capital account liberalization, financial integration is not possible. In fact, capital account convertibility represents de jure measure of financial integration. This section, therefore, examines the capital account liberalization policies adopted by BRICS as a precursor to the empirical analysis.

Brazil

Capital account liberalization initiatives were undertaken in Brazil simultaneously with trade reforms in the 1990s. The high and volatile inflation of the 1980s and the early 1990s constituted a major obstacle to the development of well-organized financial markets in Brazil (Ter-Minassian, 2012). As a result, Brazil adopted "Plano Real" in 1994 to combat the problem of hyper-inflation. Reforms, including relaxation on the restrictions of entry of foreign banks, were made during this period. Inflows of foreign direct investment (FDI) were encouraged in the early 1990s, by relaxing barriers in certain sectors and by reducing bureaucratic obstacles. Brazilian government in 1991 granted permission to foreign institutional investors for investing in equities of domestic firms. In 1992, the Central Bank of Brazil relaxed the

outflows of capital by introducing a special non-resident account called CC5 to be freely operated by foreign financial institutions with respect to foreign currencies transactions. The Central Bank in 1994 increased the minimum maturity requirement for capital inflows in order to reduce the upward pressure on exchange rate, and outflows were encouraged by allowing pre-payment for foreign borrowings and allowing import finance. The restriction on current account transactions was fully removed by 1999, facilitating full convertibility in current account of Brazil (Lattimore & Kowalski, 2011).

Russia

The period from 1991 to 1998 was extremely volatile for Russia, as this was the time when the economy was migrating from command to a market economy in a very short period. During this period, trade reforms and capital account liberalization were undertaken, though the economy was not prepared for big bang reforms precisely because of its weak institutional mechanism. The government also removed restrictions on capital account by relaxing restrictions on non-resident portfolio investment in 1994 and completed it by 1998 (de Paula, 2008). However, the inflationary pressure and the weakening of Russian currency and consequently massive capital outflows in 1998 forced the government to restore control over capital outflows. Besides, trading in short-term treasury bills was suspended, and maturity of domestic debt was extended (Pinto & Ulatov, 2012). However, Russia recovered from the crisis very rapidly with the timely global rise in oil prices and a massive rise in its foreign exchange earnings. The capital controls were lifted and full capital account convertibility was accomplished in 2006.

India

Capital account liberalization in India was initiated after the balance of payment crisis of 1991. India followed a cautious approach while liberalizing the capital account, though it had decided to open up the economy by reducing the tariffs and liberalizing the capital account. Full convertibility of current account was completed in 1994 (de Paula, 2008). However, in the case of capital account, a more cautious and vigilant approach was adopted as it partly opened it up by allowing limited access to FDI in select group of high-priority industries, that is, 51 percent foreign equity ownership. Since then, their scopes were gradually expanded in the next two decades. Liberalization of portfolio investment was started in 1992. Initially, secondary equity market was opened up followed by primary equity market. The main reason for this cautious approach was to promote long-term capital in the form of FDI and foreign institutional investment (FII) that will provide enough finance for growth. The flow of short-term capital was restricted since these were the main factors for volatility in other countries during the 1990s. In the case of external commercial borrowings, liberalization was limited, as it required prior approval from the government (Dasgupta, 2014; de Paula, 2008). Capital inflows were relaxed, but tough controls were maintained for capital outflows, especially in the case of residents. Recently, some relaxations were introduced in order to enable Indian companies to invest abroad.

China

Capital account liberalization played a crucial role in achieving economic advancement in China by facilitating the inflows of foreign investment. The rapid growth of Chinese economy since 1978 was due to a gradual approach toward reforms. Prior to 1978, China had a highly controlled exchange rate system with very little foreign capital inflow. The reforms of 1978 included a combination of trade and capital account liberalization (Morrison, 2014; Rawski, 2011; Zhu, 2012). Current account convertibility was completed in 1996. China unified its dual exchange rate system in 1994

and maintained a managed float thereafter. While the controls on inflows and outflows on non-residents were loosened, restrictions were still maintained on the residents (Hansakul, Dyck, & Kern, 2009). The policy followed by China is very flexible. After the Asian financial crisis in 1997, there were large capital flights from the East Asian economies; in order to prevent such flows, China tightened the controls on capital outflows. Even the transactions in the current account were carefully scrutinized. In 2001, China joined WTO and committed for developing a market-oriented economy. Full capital account convertibility became one of the goals of China's economic policies.

