ENERGY COMMODITIES PRICE DYNAMICS: UNDERSTANDING OIL PRICE VOLATILITY

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Overview

This paper aims to explain crude oil price volatility and its relationship respect to some macroeconomic and financial variables. Finding the main drivers of oil price dynamics is a crucial element for the definition of adequate monetary policies and risk management purposes. The role of macroeconomic and financial variables is analyzed in a Vector Error Correction Model (VECM) framework, in order to test the existence of a long run equilibrium in the oil price dynamics. We use monthly data for crude oil prices, the Dollar/Euro exchange rate, the US interest rate, the crude oil Futures open interest, the US oil imports and the gold price over the period 1993-2009. One cointegrating relationship is found which allows to identify a long run equilibrium between the variables.

Methods

Oil prices are an example of an economic variable which is completely unpredictable and recently experienced dramatic price variations over short periods, which had large consequences for oil producers, consumers and policymakers.
In such a context, a simple econometric model is unable to capture the nature of the short term volatility, so we choose a VECM framework to capture a possible long run equilibrium, if it exists.
Using monthly data over the period 1993-2009, we examine the relationship among West Texas Intermediate (WTI) crude oil spot and a set of macro-economic and financial variables, which in our opinion are the main drivers of the oil price fluctuations.
The chosen variables are the Dollar/Euro exchange rates, gold prices, US interest rates, US oil imports and oil futures open interests. We test the existence of a unique cointegration relationship among these variables. The relationship between the xamined variables is analyzed using a cointegration approach given that the standard procedures of inference -the standard regression results and the correlation measure- can be significantly biased when we deal with integrated variables.

Results

The equilibrium relationship shows that oil prices are positively affected by the macroeconomic variables we considered. Using a vector of 6 variables, represented by monthly data collected over the period January 1993-December 2009, we run the Johansen test to investigate the presence of cointegrating relationships.
A rejection of the null no cointegrated relationship in favor of r at most 1 at the 1% significance level is provided, so one cointegrating relationship (r=1) among the variables is found. In this case the cointegrating vector is unique and I(0) and can be expressed as $v_t=B'y_t$. A long run equilibrium among oil, exchange rate, interest rate, gold, US oil imports and futures trading exists and is defined by the following coefficients

$$v_t = -9.29 - 0.013WTI_t + 0.016r_t - 10.57OI_t + 10.73Im_t + 0.001FX_t + 0.011G_t$$

We identify it uniquely in order to provide an economic/financial interpretation and normalize respect to the oil price trying to identify possible restrictions required for other variables. Examining the single variables dynamics we want to carefully understand the role played by the exchange rate and gold during the chosen interval. In particular, given the non stationarity of the variables the simple correlation measure between oil prices and exchange rates provides biased results. In order to have a valid measure of the relationship existing between the two variables, following Amnno and Norden (1998), we test for cointegration between the two variables. Using an Engle Granger the cointegration regression is estimated to fit the equilibrium relationship.
So we set the just-identifying restrictions to normalize respect to oil price. A likelihood ratio test of the set of overidentifying restrictions produces the significant statistic ξ=10.41 so that the set of restrictions are accepted.
An increase in exchange rate or in the level of oil imports causes an increase in the oil price. Also gold influences positively the oil price, in line with previous findings, showing a direct relationship between these two variables, with a sensitivity coefficient =5.37. The only variable which results to have negative impact on oil prices is the oil futures trading. Open interest provides information on the use of Futures contracts in the oil market, futures trading increase is due mainly to hedging and risk managing purposes. Over the last decade Futures trading experienced a huge increase showing how this commodity has become a crucial asset for investment and hedging purposes. Banks, Fund Managers and investors started to trade in oil futures in addition to the traditional oil retailers and manufacturers.

However, the increase of the Futures trading seems to have more an informative role in the long run providing an efficient tool to control oil price fluctuations. Overall, given the cointegrating equation all the variables play a statistically significant role and in the long run all these variables contribute to bring the oil price back toward equilibrium.

Conclusions

The relationship between WTI crude oil spot prices and a set of macroeconomic and financial variables are investigated using a VECM framework. A long run equilibrium among the chosen variables is found: the US dollar/euro exchange rate, the medium term interest rate, the oil imports together with the gold price and the futures trading all contribute to build a long run equilibrium respect to the oil price fluctuations which may only be temporarily perturbed. Th e main role seems to be played by the exchange rate and the gold price. The two variables , gold and the foreign exchange rates, are found to be weakly exogenous respect to the long run equilibrium relationship. This means that gold and foreign exchanges fluctuations may be independent by the cointegrating relationship and we may state that they represent the main drivers of oil volatility

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