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THE FUNDAMENTAL AND SPECULATIVE COMPONENTS OF THE OIL SPOT PRICE: A REAL OPTION VALUE APPROACH

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Overview

In this paper we focus on some of the key causes behind the unstable oil price path, by exploring the stochastic behavior of the World Texas Intermediate (WTI) and Brent oil spot price from January 1994 until December 2010. In particular we aim to analyze the recent dynamics of oil price formation from both the point of view of its fundamental drivers and its speculative components with the objective to analyze the main drivers that during last fifteen years have led the unstable path and the volatility persistence in the international oil market.

Methods

We assume that the oil price is composed by two components, deterministic and speculative. The first one can be defined as the certain one, and it is referred to the fundamental component given by supply and demand interaction. Differently, the uncertain one is given by unclear changes in the price structure, and it is assumed to be linked to the speculative activity. Through a structural equation model (SEM) in a linear reduced form we find that the speculation in the oil market measured with the real option methodology can improve the traditional model explaining a consistent part of the oil fluctuations. To this end we use a number of results from real option theory to construct econometric estimates of the speculative components of monthly oil price movements.

Results

Our results show that speculative components, measured according to mathematical option theory, may be at the origin of significant and sizable effects on oil prices, specially for what concerns the episodes of extreme variations. We find that adding the speculative component among the explanatory variables is an achievable improvement in the understanding of the short-run market dynamics of oil prices. It can also be asserted that speculative buying by index funds in commodity futures and over the counter (OTC) derivatives markets could have created a bubble in oil prices with the result that prices level far exceeded fundamental values at the peak and that the “financialization” itself of commodities has been responsible of a speculative bubble in the price of oil.

Conclusions

Several possibilities can be conjectured: the first is that speculation may have been driven by the money invested by large financial institutions, hedge funds, pension funds, and other investment funds. These institutions have been pouring billions of dollars into the energy commodity markets, trying to take advantage of sudden price changes pushing its price far from its fundamentals. A second reason is that speculation may be just the reflection of rational expectations about future disequilibria in the supply-demand balance. A final possibility is that speculation is the mirror of geopolitical imbalances in the international markets.

References

- Agnolucci, P. (2009). Volatility in Crude Oil Futures: a Comparison of the Predictive Ability of GARCH and Implied Volatility Models. *Energy Economics*, 31:316–321.
- Al Faris, A. (1991) The Determinants of Crude Oil Price Adjustment in the World Petroleum Market. *OPEC Review*, 15.
- Amenc, N. Maffei, B. and Till, H. (2009) Oil Prices: the True Role of Speculation. Edhac Asset Management Research Centre. Position Paper ad the Edhac Business School.
- Askari, H. and Krichene, N. (2008) Oil Price Dynamics (2002-2006). *Energy Economics*, 30:2134–2153.
- Bacon, R. (1991) Modelling the Price of Oil. *Oxford Review of Economic Policy*, 7:17–34.
- Calcagnini, G. and Saltari, E. (2000). Real and Financial Uncertainty and Investment Decisions. *The Journal of Macroeconomics*, 22(3).
- Riffart, C. Chevillon, G. (2009) Physical Market Determinants of the Price of Crude Oil and the Market Premium. *Energy Economics*, 31.