South Africa

South Africa introduced capital account liberalization after the democratic transition in 1994. After years of international sanctions and isolation, the new government tried to reintegrate the economy into the global one, by gaining greater access to capital which was crucial to increase production and expedite growth. The period before transition is characterized by capital controls and restrictions. The first legislation related to capital controls was the Currency and Exchanges Act of 1933, which was operationalized in the sterling area. The sterling area means those countries that have adopted British Sterling and have their currency or had their currency pegged against British Sterling. South Africa was under the sterling area from 1933 until the mid-1970s (Khumalo & Kapingura, 2014). This Act was mainly enacted to control outflows of capital to countries that were not the part of sterling area. While capital flows among themselves were allowed by the Act. It was amended in 1961 to include new measures to control capital flows. The winds of change toward capital account liberalization began after the elections of 1994. The new government adopted a gradual approach toward capital account liberalization. Restrictions were firstly removed for transactions related to non-res-idents. Later on, current account was liberalized and also restrictions on residents and domestic institutions were gradually removed (Khumalo & Kapingura, 2014). The reforms were started with the unification of dual exchange rate system that was introduced in the 1960s to shield the economy from external fluctuations (Edwards, 2005; Hassan, 2013; Rodrik, 2008).

Literature Review

Several empirical studies have assessed the degree of financial integration among different countries. For instance, Holmes and Pentecost (1999) examined the level of financial integration in the European Union (EU) and found convincing evidence of financial integration among all economies of the EU, except for Great Britain. Hunter (2006) investigated if equity markets of Argentina, Chile, and Mexico have become internationally integrated in the post-liberalization period and reported that these markets were not even appropriately integrated with each other. Lagoarde-Segot and Lucey (2007) studied the capital market integration of Middle Eastern and North African (MENA) countries and its relations with the EU, the United States, and the regional markets. The results suggested that there was no long-run bi-variate relationship between each of these markets and the EU, the United States, and the regional markets. Park (2014) found evidences of greater integration of capital markets of emerging economies of Asia after making a detailed theoretical and empirical study on the issue. Chittedi (2010) undertook a study on the integration of the stock markets of the BRICS nations in general and their integration with the developed countries stock markets such as the United States, the United Kingdom, and Japan. The results suggest that there was no cointegration relationship between BRIC countries and developed world, namely the United States, the United Kingdom, and Japan. Joshi (2013) analyzed the relationship and cointegration of stock prices of BRIC countries' stock

markets and found the evidence of strong positive correlation of India's stock prices with that of Brazil and Russia. Bonga-Bonga (2012) assessed the extent of the transmission of financial shocks between South Africa and other BRICS members during 1996–2012 and found evidence of cross-transmission and dependence between South Africa and Brazil, although the empirical results indicated that South Africa was more affected by crises emanating from China, India, and Russia than other way round. Bellotti and Williams (2010) examined the stock market integration among the BRIC countries by using an asymmetric multivariate GARCH model with time-varying variance–covariance structure to estimate conditional price discovery and volatility transmission processes across Foreign Exchange, domestic, and international stock market price returns in the BRIC countries. The results indicated that intra and international financial integration of BRIC markets and international markets was incomplete.

Most of these studies found enhanced level of integration among the stock market of BRICS. However, these studies used the data of stock market indices of a particular stock exchange of each BRICS country, which did not represent the whole equity market.

Data Sources and Methodology

Data Sources

The study is based on secondary data comprising monthly value-weighted equity market indices of five markets from BRICS. The data have been taken from Morgan Stanley Capital International-Barra (MSCI) in US dollar terms and belong to the period January 2005–December 2014. The index constructed by MSCI is able to capture 85 percent market capitalization of major industries in a country, thus believed to be a good representation of the equity market of a country.

