

AN INVESTIGATION OF FINANCIAL LINKAGES AMONG EMERGING MARKETS, EUROPE AND USA

*Burhan F. Yavas, College of Business and Public Policy, California State University, Dominguez Hills.
1000E.Victoria, Carson, CA 90747 USA [310.243.3501](tel:310.243.3501) byavas@csudh.edu*

*Fahimeh Rezayat, College of Business and Public Policy, California State University, Dominguez Hills.
1000E.Victoria, Carson, CA 90747 USA [310.243.3484](tel:310.243.3484) frezayat@csudh.edu*

ABSTRACT

This paper investigates the linkages between stock market returns and persistence of volatilities of the US, Europe and key emerging countries' stock markets. The emerging market part of data set consists of daily returns of exchange traded funds (ETF) of the BRIC countries (Brazil, Russia India and China); the MIST countries (Mexico, Indonesia, S. Korea and Turkey) plus South Africa. The findings include the existence of significant co-movement of returns and persistence of volatilities among all country ETFs; however, despite increasing interdependencies among the global stock markets there are still very good opportunities for diversification.

INTRODUCTION

The growing global integration of financial markets has given rise to many studies that investigate the mechanism through which equity market movements are transmitted around the world. Short-term equity performance may have less to do with expected fundamentals of individual countries than financial inflows (outflows). For example, rounds of quantitative easing (QE) by the Federal Reserve (FED) in the US and the European Central bank (ECB) in the EU started in 2008 have resulted in near zero short term and very low long term interest rates by historical standards. One result of the QE has been for capital to look for higher returns elsewhere since lower interest rates tend to increase the appetite for market risk. As a consequence, countries like Brazil, Indonesia, India, Turkey and Russia became the recipients of capital flows from the US and Western Europe. Recently, however, we witness a sea change because of the FED's announcement that the long term bond purchases would be stopped by the end of 2014. The news was interpreted by the bond market that the long term rates would increase. Investors started to bring their funds back from the emerging markets. Brazil, Indonesia, India and Turkey among others started to experience depreciating currencies. The reaction of the equity markets was similar in that, many of the indices sank both in terms of local currencies as well as in dollar terms. A study [5] links equity price changes to swings in the VIX-an index of market volatility derived from S&P 500 stock option prices. It may be noted that the choice of the data period in this study (February 2012-February 2014) is especially appropriate since much of 2012 was rather calm but starting with the summer of 2013 many emerging markets have seen dips in their equity markets, sharp depreciation of their currencies and rising interest rates.

While credit expansion (capital flows into emerging markets), stock prices and volatility may move in lockstep across the globe, it is still important to study the co-movements between equity markets over a financial cycle since correlations do not remain constant over the cycle presenting diversification opportunities. Furthermore, [4], [6] and [1] found that the emerging market returns are higher, and more

predictable, with low correlations with the markets in developed countries, but have higher volatility than developed markets. In addition, equity market co-movements provide a measure of the level of market integration between the countries.

To shed further light on these issues, the present paper studies equity returns (ETF returns) and their volatilities of the following countries: BRICs (Brazil, Russia, India, and China), MISTs (Mexico, Indonesia, S. Korea and Turkey). We have also included S. Africa as another important emerging market. Finally, both the US and Europe, from the developed world are included. Our main objective is to contribute to and expand upon the literature on the linkages among international equity markets. In examining the co-movements and persistence of volatilities of American, European and selected emerging county equity markets, we seek to understand if there are opportunities for international investors/traders to earn a better return for a unit of risk.

Data:

The present study uses data on country specific Exchange Traded Funds (ETF). Further, the focus is on “emerging markets”. Even though there are many different lists of “emerging markets” the eight largest emerging economies by either nominal or inflation adjusted GDP are the BRIC countries (Brazil, Russia, India and China) as well as MIST (Mexico, Indonesia, S. Korea and Turkey). Morgan Stanley has recently coined a new term “fragile five” that identifies Turkey, Brazil, India, Indonesia and South Africa. So, we added S. Africa to our list.

This study utilizes Exchange Traded Funds (ETF) instead of market indices mostly used in the literature. ETFs are similar to index mutual funds that allow investors to diversify. By concentrating the analysis on ETF data, we can mitigate if not entirely avoid some substantial problems that arise in traditional academic research such as diversities in stock exchange trading times and bank holidays, restrictions on cross-border trading and investments and transaction costs.

