

# *The empirical relationship between US monetary policy and oil prices*

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## **Overview**

While supply and demand factors can generally explain the bulk of the fluctuations in commodity prices, other factors may play an important role too (Hamilton 2009). Considering the behavior of oil prices, Kilian (2009) and Alquist and Kilian (2010) highlight the significance of precautionary demand shocks that have been determined to increase current demand for oil through increased uncertainty about future oil supply shortages. Following the seminal paper by Frankel (1984), monetary conditions and interest rates have attracted attention as possible driving factors of commodity prices. Frankel (1986) extends Dornbusch's theory of exchange rate overshooting to the case of commodities and, using no-arbitrage conditions, derives a theoretical link between oil prices and interest rates. This current paper largely uses Frankel (1986) as the basis for own paper.

Very important contributions came about as Barsky and Kilian (2002, 2004) show that monetary policy position is a good predictor of commodity prices. A very important finding therein (Barsky and Kilian, 2002) proposes that the oil price increases of the 1970s could have been caused, at least in part, by monetary conditions. During the commodity price uproar of 2008, some commentators suggested that loose monetary policy and persistently low interest rates could have, at least in part, fueled the price hike (Hamilton 2009). If this is so, then it is important to understand whether and to what extent the massive monetary policy easing taking place could lead to yet another massive hike in commodity prices.

This paper investigates the empirical relationship between US monetary policy and oil prices. Justification for the research is twofold. First, U.S. and sometimes even global monetary conditions are occasionally referred to as a driver of commodity prices. This view is consistent with some previous research (see next section for details) which regarded the increases in prices of oil and other commodities in the 1970s as the result of overly expansionary US monetary policy, rather than as exogenous inflationary supply shocks such as the 1973 Arab oil embargo and the 1979 fall of the Shah of Iran. Second, current Federal Reserve Chair, Dr. Yellen, has recently argued that Fed's existing tools may or may not be adequate to respond to future economic downturns: "...one lesson from the crisis is that our pre-crisis toolkit was inadequate to address the range of economic circumstances that we faced. Looking ahead, we will likely need to retain many of the monetary policy tools that were developed to promote recovery from the crisis. In addition, policymakers inside and outside the Fed may wish at some point to consider additional options to secure a strong and resilient economy" (<http://www.federalreserve.gov/newsevents/speech/yellen20160826a.htm>). Hence it is clear that we do not know at the moment what direction the Fed will take in terms of its policy. Thus it is even more important to recognize potential effects different monetary policy scenarios could have on oil prices in the U.S. Timeliness of the issue is not the only contribution the paper makes. Some recently developed times series tools are used in the analysis thus distinguishing this paper from the similar research done in the past.

## **Methods**

Modified economic model of Frankel and Dornbusch will be used in the analysis. Econometric time series analysis consists of a series of tests including tests for unit roots, and cointegration including appropriate restrictions placed on cointegrating vectors. In order to examine the short-run adjustment to long-run steady states between money supply and other variables, the parsimonious VEC (PVEC) model is estimated using full-information maximum likelihood (FIML). Data used in the model and in the analysis consist of real money supply measured by M1 as nominal M1 is deflated by GDP deflator; oil prices measured in Producer Price Commodity Index (2010=100); industrial prices, measured in Producer Price Commodity Index (2010=100); and, real effective exchange rate (2010=100). Quarterly data over the period 1980:Q1-2014:Q4 are used in the analysis.

## **Results**

Preliminary results are as follows. After all series have been determined to be I(1), the results of the most recent Johansen cointegration test with a structural break (1995:Q1), where the null hypothesis that there are at most  $r$  cointegrating vectors is tested using the trace test. The trace tests show that  $r=3$  cannot be rejected, indicating that

three cointegrating vectors are found at the 10% significance level. This suggests that all of the four variables are integrated over the sample period. Since four cointegrating vectors are found, restrictions on the cointegrating spaces,  $\beta$ , are conducted using a likelihood ratio (LR) tests in order to identify the uniqueness of the cointegration space. A LR statistic of 0.008 (p-value = 0.775) indicates that the proposed restrictions are acceptable. Next, the long-run coefficients ( $\beta_1$ ,  $\beta_2$  and  $\beta_3$ ) explain the long-run relationship among the selected variables. For example, the first error-correction model, EC1 (derived from  $\beta_1$ ) shows that a 1% increase in money supply leads to an increase in oil prices by 0.525%. But it is not statistically significant. The second error-correction model, EC2 (derived from  $\beta_2$ ), indicates that a 1% increase in money supply causes a 3.037% increase in industrial prices. The third error-correction model, EC3 (derived from  $\beta_3$ ), show that a 1% increase in money supply causes a 7.910% decrease in exchange rates. In particular, it turns out that each of the coefficients of the oil and industrial prices are not equal to unity, suggesting the non-neutrality of money supply in the long-run.

The results show that the error-correction terms for oil prices and industrial prices are negative and statistically significant at least at the 10% level, indicating that, when deviating from equilibrium conditions due to money supply shocks (i.e., overshooting), oil and industrial prices adjust to correct long-run disequilibria in the markets. For example,  $EC1 = -0.070$  in the oil prices equation suggests that a short-run overshooting from the long-run money supply relationship requires oil prices to fall to restore the equilibrium. Likewise,  $EC2 = -0.044$  in the industrial prices equation implies that industrial prices must also fall to correct long-run disequilibria with the short-run overshooting. Further, the absolute values of the two error-correction terms indicate that with money supply shocks oil prices tend to adjust more quickly than industrial (sticky) prices to achieve the long-run equilibrium, thereby affecting relative prices in the short-run.

## Conclusions

Two most important conclusions are that: (1) monetary shocks cause adjustments of industrial and oil prices to be vastly different in the long run thus implying non-neutrality of money in the long run, and (2) oil prices tend to adjust more quickly than industrial (sticky) prices to money supply shocks to achieve the long-run equilibrium, thus affecting relative prices in the short-run. Hence monetary policy has both short- and long-run impacts on commodity prices and their reaction to these shocks can be used to predict how the rest of the prices in the economy (industrial prices in this case) will react to the monetary policy shocks.

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