Methodology

The convergence of asset prices of equity markets of BRICS has been estimated with the help of cointegration technique, as suggested by Johansen in 1988 and Johansen and Juselius in 1990, and the vector error correction model (VECM). Before applying Johansen cointegration test, the data have been checked up for the stationarity with the help of augmented Dickey–Fuller (ADF) test as the cointegration technique requires time series data to be integrated of the same order (Dickey & Fuller, 1979; Johansen, 1988).

Johansen Cointegration Test

Long-run relations can be obtained with the help of a procedure suggested by Johansen in 1988 and Johansen and Juselius in 1990.
The equation is as follows:

$$Y_t = \mu + \Pi_1 Y_{t-1} + \Pi_2 Y_{t-2} + \ldots + \Pi_p Y_{t-p} + \varepsilon_{t,} \quad (1)$$

where Y_t is an n × 1 vector (column vector of Brazil, China, India, Russia, and South Africa) of variables that are integrated of the order one (i(1)) and ε_t are n × 1 vectors of innovation as it is called in cointegration literature or error term which is independently and normally distributed with zero mean and covariance matrix Λ. Π_1 –Π_p are n × n coefficient matrices and μ is an intercept vector.

Equation (1) is nonstationary or has unit root, and hence it has to be written in first difference form by subtracting both sides of the equation by Y_{t-1}. By doing so, we get,

$$\Delta Y_t = \mu + \Gamma_1 \Delta Y_{t-1} + \Gamma_2 \Delta Y_{t-2} + \ldots + \Gamma_p \Delta Y_{t-p} + \Pi_p Y_{t-p} + \varepsilon_{t,} \quad (2)$$

where $\Gamma_p = -I + \Pi_1 + \Pi_2 + \ldots + \Pi_p$ and $\Pi = -\Gamma_p$.

The matrix Π in Equation (2) is called the impact matrix because it determines the extent to which the system is cointegrated. The matrix shows long-run relationship. Since the above equation is in the first difference form, all the coefficients must be stationary if the variables are cointegrated; thus, Π must be stationary (Johansen & Juselius, 1990).

Johansen (1988) suggested two tests for determining the number of cointegrated equations, namely trace statistics (J_{trace}) and maximum eigenvalue statistics (λ_{max}).

$$J_{trace} = -T \sum_{i=r+1}^{N} \ln(1-\hat{\lambda}), \quad (3)$$

where T is the number of sample observations and $\hat{\lambda}$ is the estimated value for the *i*th ordered eigenvalue from the Π matrix. The standard approach to the Johansen maximum likelihood (ML) procedure is to first calculate the trace and maximum eigenvalue statistics, and then compare these with the appropriate critical values. This test is based on the log-likelihood ratio and is conducted sequentially. It tests the null hypothesis that the cointegration rank is equal to r against the alternative that the cointegration rank is *n*.

$$\lambda_{max} = -T\ln(1-\lambda_{r+1}). \quad (4)$$

This test is also based on the log-likelihood ratio and is conducted sequentially. The name comes from the fact that the test statistic involved is a maximum generalized Eigenvalue. It tests the null hypothesis that the cointegrated rank is equal to r against the alternative that the cointegration rank is equal to r + 1.

Vector Error Correction Model

Once long-run relation is established using the above procedure, the VECM is used to determine the short as well as long-run relationship (Engle & Granger, 1987; Granger, 1988). VECM is a multivariate version of error correction model (ECM) and is used to estimate the short-run disequilibrium, once equilibrium or cointegrating relationship has been established in the long run.

Empirical Result

Results of ADF Test

Table 1 displays the results of ADF test for all the variables used in the analysis at levels as well as at first difference. The number of lags used in the test is determined by Schwartz Bayesian information criterion. In the ADF test, the null hypothesis is that the variable is nonstationary against the alternative hypothesis that the variable is stationary. Here, the computed value of the test statistic is compared with the critical values, and the probability values can also be used for rejecting null hypothesis. If the computed value of *t*-statistic is more than the critical value, and probability values are less than 5 percent, then the null hypothesis is rejected and the variable is assumed to be the stationary. From the results exhibited in Table 1, it can be seen that, at levels, all the variables are nonstationary and they are stationary at first difference.