- Dasgupta, P.S. and Heal, G.M. (1974). The Optimal Depletion of Exhaustible Resources. *Review of Economic Studies*, pages 3–28.
- Dees, S. Karadeloglou, P. Kaufmann, R.K. and Sanchez, M. (2004). Does OPEC Matter? An Econometric Analysis of Oil Prices. *The Energy Journal*, 25:67–90.
- Dees, S. Karadeloglou, P. Kaufmann, R.K. and Sanchez, M. (2007). Modelling the World Oil Market: Assessment of a Quarterly Econometric Model. *Energy Policy*, 35:178–191.
- Dixit, A.K. and Pindyck, R.S. (1994). *Investment under Uncertainty*. Princeton University Press, Princeton.
- L. Eagles. Medium - Term Oil Market Uncertainties (2008). OECD/ITF Joint Transport Research Centre Discussion Papers, 19.
- Energy Information Administration. (2008) (2009). *International Energy Outlook*. U.S. Department of Energy, Washington, DC, 2008.
- Fattouh, B. (2007). The Drivers of Oil Price: the Usefulness and Limitations of Nonstructural Model, the Demand-Supply Framework and Informal Approaches. Oxford Institute for Energy Studies - WPM, 32.
- Fattouh, B. (2010). Oil Market Dynamics through the Lens of the 2002 - 2009 Price Cycle. Oxford Institute for Energy Studies - WPM, 39.
- Fox, J. (2002). *Structural Equation Models*. Mimeo.
- Gately, D. and Huntington, H.G. (2002). The asymmetric effects of changes in price and income on energy and oil demand. *The Energy Journal*, 23(1):19–24.
- Gilbert, R. (1979). Optimal Depletion of an Uncertainty Stock. *Review of Economic Studies*, 46(1):47–57.
- Green, K.A. and Mork, S.L. (1991). Towards Efficiency in the Crude Oil Market. *Journal of Applied Econometrics*, 6.
- Gulen, S.G. (1998). Efficiency in the Crude Oil Futures Markets. *Journal of Energy Finance and Development*, 3:13–21.
- Hamilton, J.D. (2008). *Understanding Crude Oil Prices*. NBER Working Papers, 14492.
- Heckman, J.J. (2010). Building Bridges between Structural and Program Evaluation Approaches to Evaluating Policy. *Journal of Economic Literature*, 48(2).
- Hotelling, H. (1931). The Economics of Exhaustible Resources. *Journal of Political Economy*, 39:137–175.
- Kaufmann, R. Karadeloglou, P. and Di Mauro, F. (2008). Will Oil Prices Decline over the Long Run? European Central Bank, Occasional Paper Series, 98.
- Kaufmann, R.K. (1995). A Model of the World Oil Market for Project LINK Integrating Economics, Geology and Politics. *Economic Modelling*, 12(2):165–178.
- Kaufmann, R.K. Dees, S. Karadeloglou, P. and Sanchez, M. (2004). Does OPEC Matter? An Econometric Analysis of Oil Prices. *The Energy Journal*, 25:67–90.
- Kaufmann, R.K. and Ullmann, B. (2009). Oil Prices, Speculation and Fundamentals: Interpreting Causal Relations among Spot and Futures Prices. *Energy Economics*, 31:550–558.
- Kilian, L. Rebucci, A. and Spatafora, N. (2009). Oil Shocks and External Balances. *Journal of International Economics*, 77:181–194.
- Krichene, N. (2005). A Simultaneous Equations Model for World Crude Oil and Natural Gas Markets. IMF Working Paper IMF Working Paper, 32.
- Krugman, P. (2008). More on Oil Speculation, May.
- Levhari, D. and Pindyck, R.S. (1979). The Pricing of Durable Exhaustible Resources.
- Levine R. and Renelt, D. (1992). A Sensitivity Analysis of Cross-Country Regressions. *American Economic Review*, 82:942–963.
- Manera, M. Longo, C. Markandya, A. and Scarpa, E. (2007). Evaluating the Empirical Performance of Alternative Econometric Models for Oil Price Forecasting.
- Merino, A. and Ortiz, A. (2005). Explaining the so-called “Price Premium” in Oil Markets. *OPEC Review*, 29:133–152.
- Moosa, I. A. and Al-Loughani. (1995). N. E. The Effectiveness of Arbitrage and Speculation in the Crude Oil Futures Market. *The Journal of Futures Markets*, 15:167–186.
- Morana, C. A Semiparametric Approach to Short-term Oil Price Forecasting. (2001). *Energy Economics*, 22.
- Moroney, J.R. and Berg, D. (1999). An Integrated Model for Oil Production. *The Energy Journal*, 20.
- Peterson, F.M. (1975). Two Externalities in Petroleum Exploration. Brannon, Gerard M., ed.
- Pindyck, R.S. (1978). Gains to Producers from the Cartelization of Exhaustible Resources. *The Review of Economic and Statistics*, 60(2):238–251.
- Pindyck, R.S. (2001). The Dynamics of Commodity Spot and Futures Markets: A Primer. *The Energy Journal*, 22:1–29.
- Pindyck, R.S. and Rotemberg, J.. (1990). The Excess Co-movement of Commodity Prices. *The Economic Journal*, 100.
- Ramcharran, H. (2001). Opec’s Production under Fluctuating Oil Prices: further Test of the Target Revenue Theory. *Energy Economics*, 23.
- Reigner, E. (2007). Oil and Energy Price Volatility. *Energy Economics*, 29.
- Roll, R. (1994). Orange Juice and the Weather. *American Economic Review*, 74.
- Salant, S.W. Exhaustible Resources and Industrial Structure: a Nash-Cournot Approach to the World Oil Market. *Journal of Political Economy*, 84(5):1079–1093, 1976.
- Samii, M.V. Oil Futures and Spot Markets. *OPEC Review*, 4:409–417, 1992.
- Serletis, A. Rational Expectations, Risk and Efficiency in Energy Futures Markets. *Energy Markets*, 13:111–115, 1992.

Stevans, L.K. and Sessions, D.N.. Speculation, Futures Prices and U.S. Real Price of Crude Oil. Available at SSRN: <http://ssrn.com/abstract=1154686>, 2008.

Stiglitz, J.E. The Efficiency of Market Prices in Long-run Al locations in the Oil Industry. Brannon, Gerard M., ed., 1975.

Stokey, N.. The Economics of Inaction. Princeton University Press, Princeton, (NJ), 2009.

Ye, M. Zyren, J. and Shore, J. Forecasting Crude Oil Spot Price Using Oecd Petroleum Inventory Levels. *International Advances in Economic Research*, 8:324–334, 2002.

Ye, M. Zyren, J. and Shore, J. A Monthly Crude Oil Spot Price Forecasting Model Using Relative Inventories. *International Journal of Forecasting*, 21:491–501, 2005.

Ye, M. Zyren, J. and Shore, J. Forecasting Short-run Crude Oil Price Using High and Low Inventory Variables. *Energy Policy*, 34:2736–2743, 2007.

Zamani, M. An econometrics forecasting model of short-term oil spot price. Paper Presented at the 6th IAEE European Conference, 2004.

Zeng, T. and Swanson, N. R. Predictive Evaluation of Econometric Forecasting Models in Commodity Future Markets. *Studies in Nonlinear Dynamics and Econometrics*, 2, 1998.