Daily ETF data from February 3, 2012 to February 28, 2014, were used providing a sample of 518 days. The choice of the data period was based on the existence of the ETF data on all of the nine countries plus Europe-wide ETF and the S&P 500 ETF for the US (SPY). The ETFs that were used in this study are: EWZ (Brazil), MCHI (China), INDA (India), EIDO (Indonesia), EWW (Mexico), RERUS (Russia), EZA (S. Africa), EWY (S. Korea), ETUR (Turkey), IEV (Europe) and SPY (US).

Methodology: Multivariate Auto Regressive Moving Average and GARCH:

To study co-movements of daily returns, we utilized the Multivariate Auto Regressive Moving Average (MARMA). MARMA models combine some of the characteristics of the univariate autoregressive moving average models and, at the same time, some of the characteristics of regression analysis. To measure the dynamic relationship of the volatility of a process, among the models can be used are (ARCH) and (GARCH) models. ARCH models were introduced by [3] and generalized as GARCH by [1]. This study uses Garch.

FINDINGS

Table 1 presents the co-movements of ETF returns. Since the domestic and foreign stock market trading is contemporaneous (all ETFs trade in the US) and also to understand the flow of information processed, we used MARMA.

Table 1- Co-movements of daily ETF Returns

$r_{t(\text{Brazil})} = 0.177 r_{t(\text{Russia})} + 0.215 r_{t(\text{China})} + 0.090 r_{t(\text{Mexico})} + 0.103 r_{t(\text{s. Korea})} + 0.086 r_{t(\text{Turkey})} + 0.138 r_{t(\text{Europe})} + 0.185 r_{t(\text{s. Africa})} - 0.089 r_{t-1(\text{Brazil})} + 0.135 r_{t-1(\text{US})} + e_t$
$r_{t(\text{Russia})} = 0.230 r_{t(\text{Brazil})} + 0.078 r_{t(\text{India})} + 0.160 r_{t(\text{china})} + 0.483 r_{t(\text{US})} + 0.117 r_{t(\text{s. Africa})} + 0.217 r_{t(\text{Europe})} + 0.087 r_{t-1(\text{India})} - 0.057 r_{t-1(\text{Indonesia})} + 0.226 r_{t-1(\text{Europe})} - 0.414 r_{t-1(\text{US})} + e_t$
$r_{t(\text{India})} = 0.181 r_{t(\text{Brazil})} + 0.158 r_{t(\text{Russia})} + 0.154 r_{t(\text{Mexico})} + 0.216 r_{t(\text{Indonesia})} + 0.186 r_{t(\text{s. Korea})} - 0.137 r_{t-1(\text{India})} + 0.091 r_{t-1(\text{Brazil})} + e_t$
$r_{t(\text{China})} = 0.195 r_{t(\text{Brazil})} + 0.118 r_{t(\text{Russia})} + 0.086 r_{t(\text{Indonesia})} + 0.386 r_{t(\text{s. Korea})} + 0.196 r_{t(\text{us})} - 0.041 r_{t-1(\text{Indonesia})} + e_t$
$r_{t(\text{Mexico})} = 0.171 r_{t(\text{Brazil})} + 0.111 r_{t(\text{China})} + 0.097 r_{t(\text{Indonesia})} + 0.127 r_{t(\text{Turkey})} + 0.525 r_{t(\text{US})} + 0.094 r_{t-1(\text{Mexico})} - 0.075 r_{t-1(\text{Brazil})} + e_t$
$r_{t(\text{Indonesia})} = 0.180 r_{t(\text{Mexico})} + 0.146 r_{t(\text{s. Korea})} + 0.125 r_{t(\text{s. Africa})} + 0.218 r_{t(\text{India})} + 0.241 r_{t(\text{china})} + 0.225 r_{t(\text{turkey})} - 0.273 r_{t(\text{EUROPE})} + 0.373 r_{t(\text{US})} + 0.084 r_{t-1(\text{Indonesia})} + e_t$
$r_{t(\text{s. Korea})} = 0.109 r_{t(\text{Brazil})} + 0.383 r_{t(\text{china})} + 0.057 r_{t(\text{Indonesia})} + 0.209 r_{t(\text{US})} + 0.082 r_{t(\text{s. Africa})} + 0.134 r_{t(\text{Europe})} + 0.096 r_{t-1(\text{Brazil})} - 0.076 r_{t-1(\text{Russia})} + e_t$
$r_{t(\text{Turkey})} = 0.210 r_{t(\text{Brazil})} + 0.324 r_{t(\text{Mexico})} + 0.247 r_{t(\text{Indonesia})} + 0.186 r_{t(\text{s. Africa})} + 0.215 r_{t-1(\text{Brazil})} - 0.368 r_{t-1(\text{US})} + e_t$
$r_{t(\text{s. Africa})} = 0.260 r_{t(\text{Brazil})} + 0.142 r_{t(\text{Russia})} + 0.228 r_{t(\text{Mexico})} + 0.153 r_{t(\text{s. Korea})} + 0.116 r_{t(\text{Turkey})} + 0.273 r_{t(\text{US})} - 0.185 r_{t-1(\text{us})} + e_t$
$r_{t(\text{Europe})} = 0.112 r_{t(\text{Brazil})} + 0.083 r_{t(\text{Russia})} + 0.041 r_{t(\text{India})} - 0.041 r_{t(\text{Indonesia})} + 0.082 r_{t(\text{s. Korea})} + 0.886 r_{t(\text{US})} - 0.078 r_{t-1(\text{Europe})} + 0.045 r_{t-1(\text{s. Africa})} + e_t$
$r_{t(\text{US})} = 0.028 r_{t(\text{Indonesia})} + 0.072 r_{t(\text{Russia})} + 0.097 r_{t(\text{Mexico})} + 0.043 r_{t(\text{s. Korea})} + 0.391 r_{t(\text{Europe})} + 0.071 r_{t-1(\text{US})} - 0.031 r_{t-1(\text{India})} + e_t$

