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Oil price volatility and stock price fluctuations in an emerging market: Evidence from South Korea

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ABSTRACT

How important are oil price fluctuations and oil price volatility on equity market performance? What are the policy implications if volatility turns out to be significant? We assess this issue in an economics/finance nexus for Korea using a VEC model including interest rates, economic activity, real stock returns, real oil prices and oil price volatility. Our main aim is to capture the effects of crude oil prices on the Korean economy thoroughly covering the period of the Asian Financial Crisis of 1997, which heavily affected the country, and the oil price hikes in the early 1990s after the Gulf War. South Korea was the country most hit by the financial crisis together with Indonesia and Thailand. Results indicate the dominance of oil price volatility on real stock returns and emphasize how this has increased over time. Oil price volatility can have profound effect on the time horizon of investment and firms need adjust their risk management procedures accordingly. This increase in dependency has been found in other net oil importing emerging equity markets. We test the relationship between oil price movements and economic activity by using modern time series techniques in a cointegrating framework. We expand the standard error correction model by examining the dynamics of out of sample causality through the generalized variance decomposition and impulse response function techniques. The evidence from persistence profiles also gives important guidelines based on how fast the entire system adjusts back to equilibrium. In addition, we find the cointegrating relationship to be stable and find that the linear error correction model to be more favorable than an asymmetric 2 period Markov switching model.

1. Introduction

Since the oil price shocks of 1973–74 and 1979–80, dozens of academics and practitioners have explored the relationships between oil price shocks and the macroeconomic variables. The recessionary impacts of these oil prices shocks were too close for possible causal links to be ignored, and considerable attention has been devoted to study the macroeconomics of these events. Policymakers have to take serious account of the developments in the oil market, as a rise in the world price of oil imposes macroeconomic costs in two ways. First, to the extent that oil is both an important input to production and consumer goods (i.e. petrol and heating oil), results in a reduction in economic activity as energy becomes more expensive. Second, rising oil prices contribute directly to the level of inflation, particularly in energy dependent countries. Over time, the impact on activity and inflation will also depend on policy responses and supply-side effects.[3]

The high oil prices in 2005 and 2006 reflect the booming demand from Asia (especially China and India)[4] and the geopolitical risk in the Middle East[5] (the "fear premium" estimated to add between $4 and $8 to current prices). China and India have become two principal players on the global energy scene. In 1990, consumption in these two countries amounted to no less than 3.5 million barrels per day, approximately 5% of global petroleum use. In 2003, 13 years later, these two countries account for more than 10% of global oil consumption. (BP Statistical Review of World Energy Markets, 2004).

It is difficult to distinguish temporary shocks from permanent shocks; and uncertainties related to large changes in oil prices can have significant effects on consumer confidence and therefore on growth. The impact of these oil price shocks is likely to be significantly greater in oil-importing countries, especially where policy frameworks are weak,

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[3] See Hamilton (1983), Bohi (1989), Bernanke et al. (1997).
[4] See Heap (2005),Radetski (2006).
[5] See Stevens (2005).

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foreign exchange reserves are low, and access to international capital markets is limited.

Government authorities combat oil price hikes by using monetary and fiscal policies. For example, in order to maintain high industrial production and exports revenues, interest rates are kept at low levels. However, it is difficult to evaluate the impact of the oil price shocks on different variables of the macroeconomic environment, especially the impact on the stock markets. It is perhaps noteworthy that it was only in the 1990s that researchers seriously examined the impact of oil price shocks on stock markets.[6] Macroeconomics and financial dynamics have not been captured together in one model when subjected to oil price shocks, especially for a net oil importing and emerging economy such as South Korea.

The Republic of Korea (South Korea) is important to world energy markets, as it happens to be the seventh largest oil consumer and the fifth largest net oil importer in the world. Korea relies entirely on oil imports as there are no oil reserves in the country or surrounding areas. Hence, being a net importer of oil, the movements or fluctuations in oil prices are of major relevance for the Korean government when taking policy decisions that affect the national economy. The two major oil crises of the 1970s and 1980s significantly affected South Korea's macroeconomic performance. By using monetary and fiscal policies the country was able to weather the first oil price shock with some difficulties, but coping with the second crisis was much more challenging and South Korea experienced the worst stagflation between 1973 and 1990.

Korea's reliance on foreign sources for its energy requirements drastically increased between 1960 and 1990. For instance, Korea's total indigenous energy production to foreign imports continuously declined from 54.77% in 1971, to 30.21% in 1980, and to 29.95% in 1990. This, in turn, increased foreign energy dependence from 71.7% in 1971 to 77.95% in 1980 to 82.01% in 1990.[7]

More recently, petroleum accounted for 54 percent of South Korea's primary energy consumption in 2002. In 2004, the country consumed around 2.14 million barrels a day (bbl/d) of oil, all of which was imported.[8] Glasure (2002) indicates that the real oil price is the major determinant of real income and energy consumption in South Korea.

