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Assessing the impact of oil returns on emerging stock markets: A panel data approach for ten Central and Eastern European Countries

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ABSTRACT

This paper uses an international multi-factor model in order to investigate the relationship between oil price risk and stock market returns for the emerging capital markets of the Central and Eastern European Countries (CEECs). A panel data approach is being employed for the period covering 22 October 1999 until 23 August 2007. The oil price beta is found to be negative and statistically significant suggesting that the oil price is indeed an important factor in determining stock returns. No statistically significant non-linear dependency is found between market risk and emerging market stock returns or between oil price risk and returns. Observation of conditional models shows positive reaction of emerging stock market returns to upward movements of market returns. The reaction of the stock returns to upward and downward movements of the oil market is also negative but more significant when oil prices are low.

1. Introduction

Crude oil is one of the most important commodities in our society, and today's economies are very dependent on oil. When observing the world economy it is almost impossible to identify a factor that has a greater influence than the oil price and oil price shocks. Fluctuations of oil prices are responsible for economic recessions through reduced productivity, excessive inflation and lower economic growth. Increases in the oil price and consequent increases in oil import bills result in higher transportation and higher production costs. This leads to higher prices of products which in turn, assuming non-energy prices remain constant, increases inflation. Higher oil prices and oil import bills lead to a fall in GDP by causing discrepancies in the supply and demand of the economy. This, in turn, results in lower economic growth and recession. Apart from that, volatility in the oil price increases risk and uncertainty which, in turn, negatively impacts stock prices and reduces wealth and investment.

The relationship between energy prices and stock market activity has been investigated by many scientists in the last decades but most of the publications have concentrated on the developed countries. Chen et al. (1986) investigate the tradeoffs between equity returns and macroeconomic variables such as industrial production, inflation, interest rates, consumption and oil prices. Their examination of twenty years of monthly US data showed that oil price changes have no impact on asset pricing.

Jones and Kaul (1996) investigate the rationality of stock market reaction to oil price shocks. The results of their study reveal that while the US and Canadian stock markets react rationally, the results for Japan and the UK showed overreaction to oil price shocks. Pesaran and Timmermann (2000) attempt to identify the main factors that can describe a stock returns forecasting model. They included the oil price as one of the main regressors. They found that oil price changes are negatively correlated with stock returns and with results significant at 1% level of significance.

Maghyereh (2004) studied the dynamic relationship between oil price shocks and stock market returns for 22 emerging economies using the generalized approach to forecast error variance decomposition and impulse response analysis. The results of variance decomposition revealed very weak evidence of oil price shocks affecting stock market returns in emerging economies. Moreover, countries that show a high response have higher energy intensity consumption than other countries. In the other words, the author found that stock markets in the emerging economies do not rationally signal changes in the crude oil price.

El-Sharif et al. (2005) used daily data for the case of the United Kingdom (the European Union's largest oil producer), to investigate interaction between equity returns and the crude oil price. A multi-factor model capturing the relationship between share prices and

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volatility in crude oil prices was employed for the analysis. The results of the study showed that a positive and highly significant relationship exists between stock returns and the price of crude oil.

Nandha and Hammoudeh (2007) investigated the relationship between market beta risk and realized stock returns in the presence of oil price risk and exchange rate sensitivity. The authors used data from fifteen countries in the Asia-Pacific region. An international multifactor model was employed in the analysis. They studied the impact of oil price on stock market returns represented expressed in local currency and in US dollars. The results of the investigation revealed that only two countries are oil-sensitive to changes in the oil price, when it is expressed in local currency. No country shows sensitivity to oil price measured in US dollar regardless whether the oil market is up or down.

Sadorsky (1999), examined the oil price volatility pattern using GARCH and a vector autoregression approach to investigate the dynamic interactions between the oil price, stock returns and other factors of economic activity for the case of the US. His findings suggest that there is a negative correlation between stock returns and oil price volatility. Furthermore, the results suggested that stock returns are repressed by positive shocks to oil prices. Sadorsky (2001) examined the sensitivity of Canadian oil and gas industry equity returns to oil price changes using a multifactor market model. The author found that stock returns increase with increase in the oil price. Finally, Basher and Sadorsky (2006) investigated the reaction of stock market returns to oil price risk using an international multifactor model that took into account conditional and unconditional risk factors such as market risk, oil price risk, exchange rate risk and three higher moments: total risk, skewness and kurtosis. The results revealed strong evidence of sensitivity in stock market returns to oil price risk.

In this paper we investigate the tradeoffs between oil price risk and stock market returns for ten Central and Eastern European Countries (CEECs). Following Basher and Sadorsky (2006), an international multi-factor model that allows for both conditional and unconditional risk factors is employed. Our research contributes to the existing literature on oil price and stock market activity, because it examines country cases that have not been studied before. The remainder of this paper is organized as follows. Section 2 presents the data set and the methodology that is used. Section 3 presents and discuss the empirical results. Finally, Section 4 summarizes and concludes.