Note that US market returns (ETF representing S&P 500) affect returns in all of the other sample countries except India and Indonesia. Second, most of the coefficients are positive indicating that the markets move together. The two exceptions are Russia and Turkey where US returns coefficients are negative, implying a negative correlation among the US returns on the one hand and Russian and Turkish returns, on the other. European returns also appear to affect returns from Brazil, Russia, Indonesia, S. Korea and the US. However, other countries in the sample, India, Mexico, Turkey and S. Africa are not influenced by European returns.

Turning to the BRIC countries, we note Brazilian returns demonstrate not only to have concurrent relationship with most of the other country ETF returns; they are also shown to be related to own past period returns. Russian returns are positively related to the returns from Brazil, India, China, US, S. Africa and Europe. Indian market is positively related to returns from Indonesia, Russia, Mexico, S. Korea and Brazil and negatively related to the one-period lagged own returns. The absence of large countries such as the US, China and the Europe should be noted. Chinese returns include as explanatory variables returns from Indonesia, Russia, S. Korea, Brazil and the US. Similar to what was noted above, the Chinese market is not related to the Indian market, nor is it to Europe.

Next, turning to the MIST countries, we note that Mexican returns are positively correlated with returns from Indonesia, Brazil, China, Turkey and the US. As it is expected US returns had highest effect on the Mexican

returns during this period. Indonesian returns are positively correlated with returns from S. Korea, S. Africa, China, India, Mexico, Turkey and the US but are negatively correlated with returns from Europe. Brazil and Russia are two countries that do not appear in the equation. S. Korean returns exhibit positive correlations with returns from Indonesia, Mexico, S. Africa, India, China, Europe and the US. Turkish returns are positively related with returns from the following countries: Indonesia, Mexico, Brazil and S. Africa but are negatively correlated with the US returns. It is interesting to note that returns from Europe do not seem to be affecting Turkish returns.

Finally, South African returns are positively correlated with Indonesian, Russian, Mexican, Brazilian and Turkish returns as well as returns from the European and the US ETFs.

The findings of this analysis indicate that while interdependencies among the global stock markets have increased there are still very good opportunities for diversification. For example, US and Europe based investors may do well to ignore opportunities in each other's markets but can realize diversification benefits by investing in ETFs representing China, S. Africa and Turkey. Turkish investors can safely diversify by investing in the US (S&P 500) since the Turkish and US ETFs are negatively correlated. Similarly, Russian investors may be better off avoiding markets that are highly correlated with theirs such as the US, Europe, India, China and Brazil but can diversify by investing in Turkey, S. Korea and Mexico.

Conditional Volatility Persistence:

Volatility is said to be persistent if information (shock) to today's return has a large effect on the forecast variance many periods into the future. The literature indicates that the sum of the ARCH and GARCH effects is a measure of volatility persistence. If that sum is closer to 1, it means that effects of shocks fade away very slowly. For daily data ARCH reaction parameter α usually ranges between 0.05 and 0.1. α measures the extent to which shocks to today's return feed into volatility of next period. Volatility with relatively high α (arch coefficient) tend to be more spikey than those with relatively low α . The lower the values of GARCH and ARCH effects, the faster the effects fade away.

