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The Evaluation of the USD Currency and the Oil Prices: A Var Analysis*

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Abstract:

Dollar devaluation creates a huge problem in the world oil industry, leading to a vast decrease in the revenues of the oil producers, though the local oil producers use the local currencies to operate and the oil price is evaluated in dollars. The depreciation of the US dollar reduces the effect of the high prices in oil, making it rather cheap for all the countries and especially for the Eurozone area. The record high exchange rate of the Euro vis-à-vis dollar followed by a subsequent high of the crude oil price, suggests on a relation between the price of the oil and the evaluation of the US dollar.

The main aim of this research is to construct an restricted Vector Autoregressive estimation model to simulate the relation between the exchange rate of the U.S. dollar and Euro against the West Texas Intermediate (WTI) prices for light crude oil, in connection with the impulse response of the prices to the various shocks. Lastly, a co integration test will illuminate the possibility of simultaneous long term integration along with Granger causality test to estimate the direction of causality in variables.

Key Words: *Banks USD/EURO, WTI, VAR, Impulse Response, Co-integration Analysis*

JEL Classification*:*

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1. Introduction

Following the introduction of Euro currency to the world economy and the rise of oil prices, U.S dollar is constantly devaluated against Euro, reaching all time low. Since, U.S dollar is a currency of secure deposit for most countries, this devaluation is noticeable for all the economies. There were several indications that major oil production countries intended to swap their currency deposits from U.S. dollars to Euro. Furthermore, oil producers intended also to change the prices of oil from U.S dollars to Euro, with all the negative effects that this will cause to the global growth.

United States economic policy intended to a less restraining currency policy for U.S. dollar and this resulted to the continuous drop of the exchange difference with Euro and other currencies, thus creating a favourable environment for cheaper exports for United States. In reality this currency policy is an efficient tool to refinance the economy and make the products more attractive. United States are suffering from long run deficits in economy and this loosening policy in currency has sustained a constant growth in American economy and avoids the recession from expensive oil prices. Moreover, the devaluation of U.S. dollar causes a great impact in the other currencies and more specific to the newly arrived rivals, the Euro.

On the other hand, oil industry is operating world wide using the local labor forces and local currencies. Exploration, exploitation and transportation of oil costs rose the last years, creating unsustainable additional costs for the oil companies and the oil producing countries. Because, of the decrease in the oil reserves and the even growing demand for more quantities of oil production, prices of barrel went higher. The emerging markets are constantly increasing their estimations for the oil quantities needed to sustain the rate of economic growth. With China being the leader of this change and also one of the major bond holders of United States debt, this increase in oil prices would have negatively impact in their economy.

Another reason for the constant rise in oil prices is the exploitation of oilfields, which used to be unprofitable to operate due to various factors. If the depth of the drilling is prohibitive in terms of cost, the oilfield is being rejected. Also, there areas with unstable climate, like north and southern pole that have major oil reserves but the operation is dangerous and sometimes economically unviable. The transport of the mined oil to refineries from these difficult areas is very expensive and there is not enough transportation means for these areas. The solution of underwater pipes is being discarded, because the investment will not be profitable. However, conditions have changed after the rally in oil prices. These oilfields that were abandoned as an uneconomic investment nowadays are being exploited. Although, there are several cases that the operation is being halted or the transport is being delayed, creating negative impact in prices, but the scarcity of oil deposits creates a profitable gap in the oil market.

Opec and non opec countries are constantly rejecting the idea to re evaluate the rate of oil production to higher levels so as suppress the expensive oil prices.

Being aware of the danger to reduce the oil reserves in the next fifty years, thus loosing a great part of their income, oil producing countries are not investing in new exploitation and refinery methods to boost oil production, deliberately. However, with US dollar devaluated, oil producing countries are suffering from loss in their reserves and income. Furthermore, the cost of exploitation is rising because the operation is being paid in the local currency. Therefore, they prefer oil prices to follow the rise of Euro currency against U.S. Dollars, so as to sustain their profits. Furthermore, there were constant discussion to create a basket of currencies for the price of barrel, but this idea has been rejected and the solution of the Euro currency as an alternative pricing currency had gained more supporters.

There is difficulty to determine if the oil prices are increasing due to the rates of US. Dollar deprecation or vice-versa, but surely there is some king of long term co integration. Furthermore, this change is only for the period after the initiation of the Euro currency, because before that the oil prices and U.S. Dollar appreciation against other currencies seem to had a positive relationship.

