Dynamic Linkages and Volatility Spillover

Effects of Oil Prices on Exchange Rates, and Stock Markets of Emerging Economies

To the Feet of His Holiness
Sai Baba of Shirdi

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Effects of Oil Prices on Exchange Rates, and Stock Markets of Emerging Economies

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Foreword

It gives me immense pleasure in writing the foreword for the book *Dynamic Linkages and Volatility Spillover: Effects of Oil Prices on Exchange Rates, and Stock Markets of Emerging Economies*, authored by Dr. Bhaskar Bagchi, Prof. Dhrubaranjan Dandapat, and Dr. Susmita Chatterjee. The book contains a very interesting study relating to the dynamic relationship and volatility spillover among crude oil prices, exchange rates, and stock indices of emerging economies like Brazil, Russia, China, South Africa, and South Korea with a special emphasis on India.

I hope that the book will be very useful to the students, researchers, academicians, and professionals who are interested in the field of capital market.

Prof. Swagata Sen
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Abstract

Purpose

This study investigates the dynamic linkages and volatility spillover between crude oil prices, exchange rates, and stock indices of emerging economies like Brazil, Russia, India, China, South Africa, and South Korea. The study also analyzes the impact of falling crude oil prices which is also known as "new oil price shock" on the exchange rates and stock indices of these countries.

Methodology/approach

Special emphasis has been given on India, so, the total length of the study for India covers a period from April 2003 to March 2016. This total span has been divided into three sub-periods – pre-recession period (April 2003–November 2007), recession period (December 2007–June 2009) and post-recession period (July 2009–March 2016). However, in order to capture the effect of spill-over characteristic from one period to another and also for better performance analysis of APARCH (Asymmetric Power ARCH) model and multivariate CCC-GARCH (Constant Conditional Correlations-GARCH) model, all the three sub-periods are taken together, and we have considered total study period beginning from April 2003 to March 2016 as our dataset in case of India. Nonetheless, with respect to other emerging economies, we have covered a period from July 2009 to March 2016.

We have applied multivariate cointegration analysis to examine the long-run relationship while allowing for the possibility of short-run divergences. Variance Decomposition Test has been used to observe the long-run and short-run dynamics of the series. Granger Causality Test and Vector Error Correction Model along with Structural Vector Auto Regression (SVAR) with Impulse Response Analysis have also been applied for further study of the interactions between crude oil prices, exchange rates, and stock markets. To measure the volatility spillovers between crude oil price, exchange rates, and stock indices of the emerging economies, we have applied APARCH model and multivariate CCC-GARCH model

Findings

In case of India, cointegration analysis reveals the existence of stationary long-run relationship between crude oil prices, stock indices (BSE Sensex and NIFTY), and exchange rates (USD/INR, EUR/INR, GBP/INR, and JPY/INR) during all the three periods of our study. However, the directions of the causality are not uniform in all the three periods. In case of other emerging economies, common stochastic trends which indicate a degree of economic integration between crude oil price, exchange rates, and stock index is observed only for Brazil and Russia. In case of China, the degree of economic integration is very weak as revealed by both trace statistic and maximum eigenvalue statistic. However, no such long-run relationship exists in South Africa and South Korea.

All the cases of Granger Causalities during the pre-recession and recession periods are found to be unidirectional running from exchange rates to stock indices. However, in the post-recession period, unidirectional causality flows from exchange rates to stock indices (USD/INR and EUR/INR to BSE Sensex and NIFTY) and also from stock indices to exchange rates (BSE Sensex and NIFTY to GBP/INR and JPY/INR). In Brazil, it is found that unidirectional causality flows from USD/BRL to Bovespa and crude oil to Bovespa and also from USD/BRL to crude oil prices. In case of Russia, unidirectional causality is found to be running from USD/RUB and crude oil to MICEX. Again, crude oil prices are influenced only by the exchange rates of Russian Ruble. Next, in China, unidirectional causality flows from USD/CNY to Shanghai Composite and from crude oil prices to USD/CNY. In South Africa, feedback causality is running between FTSE SA and USD/ZAR and in South Korea, it is observed that the stock index KOSPI is unresponsive to changes in exchange rates of USD/KRW and crude oil prices and only unidirectional causality flows from crude oil to USD/KRW.

The results of variance decomposition analysis signify a fairly high degree of interdependence among exchange rates and stock prices. The results of VECM reveal that both BSE Sensex and NIFTY adjust more rapidly to shocks to restore long-run equilibrium though the speed of the adjustments varies between the periods. In Brazil, Bovespa and crude oil prices reveal highest relative interdependence; in Russia, the highest relative interdependence is demonstrated by MICEX and USD/RUB; in China, the interdependence is observed between Shanghai Composite and USD/CNY; in South Africa as well, we find the highest

relative interdependence between FTSE SA and USD/ZAR; and finally in South Korea, KOSPI and crude oil reveal highest relative interdependence.

The findings of our study also reveal that BSE Sensex has the highest level of excess kurtosis which indicates the existence of "fat tails" and therefore extreme changes are likely to take place more regularly for this stock index. However, NIFTY and the exchange rates also show substantial high values of excess kurtosis. The leverage term $\gamma > 0$ for BSE Sensex, NIFTY, and JPY/INR which implies an asymmetric response of volatilities to positive and negative shocks thus indicating that bad news will create greater volatility in comparison to good news. In contradiction, $\gamma < 0$ for USD/INR, EUR/INR, and GBP/INR, and therefore, negative γ signifies good news has greater impact on the price volatility than the bad news. The positive values of ω, α, and β satisfy the basic conditions of APARCH modeling. Moreover, the summation of $\alpha + \beta$ is very close to 1 which implies rather persistent volatility clustering. The presence of long memory characteristic is substantiated by the results of autocorrelation analysis, Ljung-Box Test, and LM Arch Test. Results of Multivariate CCC-GARCH show that in India convergence has been achieved after 133 iterations.

In case of other emerging economies, Shanghai Composite has the highest level of excess kurtosis, and other variables also show substantial high values of excess kurtosis. The Summary statistics results show that FTSE SA and Bovespa are the most volatile as measured by the standard deviation. APARCH analysis show that for Bovespa, MICEX, FTSE SA, KOSPI, and crude oil, there is an asymmetric response of volatilities to positive and negative shocks and negative correlation exists between returns and volatility indicating that negative information will create greater volatility. However, for Shanghai Composite positive information has greater effect on stock price volatility in comparison to negative information. The study results also suggest the presence long memory behavior and persistent volatility clustering phenomenon among crude oil price and the emerging stock markets. Multivariate CCC-GARCH analysis reveals that convergences have been achieved for all the emerging economies.

Originality/value

This book entails a dataset up to March 31, 2016, so as to capture the volatility spillovers and also the latest effect of declining crude oil prices or oil price shock on the stock markets and

exchange rates of India as well as of the other emerging economies like Brazil, Russia, China, South Africa, and South Korea which can surely be considered a new contribution to the existing oil price literature. Our study results provide enough evidence that volatilities are better modeled by incorporating leverage effects, power effects, and long memory characteristics as well as by CCC-GARCH model. Moreover, our empirical analysis provides further appealing findings that contribute to both the volatility literature and also the studies on stock markets and exchange rate markets. We believe that our empirical findings do have major policy implications and considerably contribute to advance risk management practices which could unravel significant inferences and propositions from the investors' as well as policymakers' perspective.

Keywords: Emerging economies; crude oil prices; exchange rates; stock prices; cointegration; vector error correction model; Granger causality; variance decomposition; structural vector autoregression; impulse response analysis; volatility spillover; APARCH; CCC-GARCH