Table 1. Results of ADF Test

Variables at Level	t-statistic	Critical Values at 5%	Prob.	Remarks
Brazil	–1.58007	–3.452358	0.7945	Nonstationary
China	–2.116596	–3.452358	0.5304	Nonstationary
India	–2.006355	–3.452358	0.591	Nonstationary
Russia	–2.690152	–3.452764	0.2429	Nonstationary
South Africa	–2.624334	–3.452358	0.2706	Nonstationary
After "1st" Difference				
Δ Brazil	–8.698439	–3.452764	0	Stationary
Δ China	–9.376222	–3.452764	0	Stationary

(Table 1 continued)

(Table 1 continued)

Variables at Level	t-statistic	Critical Values at 5%	Prob.	Remarks
Δ India	–10.09987	–3.452764	0	Stationary
Δ Russia	–8.581191	–3.452764	0	Stationary
Δ South Africa	–11.14089	–3.452764	0	Stationary

Source: Authors' own calculations.
Note: "Δ" indicates first difference of equity market index of BRICS.

Results of Cointegration Analysis

Tables 2 and 3 present the results of trace and maximum eigenvalue statistics from which the number cointegrated equation or long-run or equilibrium relationship among the variables can be found. The null hypothesis is rejected when the calculated value of trace statistics and maximum eigenvalue statistics is more than their critical value at 5 percent level of significance. The results indicate that both the trace and maximum eigenvalue statistics have one cointegrated equation in the system which implies that there exists a long-run relationship among the equity markets of BRICS.

Table 2. Results of Johansen Cointegration Test: Trace Statistics

No. of Cointegrated Equations					
Null Hypothesis	Alternate Hypothesis	Eigenvalue	Trace Statistics	0.05 Critical Value	Prob.
r = 0[a]	r ≥ 1	0.294537	76.93754	69.81889	0.0121
r ≤ 1	r ≥ 2	0.215764	42.04740	47.85613	0.1574
r ≤ 2	r ≥ 3	0.095015	17.74293	29.79707	0.5851
r ≤ 3	r ≥ 4	0.05549	7.759255	15.49471	0.4915
r ≤ 4	r ≥ 5	0.020294	2.050321	3.841466	0.1522

Source: Authors' own calculations.
Note: "[a]" indicates the rejection of null hypothesis at 5 percent level of significance.

Table 3. Results of Johansen Cointegration Test: Max Eigen Statistics

No. of Cointegrated Equations					
Null Hypothesis	Alternate Hypothesis	Eigenvalue	Max Eigenvalue	0.05 Critical Value	Prob.
r = 0[a]	r ≥ 1	0.294537	34.89014	33.87687	0.0378
r ≤ 1	r ≥ 2	0.215764	24.30447	27.58434	0.1245
r ≤ 2	r ≥ 3	0.095015	9.983678	21.13162	0.7462
r ≤ 3	r ≥ 4	0.05549	5.708935	14.2646	0.6508
r ≤ 4	r ≥ 5	0.020294	2.050321	3.841466	0.1522

Source: Authors' own calculations.
Note: "[a]" indicates the rejection of null hypothesis at 5 percent level of significance.

Results of VECM

Once equilibrium or cointegrating relationship was established in the long run, VECM is used to estimate the short-run disequilibrium. Error correction term (ECT) tells the speed of adjustment or time taken to correct the disequilibrium in the short run and converge with the long-run equilibrium. Table 4 reports the results of VECM. The coefficient of ECT is negative and significant at 5 percent level of significance for all the five models, which suggest that the speed of adjustment toward long-run equilibrium, due to disequilibrium in short run, is 31, 5, 13, 8, and 9 percent per month (data is monthly in nature) for Brazil, Russia, India, China, and South Africa, respectively. The coefficient of the VECM indicates the causality in the Granger sense in the short run. The results establish that in the short run, the equity markets of China, India, and Russia Granger cause Brazilian equity market; the equity markets of Brazil, China, and India Granger cause Russian equity market; the equity markets of China and Russia Granger cause Indian equity market; the equity markets of India and South Africa Granger cause Chinese equity market; and the equity markets of India and China Granger cause South African equity market.