2. Literature Review

Existing empirical research suggests that a rise in oil prices is being followed by and appreciation of U.S. dollar. (Throop, 1993,Zhou, 1995, Dibooglu, 1996, Amano and van Norden, 1998).More specific this positive relationship is being directed by oil prices, which explain the movement of U.S Dollar, meaning causality runs from oil price variations to exchange rate. Chaudhuri and Daniel (1998) used co integration methodology and proved that the non stationay behaviour of U.S dollar exchange rates is being is derived from the non stationarity of oil prices. Bénassy-Quéré, Mignon and Penot (2007) showed a long–term relation of the two series in real terms and for a causality running from the real price of oil to the real effective exchange rate of the dollar.

On the other hand, Sadorsky (2000) examined the co integration and causal relationship between energy futures price of crude oil, heating oil and unleaded gasoline, and the U.S. dollar effective exchange rates. He suggested that exchange rates create exogenous shocks to energy futures prices, and that recent movement in oil prices maybe it is a response to the change in the U.S. dollar.

3. Methodology and Data

Stationarity: Stock market time series used in this study must be examined for the level of their integration by using the Augmented Dickey-Fuller (1979; 1981); methodologies. Augmented Dickey-Fuller(ADF)(1979) test is being applied to define the order of integration of variables . More specific, the general form of ADF test is used, which suggests that time series have a trend and an intercept. The

optimal lag length is being determined with the Schwartz's Bayesian Criterion (Wei 1994; Schwartz 1978).

$$\Delta y_t = a_0 + a_1 y_{t-1} + a_2 t + \beta_1 \Delta y_{t-1} + \beta_2 \Delta y_{t-2} + ... + \beta_\rho \Delta y_{t-\rho} + \upsilon_t$$

Ho: Non stationary, if $a_1 = 0$

The variables must the same order of integration so as to proceed with the test of co integration. In case a variable is found to be stationary without differencing, is not omitted from the model, thus is included as an exogenous variable

When all stock market time series are integrated in first level I (1), the co-integration test proposed by Johansen can be conducted.

Consider a general kth order VAR model:

$$\Delta Y_t = D + \Pi Y_{t-1} + \sum_{i=1}^{k-1} \Gamma_t \Delta Y_{t-1} + \varepsilon_t$$

Where:

Yt = An (n ×1) vector to be tested for co-integration

ΔYt = Yt-Yt-1

D = The deterministic term which may take different forms such as a vector of zeros or non-zeros constants depending on several properties of the data

Π and Γ= Non unit matrices of coefficients

The co-integration relationship can be determined from matrix Π. If matrix Π = 0 there is no co-integration. In a bi-variable case, i.e., n = 2, the two variables are co-integrated only if the rank of matrix Π equals 1 (Johansen and Juselius 1990), considering that the kth order of VAR has a vector of εt, that is a multivariate normal white noise process with mean 0 and finite covariance matrix.

Johansen (1998) proposed to test for co-integration by examining a combination of null hypotheses as follows. If the rank of matrix Π = 0 there is no-co-integration in the set of series in question, if the rank of matrix Π = m, where m is the number of the series used, all the series m are stationary and if the rank of matrix Π = r, where 0<r<1, then the series are co-integrated.

Alternatively co-integration can be tested by examining the trace and the maximum Eigenvalues as stated below:

$$\lambda_{trace} = -T\sum_{i=r+1}^{n} \ln(1-\lambda_t)$$

$$\lambda_{max} = -T\ln(1-\lambda_{r+1})$$

where, λ1,…, λr, are the r largest squared canonical correlations between the residuals obtained by regressing ΔYt and Yt-1 on ΔYt-1, …, ΔYt-k-1, where k = 0, 1, 2,...,n. The critical values are provided by MacKinnon et al. (1999) for p-values and by Osterwald-Lenum (1992) for λ (r).

To determine the number of co integration equations and the model of the vector error correction model the Pantula Principle will be used which is being proposed by Johansen. Pantula principle suggests that the co integration rank must be jointly be examined with the model to be applied. The test is base on the assumption that the estimation should start from the most restrictive model to the less restrictive. When the Ho hypothesis is being firstly rejected, this is the model that should be used for estimating the indicative co integration relations.

