UNCERTAINTY TRANSMISSION IN COMMODITY MARKETS

Marc Joëts, Ipag Business School and University of Paris West, marc.joets@ipag.fr
Valérie Mignon, University of Paris West and CEPII, valerie.mignon@u-paris10.fr
Tovonony Razafindrabe, University of Paris West, t.razafindrabe@u-paris10.fr

Overview

Uncertainty in economics has been widely documented in the literature, and the propagation mechanism of this shock to activity has been extensively discussed both theoretically and empirically. For instance, the theories of investment under uncertainty explain why under condition of irreversibility or fixed cost, uncertainty over future returns reduces current investment, hiring, and consumption through an "option value to wait" (see Henry, 1974; Bernanke, 1983; Brennan and Schwartz, 1985; Majd and Pindyck, 1987; Brennan, 1990; Gibson and Schwartz, 1990; Bloom et al., 2007; Bloom, 2009; Bredin et al., 2011; ...). At a micro-level, increased uncertainty may diminish the willingness of firms to commit resources to irreversible investment, and the willingness of consumers to spend or allocate their consumptions. Bernanke (1983) argues, in addition, that uncertainty about the return to investment at a micro-level may create cyclical fluctuations in aggregate investment at a macro-level. By extending this theory to oil market, several empirical and theoretical studies have demonstrated the significance of oil price uncertainty in various perspectives. Pindyck (1991) suggests that oil price uncertainty is the cause of the recessions of 1980 and 1982. Favero, Pesaran and Sharma (1994) confirm the existence of "option value to wait" in oil market due to oil price uncertainty. Lee et al. (1995) evidenced the significance of oil price uncertainty rather than real oil price changes in forecasting economic activity (i.e. GNP growth). More recently, Kellogg (2010) by using Texas oil well drilling data confirms the real option as firms reduce their drilling activity when uncertainty rises (i.e. when expected volatility increases). In a serie of papers, Elder and Serletis (2009a, 2010) show, by using structural vector autogressive (VAR) model with multivariate Generalized Autoregressive Conditional Heteroskedasticity (GARCH) in-mean process for post-1980 data, empirical evidence that uncertainty about oil prices has tended to depress output, investment, and consumption in the United States and the G-7 countries. Finally, Jo (2013) supports, by using a quaterly VAR model with stochastic volatility in mean, that oil price uncertainty shock has negative effects on world industrial production.

All these papers, are exclusively concerned about uncertainty with respect to the oil price itself and its impact on economic and do not address the reverse issue (i.e. the effect of macroeconomic uncertainty to oil price fluctuations). Three exceptions addresse this issue: Pindyck (1980) which discusses the theoretical implication on oil price behavior of the demand and oil reserves uncertainty; Litzenberger and Rabinowitz (1995), who analyze backwardation behavior in oil futures contracts; and Van Robays (2013), who investigates, by a threshold vector autoregressive model, whether macroeconomic uncertainty changes the responsiveness of oil prices to shocks in oil demand and supply. Building of this line of literature, our paper is more related to the Van Robays (2013)'s paper but extend his framework in a considerable way. Because commodity markets are known to be related each other, we first investigate how uncertainty affects various commodity price behaviors (i.e. energy, precious metals, agricultural, and industrial markets) to see whether this impact is different depending on type of markets. Second, unlike to Van Robays (2013) who uses inconsistant proxies of uncertainty which tend to erroneously attribute forecastable variations as uncertain (such as the volatility in world industrial production growth, the conditional variance of US GDP production growth, and the Chicago Board of Exchange VXO stock market volatility), we employ the robust approach developed by Jurado, Ludvigson, and Ng (2013) to measure uncertainty which has the particularity to be free as possible from any theoretical models, and to provide measure at both macroeconomic and microeconomic levels and for distinct maturities. We can therefore compare the effect of uncertainty in three ways: (i) across commodity markets, (ii) between micro level and macro level, and (iii) across maturity.

Methods

To provide a coherent measure of macroeconomic uncertainty, we follow the definition of Jurado, Ludvigson and Ng (2013) by considering uncertainty as predictability. Therefore, when an economy is more or less predictable it means that is more or less uncertain. According to this notion of uncertainty, unforecastable component of the future value of the series, authors define the h-period-ahead uncertainty in the variable $y_{jt} \in Y_t = \left(y_{1t}, \dots, y_{N_y t}\right)$ to be $U_{jt}^{y}(h)$, the conditional volatility of the purely unforecastable component of the future value of the series

$$U_{jt}^{y}(h) = \sqrt{E\left(y_{jt+h} - E\left(y_{jt+h}/I_t\right)\right)^2 /I_t}$$

here $E(./I_t)$ is the conditional expectation of the considered variable and I_t the available information at time t. Uncertainty of variable y_{jt+h} is therefore defined by the expectation of the squared error forecast.

Our purpose in this paper is to analyze whether macro and micro uncertainty affects commodity prices behavior, and thereby explains commodity price movements. To address this issue, we first consider large dataset of 19 principal commodity markets (energy, precious metals, agricultural and industrial markets) and assume that uncertainty may be a nonlinear propagator of shocks across markets, captured by a structural threshold vector autoregressive (TVAR) model. The TVAR model is relatively simple and intuitive way to capture nonlinear uncertainty effect on markets. Moreover, the model has the advantage to endogeneously identify different regimes. Indeed, since the transition variable that determines regimes is included in the model, the TVAR allows uncertainty regimes to switch as a result of shocks to commodity markets.

Preliminary results & conclusion

Our preliminary results reveal that macroeconomic uncertainty affects price dynamics and comovements of commodity markets. First, it appears that uncertainty has a nonlinear impact on commodity prices (i.e. we strongly reject linearity in each case), revealing the macroeconomic nonlinear propagator nature. Second, impulse response functions in low and high uncertainty regimes show that the degree of uncertainty influences commodity market dynamics as well as price comovements, especially for energy, precious metals, and industrial markets. More formally, comovements between markets are more intense in high uncertainty regime. Third, the effect of uncertainty is different as maturity increases. Indeed, the threshold variable is higher as maturity increases meaning that the percentage of high uncertainty decreases at longer horizon. The level of uncertainty is also higher but less variable at longer maturities, and the impact on commodity price behaviours is less pronounced. This result means that what is important in the effect on commodity markets is more the variability than the level of uncertainty.