Table 2-Conditional Volatility of the ETF's Returns

$\sigma^2_t(\text{Brazil}) = 0.022 + 0.055 e^2_{t-1}(\text{Brazil}) + 0.912 \sigma^2_{t-1}(\text{Brazil})$
$\sigma^2_t(\text{Russia}) = 0.029 + 0.061 e^2_{t-1}(\text{Russia}) + 0.901 \sigma^2_{t-1}(\text{Russia})$
$\sigma^2_t(\text{India}) = 0.240 + 0.075 e^2_{t-1}(\text{India}) + 0.750 \sigma^2_{t-1}(\text{India})$
$\sigma^2_t(\text{China}) = 0.043 + 0.915 \sigma^2_{t-1}(\text{China})$
$\sigma^2_t(\text{Mexico}) = 0.0098 + 0.054 e^2_{t-1}(\text{Mexico}) + 0.93 \sigma^2_{t-1}(\text{Mexico})$
$\sigma^2_t(\text{Indonesia}) = 0.105 + 0.25 e^2_{t-1}(\text{Indonesia}) + 0.696 \sigma^2_{t-1}(\text{Indonesia})$
$\sigma^2_t(\text{S. Korea}) = 0.02 + 0.024 e^2_{t-1}(\text{S. Korea}) + 0.928 \sigma^2_{t-1}(\text{S. Korea})$
$\sigma^2_t(\text{Turkey}) = -0.184 + 0.194 e^2_{t-1}(\text{Turkey}) + 0.711 \sigma^2_{t-1}(\text{Turkey})$
$\sigma^2_t(\text{S. Africa}) = 0.115 + 0.067 e^2_{t-1}(\text{S. Africa}) + 0.746 \sigma^2_{t-1}(\text{S. Africa})$
$\sigma^2_t(\text{Europe}) = 0.037 + 0.862 \sigma^2_{t-1}(\text{Europe})$
$\sigma^2_t(\text{US}) = 0.0162 + 0.867 \sigma^2_{t-1}(\text{US})$

As can be seen from table 2, conditional volatility persistence ($\alpha + \beta$) for all BRIC countries was more than 0.93 except for India (0.825). This indicates any event or shock will have a long lasting effect on the returns of BRIC countries. The conditional persistency for MIST countries was between 0.90 and 0.98, (conditional volatility persistency for Turkey was 0.90 and for Mexico was 0.98). For South Africa, conditional volatility persistency was 0.81. For Europe and US, the conditional volatility persistency were both around 0.86. As indicated in table 3, arch coefficients for all of the countries with the exception of Indonesia and Turkey are less than 0.10. Clearly, Indonesia (0.25) and Turkey (0.19)

are among the relatively more jumpy markets as far as conditional volatility is concerned. Next come India and S. Africa having arch coefficients of 0.075 and 0.067 respectively. Again, the implication is that conditional volatilities in India and S. Africa are relatively spikier than in other countries. On the other hand, for Chinese, European and the US markets conditional volatility equations demonstrate that the events during the past period have rather insignificant effect on their conditional volatilities (ARCH coefficient “ α ” for those countries were not statistically significant and were not included in the equations).

Long term (cumulative) effects of past shocks on returns is measured by the Garch parameter β which usually ranges between 0.85 and 0.98. In this study, β ranges from a low value of 0.696 (Indonesia) to 0.92 (Brazil).

Finally, we present constant conditional correlation coefficients of ETF returns below in table 3.