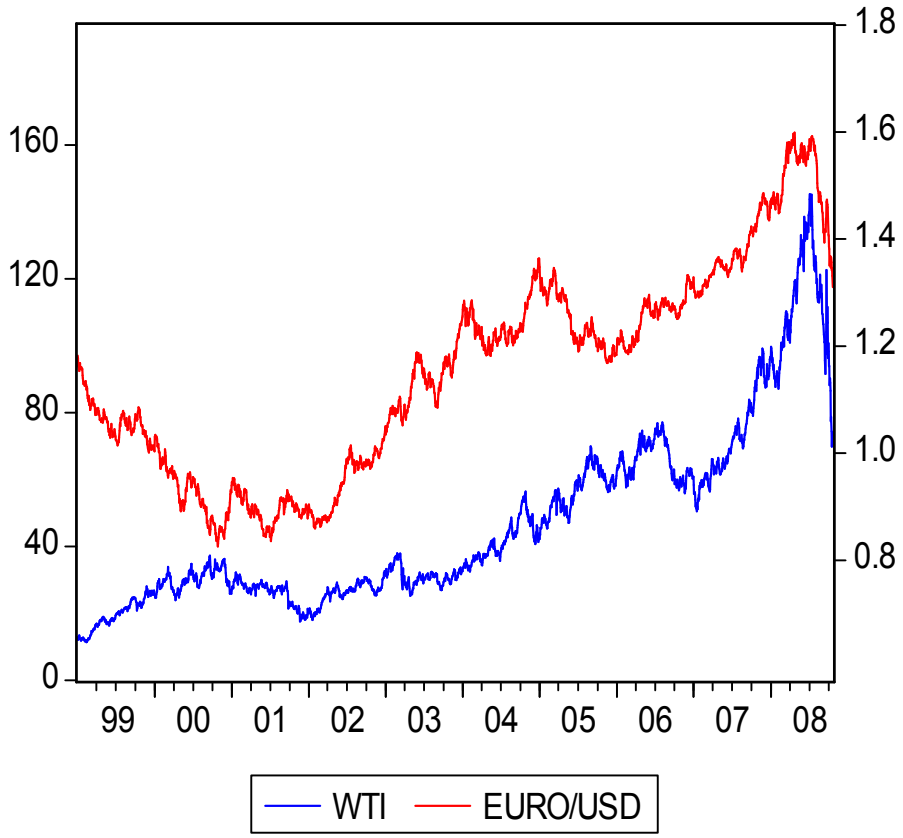
Granger Causality: The Granger causality test is a statistical hypothesis test for determining whether one time series is useful in forecasting another. A time series X is said to Granger-cause Y if it can be shown, if X values provide statistically significant information about future values of Y.

The test for Granger causality works by regressing ΔY on lagged values of ΔY. Once the set of significant lagged values for ΔY is found, the regression is augmented with lagged levels of ΔX. Then the null hypothesis of no Granger causality is retained if and only if no lagged values of ΔX have been retained in the regression.

Data: The dataset is a daily WTI and EURO/USD prices from 04/01/1999 to 21/10/2008, covering a period of ten years (2453 observations). West Texas intermediate is used for the price of crude oil as the most common index related with the USD currency

The data will be transformed in their logarithm form so as to eliminate the different measurement units and include all the prolific characteristics of time series.

Graph 1:West Texas Intermediate and Euro to Usd exchange difference



Source: US energy Information Administration – Clarkson's Research

4. Results

Stationarity test: Time series are non stationary in their levels, but after one differation are becoming stationary, meaning they are I(1). The lag used for Augmentd Dickey Fuller test has been determined by Schwarz info Criterion and for statistic significane a:0,05.

Table 1. Stationarity Test

Augmented Dickey Fuller				
(SC criterion,a=0,05)	In their Levels	Critical Val	1st Diff	Critical Val
L(Euro_Usd)	-0,719	-2,863	-50,696	-2,863
L(WTI)	-1,953	-3,433	-51,531	-2,863

Co integration test: Pantula principle suggest model no 2, meaning intercept (no trend) in CE, no intercept or trend in VAR.

Table 2. Pantula Principle-Model and Rank Specification

	a=0,05					
	TRACE	**C.V.**	**P-values**	**MAX-EIGEN**	**C.V.**	**P-values**
Ho: r = 0 vs Ha: r = 1	17,20297*	15,4971	0,0274	16,90232	14,26460	0,0187
Ho: r = 1 vs Ha: r = 2	0,300649**	3,841466	0,5835	0,300649*	3,841466	0,5835
*Ho is rejected for a=0,05 **Ho is not rejected for a=0,05						

Long term part: In long run a rise by 1% percent in the price of Euro against US dollar causes the rise of oil prices by 2,76%. Because the series are transformed, the theory of elasticity can be used to interpret the results, thus the WTI is highly elastic to the change of EURO/US.dollars exchange difference. As far as it concerns the statistic part of this model, the only independent variable is significant.

$$LOG(WTI(-1)) = 2.76*LOG(EURO\_USD(-1)) - c$$
$$[-6,05924]$$

Short term part: In order to sustain the equilibrium in the long term period, the error correction term must negative, so as to have the characteristic of correction.