With the close dynamics between economic indicators and financial markets, many studies have used various proxies to illustrate the degree and direction of causality in a cointegrating VAR framework. To our knowledge these dynamics have not been observed together with exogenous oil price movements and oil price volatilities.

This paper tries to answer the following questions. What is the long-run relationship between oil price movements and stock markets in an emerging market like South Korea? Did the stochastic trends change between industrial production, interest rates, stock markets and oil price change during the financial crises and oil price hikes in the early 1990s? What is the direction of causality between these variables and what are the implications for the transmission mechanisms of shocks? Can the domestic stock market be isolated from oil price movements? Answers to these questions will have serious fiscal and monetary policy implications not only to Korea but also to other energy dependent countries. The negative impact of oil price volatility on Korean industries could help the government in looking at alternative less volatile sources of fossil fuels such as nuclear, coal and Liquefied Natural Gas (LNG) which has continued to grow in popularity especially in electricity generation.[9] To ensure energy substitution, proper infrastructure needs to be in place to make sure industries have the means to convert from oil intensive to gas or coal intensive processes.

The paper is structured as follows. Section 2 provides a review of the literature and main debates surrounding the dynamics between stock markets and economic markets, together with impacts from energy and oil price movements. In Section 3 we describe the data used in the analysis and briefly discuss econometric concepts and methodology surrounding multivariate cointegration analysis and the out-of sample testing framework. The application and estimation results are presented in Section 4 with some tables and figures presented in Appendix A of the paper. In Section 5 we draw some important policy conclusions with respect to monetary policy and policies designed for stock markets to withstand oil price movements.

2. Literature review

James Hamilton's (1983) study of the role of oil price shocks in US business cycles has had considerable influence on research on the macroeconomics of oil price shocks. As Mork et al. (1994) review paper outlines, economists worked for nearly a decade on methods of incorporating oil price shocks into macroeconomic models before a synergy developed with real business cycle (RBC) models and oil price shocks. This theoretical relationship between macroeconomics and oil price movements has been applied and tested using various econometric techniques.

Chaudhuri and Daniel (1998) use cointegration and causality to demonstrate that nonstationary behaviour of the US dollar real exchange rate is explained by nonstationary behaviour of real oil prices. The authors argue that oil price shocks can have long-run effects on real exchange rates even if perfect markets exist in the long run.

Greene et al. (1998) assess the impact of cartels like OPEC on the U.S. economy. They identify three main separate and additive types of economic losses resulting from oil prices increases: the loss of the potential to produce, macroeconomic adjustment losses and the transfer of wealth from US oil consumers to foreign oil exporters. Whereas, Kaneko and Lee (1995) use an eight-variable VAR model to test the pricing influence of economic factors on U.S. and Japanese stock market returns and in identifying their relative importance in a dynamic context. The eight variables used in this study are as follows: risk premium, term premium, growth rate in industrial production, rate of inflation, changes in terms of trade, changes in oil prices, change in exchange rates and excess stock returns. They find the average values of excess stock returns, rates of inflation, risk premiums and term premiums to be higher for the United States than for Japan.

Papaetrou (2001) on the other hand tests the dynamic linkage between crude oil price and employment in Greece using industrial production and industrial employment as alternative measures of economic activity. His study is modelled in a cointegrated VAR framework and extends out by looking at the generalized variance decomposition and impulse response functions, which is very encouraging as most studies have not gone beyond cointegration and error corrections modelling.

Sadorsky's (1999) research meanwhile draws attention to a negative relationship between shocks in oil prices and real stock returns for the US economy and a negative impact of shocks to real stock returns on interest rates and industrial production.

In a later study, Sadorsky (2001) finds a significant and positive relationship between oil and gas equity index and the price of crude oil in Canada. Furthermore the author indicates a positive relationship between the return on the index and the return on the stock market as a whole. Finally a negative association is found between the stock market index value and both the premium on 3-month vs. 1-month Government debt and the US/Canadian Dollar exchange rate.

[6] Driesprong et al. (2003), argue that changes in oil prices strongly predict future stock market returns in 12 out of 18 developed countries surveyed. South Korea is not on the list of the countries surveyed.

[7] Glasure (2002).

[8] Data from Energy Information Administration (EIA), US Department of Energy.

[9] According to EIA estimates in 2008, South Korea primary energy consumption constituted of 45% Petroleum, 27% Coal and 14% Natural Gas.