Table 4. Results of VECM

	Brazil	Russia	India	China	South Africa
D(Brazil) 1	—	2.211983 (0.004)[a]	0.072283 (0.660)	–0.066339 (0.638)	0.005901 (0.925)
D(Brazil) 2	—	–0.193231 (0.812)	0.072559 (0.678)	0.210095 (0.152)	0.046583 (0.486)
D(Russia) 1	–0.046689 (0.250)	—	–0.060706 (0.086)[b]	0.028451 (0.796)	0.00157 (0.907)
D(Russia) 2	0.087045 (0.030)[a]	—	0.064363 (0.064)[b]	0.113785 (0.276)	0.015042 (0.254)
D(India) 1	–0.407654 (0.031)[a]	–1.82011 (0.017)[a]	—	–0.061907 (0.615)	–0.061785 (0.319)
D(India) 2	–0.853346 (0)[a]	–2.27857 (0.002)[a]	—	–0.273293 (0.026)[a]	–0.261887 (0)[a]
D(china) 1	0.977306 (0.145)	3.599103 (0.183)	1.217985 (0.037)[a]	—	0.506882 (0.024)[a]
D(china) 2	2.048415 (0.003)[a]	7.710272 (0.006)[a]	2.627184 (0)[a]	—	0.606355 (0.008)[a]
D(South Africa) 1	–0.287527 (0.560)	–0.589604 (0.767)	–0.060623 (0.887)	–0.221904 (0.168)	—
D(South Africa) 2	0.074142 (0.876)	0.337589 (0.860)	–0.250767 (0.544)	–0.31818 (0.052)[a]	—
ECT	–0.319257 (0)[a]	–0.051557 (0)[a]	–0.130025 (0.015)[a]	–0.08563 (0.012)[a]	–0.090152 (0.007)[a]

Source: Authors' own calculations.

Notes: Values within parentheses "()" indicate the *p*-value, "[a]" indicates significant at 5 percent level of significance, "[b]" indicates significant at 10 percent level of significance, and "D" first difference operator.

Table 5 displays the results of diagnostic test for the VECMs which suggest that all the models are normally distributed with probability of Jarque–Bera statistics more than 5 percent. The models also do not suffer from the problems of serial correlation and heteroscedasticity. The probability values of *F*-statistic of Breusch–Godfrey serial correlation LM test and Breusch–Pagan–Godfrey test are more than 5 percent.

Table 5. Diagnostic Test

	Brazil	Russia	India	China	South Africa
Normality Test (Jarque–Bera Statistic)	0.304585 (0.8587)	0.017336 (0.9913)	1.596368 (0.4501)	1.777467 (0.4111)	5.484576 (0.0644)
Serial Correlation (Breush–Godfrey Serial Correlation LM Test)	1.597078 (0.2081)	1.309617 (0.2750)	0.220677 (0.8024)	1.238753 (0.2936)	0.027424 (0.9730)
Heteroscedasticity Test (Breusch–Pagan–Godfrey)	0.550999 (0.9037)	0.977336 (0.4854)	1.106353 (0.3627)	1.418613 (0.1505)	0.572902 (0.8883)

Source: Authors' own calculations.
Note: Values within parentheses "()" indicate the *p*-value.

Results of Granger Causality Test

Table 6 shows the results of Granger causality test. The result reveals that there is bidirectional causality in the equity markets of India–Brazil and India–China; unidirectional causalities between market pairs China–South Africa, India–Russia, and Russia–South Africa equity markets; and no causality among market pairs China–Brazil, Russia–Brazil, South Africa–Brazil, Russia–China, and South Africa–India.