2. Data, methodology and results

2.1. The data set

The data set mainly consists of daily closing prices of the stock markets of ten emerging CEECs. The data span from October 22, 1999 to 23 August, 2007 and the source of the data is the Datastream. The short period of observations is explained by the short time of trading of the chosen countries. The countries that are included in the analysis are Czech Republic (CZR), Estonia (EST), Hungary (HNG), Lithuania (LTN), Latvia (LTV), Romania (ROM), Poland (PLD), Russia (RUS), Slovakia (SLK) and Slovenia (SLN). Bulgaria is not included because its stock market does not have long enough trading history.

The MSCI World Index is a free float-adjusted market capitalization index that is designed to measure global development market equity performance. As of June 2006 the MSCI World Index consisted of the following 23 market country indices: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hong Kong, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, the United Kingdom and the United States.

For both country case and the world index data excess returns are calculated by subtracting the daily yield on a three month U.S. Treasury Bill from the continuously compounded daily returns.

In our analysis we need also to investigate whether exchange rate risk is an important factor in pricing of the stock market returns. To capture this we use the Trade Weighted Exchange Index (TWEX) variable, which is a weighted average of the foreign exchange value of the US dollar against a subset of the broad index currencies that circulate widely outside the country of issue. This series is collected from the Federal Reserve Board of St. Louis.[1]

Finally, we use oil returns measured as the logarithmic differences of the spot daily crude oil prices of the West Texas Intermediate (WTI) in dollars per barrel. The oil price data is available from the Energy Information Administration website.[2] Since we use a panel of countries with different domestic currencies all our variables are measured in US dollars.

2.2. Methodology

The methodology used in this paper is related to the international capital asset pricing model (CAPM) which has been extensively tested during the last two of decades by many authors. Based on Basher and Sadorsky (2006) an international multi-factor model that allows for conditional and unconditional risk factors is employed in order to investigate the relationship between oil price risk and the stock market returns.

First, we estimate market betas, oil betas and exchange rate betas for each country case in the sample using the following equation:

$$R_{it} = \alpha + \beta_{1,it}R_{m,t} + \beta_{2,it}R_{o,t} + \beta_{3,it}R_{e,t} + \varepsilon_{e,t} \tag{1}$$

where R_{it} is the daily excess returns for country i at time t, R_{mt} is the daily returns on the market index, R_{ot} is the daily returns on oil prices and R_{et} is the daily exchange rate returns. Obviously, β_1, β_2 and β_3 are the estimated coefficients denoting the market beta, the oil price beta and the exchange rate beta respectively.

The method of estimation is simple OLS. We estimate Eq. (1) using the rolling regression method for a window of 1250 observations.[3] For each sub-sample the market beta, oil beta, exchange rate beta and other risk measures (standard deviation, skewness and kurtosis) are estimated and recorded. Then, the estimation window is moved forward by adding one new observation and dropping the most distant one, in order to obtain new estimates of betas and risk variables. This gives us a set of 912 observations of estimated betas.

In the second step, the following model is estimated to test for an unconditional relationship between returns and betas obtained from Eq. (1) using panel data estimation,

$$R_{i,t} = \gamma_0 + \gamma_{1,i}\beta_{1,it} + \gamma_{2,i}\beta_{2,it} + \gamma_{3,i}\beta_{3,it} + \varepsilon_{2t}. \tag{2}$$

To test for a conditional relationship between returns and betas dummy variables are created and the following equation is estimated as suggested by Pettengill et al. (1995):

$$R_{it} = \gamma_0 + \gamma'_1 D1\beta_{1,it} + \gamma''_1(1-D1)\beta_{1,it} + \gamma'_2 D2\beta_{2,it} + \gamma''_2(1-D2)\beta_{2,it} + \gamma_3\beta_{3,it} + \varepsilon_{3t} \tag{3}$$

where *D1* is a dummy variable that is equal to 1 when market returns are positive and 0 otherwise, and *D2* is a dummy variable that is equal to 1 when oil price returns are positive and 0 otherwise. Since γ'_1 is estimated in periods with positive market returns, the expected sign of this coefficient is positive. Since γ''_1 is estimated in periods with negative market returns, the expected sign of this coefficient is negative.

[1] For more information see http://research.stlouisfed.org/fred.

[2] For more information see http://tonto.eia.doe.gov.

[3] We chose the trading window to be 1250 days in order to cover a period of approximately five years of daily trading data as it is recommended by Brealey and Myers (2003) for most CAPM applications.