Table 3- Constant conditional correlation coefficients of ETF’s returns

	ρ	P-Value		P	P-Value
(Brazil and Russia)**	-0.207	0.000			
(Brazil and India)	-0.033	0.448	(Russia and India)**	-0.122	0.005
(Brazil and China)**	-0.211	0.000	(Russia and China)**	-0.145	0.001
(Brazil and Mexico)	-0.160	0.000	(Russia and Mexico)	0.037	0.401
(Brazil and Indonesia)	0.402	0.361	(Russia and Indonesia)	-0.004	0.932
(Brazil and S. Korea)**	-0.105	0.017	(Russia and S. Korea)	0.011	0.812
(Brazil and Turkey)**	-0.124	0.005	(Russia and Turkey)	-0.038	0.385
(Brazil and S. Africa)**	-0.217	0.000	(Russia and S. Africa)**	-0.136	0.002
(Brazil and Europe)**	-0.121	0.006	(Russia and Europe)**	-0.139	0.002
(Brazil and US)	-0.072	0.112	(Russia and US)**	-0.178	0.0001
(India and China)	0.058	0.188			
(India and Mexico)	-0.020	0.730	(China and Mexico)	-0.042	0.342
(India and Indonesia)**	-0.228	0.000	(China and Indonesia)**	-0.157	0.000
(India and S. Korea)	-0.041	0.336	(China and S. Korea)**	-0.385	0.000
(India and Turkey)	0.041	0.352	(China and Turkey)	-0.009	0.834
(India and S. Africa)	0.035	0.427	(China and S. Africa)	-0.0081	0.8551
(India and Europe)	0.002	0.972	(China and Europe)	0.040	0.356
(India and US)	-0.055	0.207	(China and US)	-0.042	0.341
(Mexico and Indonesia)**	-0.161	0.000			
(Mexico and S. Korea)	0.056	0.205	(Indonesia and S. Korea)**	-0.099	0.024
(Mexico and Turkey)**	-0.214	0.000	(Indonesia and Turkey)**	-0.234	0.000
(Mexico and S. Africa)	-0.004	0.925	(Indonesia and S. Africa)	-0.019	0.664
(Mexico and Europe)	-0.036	0.411	(Indonesia and Europe)**	0.089	0.043
(Mexico and US)**	-0.224	0.000	(Indonesia and US)**	-0.091	0.037
(S. Korea and Turkey)	-0.048	0.273			
(S. Korea and S. Africa)**	-0.123	0.005	(Turkey and S. Africa)**	-0.156	0.0004
(S. Korea and Europe)**	-0.123	0.005	(Turkey and Europe)	0.070	0.110
(S. Korea and US)**	-0.106	0.016	(Turkey and US)	-0.030	0.495
(S. Africa and Europe)	0.053	0.239			
(S. Africa and US)	-0.039	0.366	(Europe and US)**	-0.5836	0.000

Conditional correlations of the returns:

Starting with Brazil, the findings indicate that conditional correlation coefficients between Brazil's returns and the other ETF returns are statistically significant except for conditional correlations with India, Indonesia and US (at $\alpha = 0.05$). The conditional correlation coefficients between Russian returns on the one hand and the returns of BRIC countries as well as S. Africa, Europe, and US are significant; between Indian returns and returns of Russia and Indonesia are significant as well as those between China's returns and the returns of Brazil, Russia, Indonesia and South Korea are significant.

Turning to the MIST countries, the conditional correlation of returns between Mexico and the returns of Brazil, Turkey, South Africa, and US are significant and between return of Indonesia and following returns are found to be significant: India, China, Mexico, S. Korea, Turkey, Europe, and US. The reader is referred to the table for the rest.

CONCLUSIONS

The findings of the analysis indicate that the stock markets are indeed becoming more and more integrated. As such, it is important that information from both domestic and global markets be studied before investors (institutional and individual) make investment decisions since international spillovers for both returns and their volatilities are significant. It may also be possible for investors to ride the financial cycle by following closely monetary policies of the FED and ECB and resulting credit expansion or contraction since research indicates (and as corroborated in this study) equity prices are linked to VIX which is also correlated with capital flows and credit expansion and interest rates.

REFERENCES

- [1] Bekaert, G. (1995), "Market Integration and Investment Barriers in Emerging Equity Markets," *World Bank Economic Review*, 9: 75-107.
- [2] Bollerslev, T. (1986), "Generalized Autoregressive Conditional Heteroskedasticity," *Journal of Econometrics*, 31(3): 307-327.
- [3] Engle, R.F. (1982), "Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation," *Econometrica*, 50:987-1007.
- [4] Harrison, B., and Moore, W. (2009), "Spillover Effects from London and Frankfurt to Central and Eastern European Stock Markets," *Applied Financial Economics*, 19(18): 1509-1521.
- [5] Rey, H. (2013), "Dilemma not Trilemma: *The Global Financial Cycle and Monetary Policy Independence*" www.kc.frb.org/publicat/sympos/2013/2013Rey.pdf
- [6] Yavas, B.F. and Rezayat, F. (2008), "Integration among Global Equity Markets: Portfolio Diversification using Exchange-Traded Funds," *Investment Management & Financial Innovations*, 5(3):30-43.