Table 6. Results of Pair-wise Granger Causality Test

Null Hypothesis	*F*-statistic	Prob.	Results	Direction
C* does not Granger cause B	1.19581	0.3178	NC	
B does not Granger cause C*	1.15466	0.3359	NC	None
I does not Granger cause B	3.53722	0.0098	C	
B does not Granger cause I	2.94041	0.0244	C	Bidirectional
R does not Granger cause B	1.44999	0.2237	NC	
B does not Granger cause R	1.73473	0.1487	NC	None
SA does not Granger cause B	0.93991	0.4444	NC	
B does not Granger cause SA	0.80566	0.5246	NC	None
I does not Granger cause C*	2.34176	0.0604	C	
C* does not Granger cause I	6.42226	0.0001	C	Bidirectional
R does not Granger cause C*	1.34321	0.2597	NC	
C* does not Granger cause R	1.06227	0.3796	NC	None

(Table 6 continued)

(Table 6 continued)

Null Hypothesis	*F*-statistic	Prob.	Results	Direction
SA does not Granger cause C*	0.85446	0.4944	NC	
C* does not Granger cause SA	2.21907	0.0727	C	Unidirectional
R does not Granger cause I	4.31476	0.0030	C	
I does not Granger cause R	0.34792	0.8449	NC	Unidirectional
SA does not Granger cause I	0.75384	0.5579	NC	
I does not Granger cause SA	1.47859	0.2148	NC	None
SA does not Granger cause R	0.90066	0.4669	NC	
R does not Granger cause SA	2.52942	0.0455	C	Unidirectional

Source: Authors' own calculations.
Notes: "C*" stands for China's equity market, "B" for Brazil's equity market, "R" for Russia's equity market, "I" for India's equity market, "SA" for South Africa's equity market, "NC" for no causality, and "C" for causality.

Conclusion

The results suggest that there is an overwhelming existence of cointegration among the equity markets of BRICS in the short as well as long run. There is only one cointegrated equation in the system which implies that cointegration among the equity markets does exist, although it is weak, and results of Granger causality test show that there is no causality among market pairs China–Brazil, Russia–Brazil, South Africa–Brazil, Russia–China, and South Africa–India. Therefore, the result reveals that even though the financial integration among the equity markets of BRICS is on an ascendance, still it is far from complete.

The article recommends for further relaxations of restrictions of capital account with a rider that full capital account convertibility should be preceded by strong macroeconomic policies, better institutions, and development of financial markets. It may be noted that the capital account is not fully opened up in any of the BRICS economies except for Russia. Harmonization of laws, regulations, and operations based on internationally acceptable norms, standards, and best practices that will facilitate greater cross-border transactions are also recommended. Appropriate regulatory supervision, however, needs to be ensured at every level so as to minimize the risks associated with the financial integration.

References

Agénor, P. R. (2003). Benefits and costs of international financial integration: Theory and facts. *The World Economy*, *26*(8), 1089–1118.

Ayuso, J., & Blanco, R. (2001). Has financial market integration increased during the nineties? *Journal of International Financial Markets*, *11*(3), 265–287.

Bellotti, X., & Williams, J. (2010). Financial integration and price discovery: Evidence from FX & stock markets in the BRICs. *International Review of Economics and Finance*, 1–47. Retrieved October 5, 2010, from https://www.researchgate.net/publication/238703898_Financial_Integration_and_Price_Discovery_Evidence_from_FX_Stock_Markets_in_the_

Bonga-Bonga, L. (2012). Equity prices, monetary policy, and economic activities in emerging market economies: The case of South Africa. *Journal of Applied Business Research*, *28*(6), 1217–1228.

Chittedi, K. R. (2010). Global stock markets development and integration: With special reference to BRIC countries. *International Review of Applied Financial Issues and Economics*, *2*(1), 18–36.

Dasgupta, R. (2014). Integration and dynamic linkages of the Indian stock market with BRIC: An empirical study. *Asian Economic and Financial Review*, *4*(6), 715–731.

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*, *74*(366a), 427–431.

Edwards, L. (2005). Has South Africa liberalised its trade? *South African Journal of Economics*, *73*(4), 754–775.

Engle, R. F., & Granger, C. W. (1987). Co-integration and error correction: Representation, estimation, and testing. *Econometrica: Journal of the Econometric Society*, *55*(2), 251–276.