$$\Delta \log WTI_t = \Delta \log WTI_{t-1} + \Delta \log Euro\_USD_{t-1} + Lu_{t-1} + V_t$$

where as:Δ is the first difference of the variable

L is the short run parameter

u_{t-1}:are the residuals from the long-run equilibrium

and V_{t-1} :white noise

The results suggest that the oil prices are being corrected each year by -0,0055 or 0,55%. Furthermore, the error correction term is statistic significant in this model

$$D(LOG(WTI)) = -0.0055*(u_{t-1}) - 0.038*D(LOG(WTI(-1))) - 0.0778*D(LOG(EURO\_USD(-1)))$$
$$[-3.51737] \qquad [-1.91008] \qquad [-0.96398]$$

$$+0.000757$$
$$[1.52509]$$

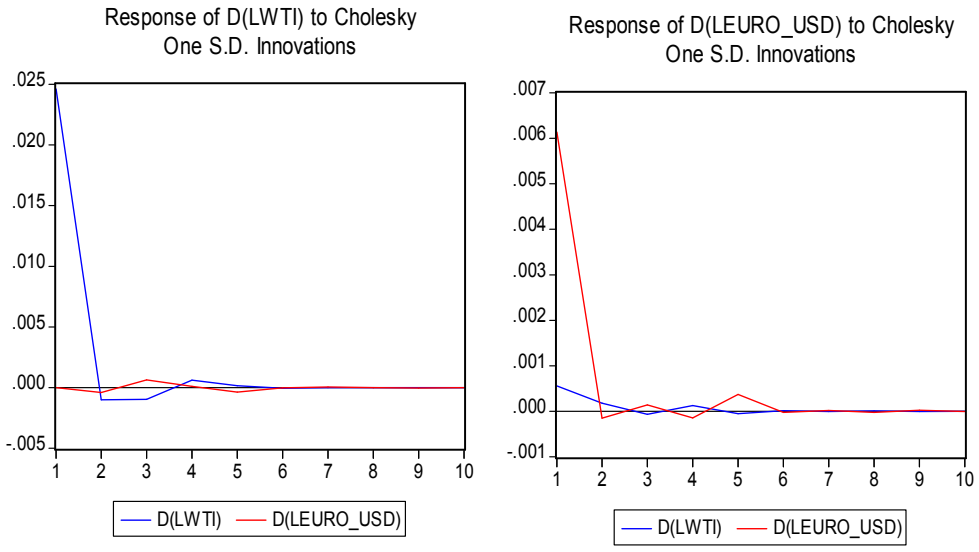
Granger Causality: For a:0,05 statistic or a:0,10 statistic we reject for both cases the Ho. Therefore, WTI granger causes the Euro/USD and vice versa, meaning that there is bilateral relationship between the two variables.

Table 3:Granger Causality test

Pairwise Granger Causality Tests			
Null Hypothesis:	Obs	F-Statistic	Probability
D(LOG(EURO_USD)) does not Granger Cause D(LOG(WTI))	2451	0,86799	0,3516
D(LOG(WTI)) does not Granger Cause D(LOG(EURO_USD))		2,45	0,11746

Impulse response: An impulse response of one standard deviation of WTI influences the Euro/Usd exchange difference moderately, and after the six periods this unconditional changes are eliminated. When an impulse response of one standard deviation of Euro/Usd is inserted to the system, WTI reacts more sharply and takes a longer period to eliminate this change in the variables. Furthermore, this drastic response in the first period suggests that series are very well fitted by the VAR, which inherits all the significant characteristics of a short run dynamic system.

Table 4. Impulse Response



5. Conclusion

The results, suggest that there is a long run dynamic co integration of oil and euro /usd exchange, without to determine this relationship from Johansen Co integration test if it is one way relation or both ways. In the long term period oil prices follow the appreciation of Euro and are being corrected by a very low convergence rate. The model used in this case can be further enhanced with the implementation of Dummy Variable in unstable periods.

Furthermore, Granger causality test answers the initial question for the direction of this relation of oil prices and exchange difference. In both case Granger non causality is being rejected, and the direction change from the one price to another. This bilateral connection of the two variables maybe suggests that the co integration scheme proposed is sufficient to manifest any future continuous relation of the two variables.

The adjustment of Oil prices from a shock in the economy takes longer period and the changes are drastic. One the other hand the exchange difference of Euro/Usd is absorbing the shock and radically reduces the effect of the change.

Finally, the relation of the two markets maybe change again in the future, since the economic policy of United States maybe change to a more restraining currency policy. Furthermore, there is always the possibility of more efficient oil production or a radical facilitation of other fuels instead of oil, which will suppress the prices of oil in the long term.

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