DYNAMIC LINKAGES AND VOLATILITY SPILLOVER

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

Bhaskar Bagchi Dhrubaranjan Dandapat Susmita Chatterjee

Emerald

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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

By

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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

CHAPTER

1 Introduction

> Newton lost his wealth in the crash of Stock market (South Sea bubble 1716–1720), and remarked, "I can calculate the movement of the stars, but not the madness of men."

1.1. Background of the Study

Crude Oil is one of the important commodities worldwide and countries like India, China, South Africa, and South Korea have to import huge volume of crude oil spending considerable amount of foreign exchange. Therefore, cost of importing such crude oil is dependent on price of crude oil in the international market and exchange rate. Any change in the crude oil price and exchange rate will have direct and indirect impact on the economy and stock market is also expected to be affected due to such changes. Higher fuel charges are translated into expensive carrying costs and also heating and production costs that can affect the corporate profitability. Again, higher oil prices can raise concerns about inflation and therefore the consumers will be prompted to curtail down their discretionary spending that will bring down the demand for goods and services which will finally affect the corporate earnings (Pescatori & Mowry, 2008). Unexpected hike in oil prices or oil price shocks very often indicates inflation and the policy makers automatically react to inflationary pressures by increasing the interest rates that have an

effect on the discount rates employed in the stock pricing formula (Basher, Haug, & Sadorsky, 2010).

Global crude oil prices have experienced a continuous and steady decline particularly over the last 12 months, leading to a noteworthy revenue deficit in many crude oil exporting nations, while for consumers in many crude oil importing countries lower crude oil price means paying less to heat their homes or drive their cars. But cheap oil, at its lowest price in over a decade, is also having far-reaching and unexpected geopolitical and economic consequences around the world. For example, the oil-price plunge causes severe problems for Iraq. Iraq depends on oil for 95% of its budget, meaning price drops can affect everyone and everything. Lower oil prices cause's difficulties in Iraq's military campaign against Islamic State (IS) militants, who took over a section of western and northern parts of the country. In terms of Iraq's challenging attempt to turn back IS, less cash obstruct Baghdad's ability to buy military equipment, pay its security forces, and rebuild cities that have been re-conquered from IS fighters (www.rferl.org/content/falling-oil-prices-impact-russia-saudi-arabia-iran-iraq/).

Brazil, the second largest producer of crude oil in Latin America also suffered a setback. More than 50% of total oil production in Brazil comes from its pre-salt fields. Pre-salt refers to the oil reservoirs found under the thick layer of salt in Brazil's deepwater. These fields have proved to be highly productive, with production already at more than 700,000 barrels a day in May 2015. Lower crude oil prices added pressure to the Brazilian economy as because elevated crude oil prices are required to stimulate investment in the country's deep-water offshore oil fields that contribute to country's economic growth. According to the World Economic outlook published by the International Monetary Fund, Brazil's gross domestic product (GDP) has contracted by 1.5% in 2015 which simply reflects the dampening effect of lower crude oil prices and tighter external financial condition. The analysts are of the opinion that Brazil will experience slower economic growth in 2016 or even recession if oil prices fail to get momentum in 2016 (www.investopedia.com/articles/markets/071515).

The economy of Russia depends heavily on energy revenues with oil and gas accounting for more than 70% of export incomes. It is anticipated that Russia loses about $2 billion in revenues for every dollar fall in oil prices (www.bbc.com/news/business/29643612). The growth rate of Russian economy

shrinks by about 0.7% in 2015 and there is a forecast by World Bank that the Russian economy will sink into recession in 2016, if oil prices do not recover. Russian rouble (RUB) already suffers a heavy setback and Russia is compelled to hike its interest rate to 17% in support of its currency which simply shows that the Russian economy is hardly punched by falling oil prices (www.bbc.com/news/business/29643612).

On the other hand, falling crude oil price is just like a blessing for Indian economy, though there are many hitches. It helps to narrow down India's current account deficit – the amount India owes to the world in foreign currency. A fall in oil prices by $10 per barrel helps to reduce the current account deficit by $9.2 billion, according to a report by Livemint. This amounts to nearly 0.43% of the GDP – a measure of the size of the economy (www.kotaksecurities.com/ksweb/). Moreover, falling oil prices also help to curb down inflation. As per the report published by Moneycontrol, an Indian financial agency, every $10 per barrel fall in crude oil price helps reduce retail inflation by 0.2% and wholesale price inflation by 0.5% (www.moneycontrol.com/business/reports). Again, the Indian rupee (INR) exchange rates also gets affected though, to a very few extent. The value of a free currency like rupee depends on its demand in the currency market. This is because it significantly depends on the current account deficit. A towering deficit means the country has to sell rupees and purchase dollars to disburse its bills. This diminishes the value of the rupee. A plunge in oil prices is, thus, good for the rupee. However, the disadvantage is that the dollar strengthens each and every time, whenever crude oil prices plunge down, which counteracts any benefits that have been derived from a fall in current account deficit (www.kotaksecurities.com/ksweb/).

Brent crude oil was recorded at a new low of $28.94 per barrel (as on January 10, 2016) and West Texas Intermediate (WTI) crude is down to below $29.44 per barrel (as on February 7, 2016). Simultaneously, demand for crude oil has plummeted throughout the globe and especially in Asia where the bigger economy and energy consumer, China, is undergoing the slowest economic growth in a decade. With the global economy looking shaky due to China's slowdown, traders said the outlook for oil remains for cheap prices for much 2016. According to the analysts, the reasons for this sharp decline in oil prices are twofold – weak demand in many countries due to insipid economic growth, coupled with surging US production. They are of the opinion that the enormous US storage project is the main cause