Fahami, N. A. (2011, October). The structure of linkages and causal relationships between BRIC and developed equity markets. *International Conference on Information and Finance IPEDR*, *21*, 72–77.

Granger, C. W. (1988). Some recent developments in a concept of causality. *Journal of Econometrics*, *39*(1), 199–211.

Gourinchas, P. O., & Jeanne, O. (2006). The elusive gains from international financial integration. *The Review of Economic Studies*, *73*(3), 715–741.

Hansakul, S., Dyck, S., & Kern, S. (2009). China's financial market. A future global force? Retrieved January 6, 2016, from www.dbresearch.eu/.../China's+financial+markets+-+a+future+global+for

Hassan, S. (2013). South African capital market: An overview. Retrieved January 3, 2016, from www.resbank.co.za/Lists/News%20and%20Publications/.../WP1304.pdf

Holmes, M. J., & Pentecost, E. J. (1999). A new test of international financial integration with application to the European Union. *Journal of Economic Integration*, *14*(1), 1–12.

Hunter, D. M. (2006). The evolution of stock market integration in the post-liberalization period: A look at Latin America. *Journal of International Money and Finance*, *25*(5), 795–826.

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control*, *12*(2), 231–254.

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration: With applications to the demand for money. *Oxford Bulletin of Economics and Statistics*, *52*(2), 169–210.

Joshi, S. S. (2013). Correlation and co-integration of BRIC countries' stock markets. *Indian Journal of Finance, 7*(4), 42–48.

Khumalo, S. A., & Kapingura, F. M. (2014). Impact of capital account liberalization on economic growth in Africa: A case study of South Africa. *Mediterranean Journal of Social Sciences*, *5*(20), 2753–2763.

Lagoarde-Segot, T., & Lucey, B. M. (2007). Capital market integration in the Middle East and North Africa. *Emerging Markets Finance & Trade*, *43*(3), 34–57.

Lattimore, R., & Kowalski, P. (2011). Brazil. In OECD (Ed.), *Globlisation and emerging economies/BRICS* (pp. 211–249). New Delhi: Bookwell.

Morrison, W. M. (2014). China's economic rise: History, trends, challenges, and implications for the United States. Retrieved January 28, 2015, from fas.org/sgp/crs/row/RL33534.pdf 11

Park, C. Y. (2014). Asian capital market integration: Theory and evidence. In Asian Development Bank & Korea Capital Market Institute (Eds), *Asian capital market development and integration challenges and opportunities* (pp. 251–285). London: Oxford University Press.

De Paula, L. F. (2008). Financial liberalization, exchange rate regime and economic performance in the BRICs countries. In P. Arestis & L. F. de Paula (Eds), *Financial Liberalization and Economic Performance in Emerging Countries*. London: Palgrave Macmillan.

Pinto, B., & Ulatov, S. (2010). *Financial globalization and the Russian crisis of 1998*. In G. Caprio (Ed.), *The evidence and impact of financial globalization* (pp. 689–708). London: Academic Press.

Prasad, E., Rajan, R. G., & Subramanian, A. (2006). *Patterns of international capital flows and their implications for economic development*. Washington, DC: IMF.

Rawski, T. G. (2011). *The rise of China's economy*. Retrieved January 20, 2015, from http://www.fpri.org/articles/2011/06/rise-chinas-economy

RBI (Reserve Bank of India). (2007). *Financial market integration*. Retrieved September 6, 2017, from rbidocs.rbi.org.in/rdocs/PublicationReport/Pdfs/77579.pdf

Rodrik, D. (2008). Understanding South Africa's economic puzzles. *Economics of Transition*, *16*(4), 769–797.

Ter-Minassian, T. (2012). Structural reforms in Brazil: Progress and unfinished agenda (Policy Brief No. IDB-PB-158). Washington, DC: Inter-American Development Bank.

Worthington, A. C., & Higgs, H. (2010). Assessing financial integration in the European Union equity markets: Panel unit root and multivariate cointegration and causality evidence. *Journal of Economic Integration*, *25*(3), 457–479.

Zhu, X. (2012). Understanding China's growth: Past, present, and future. *Journal of Economic Perspectives*, *26*(4), 103–124.

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