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The Impact of Monetary Policy on Commodity Prices

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of "The Effect of Monetary Policy on Real Commodity Prices," NBER, 2006
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By Jeffrey Frankel

Commodity prices are back, with a vengeance. In the 1970s, macroeconomic discussions were dominated by the oil price shocks and other rises in agricultural and mineral products that were thought to play a big role in the stagflation of that decade. In the early 1980s, any discussion of alternative monetary regimes was not complete without a consideration of the gold standard and proposals for other commodity-based standards.

Yet the topic of commodity prices fell out of favour in the late 1980s and the 1990s. Commodity prices generally declined during that period; perhaps declining commodity prices are not considered as interesting as rising prices. Nobody seemed to notice how many of the victims of emerging market crises in the 1990s were oil producers that were suffering, among other things, from low oil prices (Mexico, Indonesia, Russia) or others suffering from low agricultural prices (Brazil and Argentina). The favourable effect of low commodity prices US macroeconomic performance – helping deliver lower inflation in the 1990s than had been thought possible at such high rates of growth and employment – was occasionally remarked. But it was not usually described as a favourable supply shock, the mirror image of the adverse supply shocks of the 1970s. It always received far less attention than the influence of other factors, such as the declining prices of semi-conductors and other information technology and communication equipment. Indeed, anyone who talked about sectors where the product was clunky and mundane as copper, crude petroleum and soy beans was considered behind the times. In Alan Greenspan's phrase, GDP had gotten "lighter". Agricultural and mining no longer constituted a large share of the New Economy, and did not matter much in an age dominated by ethereal digital communications, evanescent dotcoms, and externally outsourced services.

Now oil prices and many broader indices of commodity prices are again at or near all-time highs in nominal terms, and are very high in real terms as well. Copper, platinum, nickel and zinc, for example, all hit record highs in 2006, in addition to crude oil. As a result, commodities are once again hot. It turns out that mankind has to live in the physical world after all! Still, the initial reaction in 2003-04 was relaxed, on several grounds: (1) Oil was no longer a large share of the economy, it was said; (2) Futures markets showed that the "spike" in prices was expected to be only temporary; and (3) Monetary policy need focus only on the core CPI inflation rate and can safely ignore the volatile food and energy component, unless or until it starts to get passed through into the core rate. But by 2005-2006, the increase in prices had gone far enough to receive much more serious attention. This was especially true with regard to the perceived permanence of oil prices, largely because the futures price had gone from implying that the rise in the spot price was mostly temporary to implying that it is mostly permanent.

With regard to point (3), it is time to examine more carefully the claim that if an increase in energy or agricultural prices does not appear in the core CPI, then monetary policy can ignore it. The central argument of our research, reported in the NBER working paper "The Effect of Monetary Policy on Real Commodity Prices," is that high real commodity prices can be a signal that monetary policy is loose. Thus they can be a useful monetary indicator (among many others). The analysis is both theoretical and empirical. The empirical work includes the determination of real commodity prices in the United States, the determination of prices in other smaller countries, and the determination of inventories.

Effect of US Short-Term Real Interest Rates on Real US Commodity Prices
The argument we test is that high interest rates reduce the demand for storable commodities, or increase the supply. The effects come through a variety of channels:

- By increasing the incentive for extraction today rather than tomorrow
- By decreasing firms' desire to carry inventories
- By encouraging speculators to shift out of commodity contracts and into treasury bills

All three mechanisms work to reduce the market price of commodities, as happened when real interest rates were high in the early 1980s. A decrease in real interest rates has the opposite effect, lowering the cost of carrying inventories, and raising commodity prices, as happened during 2002-2004.

The Theory: The Overshooting Model
The theoretical model is based on Dornbusch's (1976) famous theory of exchange rate overshooting and can be summarized as follows. A monetary contraction temporarily raises the real interest rate, whether via a rise in the nominal interest rate, a fall in expected inflation, or both. Real commodity prices fall. How far? Until commodities are widely considered "undervalued" – so undervalued that there is an expectation of future appreciation (together with other advantages of holding inventories, specifically the "convenience yield") that is sufficient to offset the higher interest rate (and other costs of carrying inventories: storage costs plus any risk premium). Only then, when expected returns are in balance, are firms willing to hold the inventories despite the high carrying cost. In the long run, the general price level adjusts to the change in the money supply. As a result, the real money supply, real interest rate, and real commodity price eventually return to where they were.

The theory can be reduced to its simplest algebraic essence as a claimed relationship between the real interest rate and the spot price of a commodity relative to its expected long-run equilibrium price. This relationship can be derived from two simple assumptions. The first relates to the tendency for the spot price of a commodity to regress back toward long run equilibrium. The second concerns the decision as to whether to hold the commodity for another period – either leaving it in the ground or on the trees or

holding it in inventories – or to sell it at today's price and deposit the proceeds in the bank to earn interest.

We simply combine the equations relating to these two assumptions into a unified equation that says that the real price of the commodity (measured relative to its long-run equilibrium) is inversely proportional to the real interest rate (measured relative to a constant term that depends on convenience yield). When the real interest rate is high, as in the 1980s, money flows out of commodities, just as it flows out of foreign currencies, emerging markets, and other securities. Only when the prices of these alternative assets are perceived to lie sufficiently below their future equilibria will the arbitrage condition be met. Conversely, when the real interest rate is low, as in 2001-05, money flows into commodities, just as it flows into foreign currencies, emerging markets, and other securities. Only when the prices of these alternative assets are perceived to lie sufficiently above their future equilibria will the arbitrage condition be met.

The Test

We begin with a look at some plots. Three major price indices have been available since 1950 – from Dow Jones, Commodity Resources Board and Moody's. See <Figure 1>. To compute the real commodity price we take the log of the commodity price index minus the log of the CPI. To compute the real interest rate, we take the one-year interest rate and subtract the one year inflation rate observed over the preceding year. The negative relationship predicted by the theory seems to hold. We next apply OLS regression to these data.

It would be foolish to think that the model captures everything. In reality, a lot of other things beyond real interest rates influence commodity prices. There are bound to be fluctuations both in the long-run equilibrium real price, the convenience yield, storage costs and risk premium. These fluctuations are not readily measurable. Such factors as weather, political vicissitudes in producing countries, and so forth, are likely to be very important when looking at individual commodities. Indeed analysts of oil or coffee or copper pay rather little attention to macroeconomic influences, and instead spend their time looking at microeconomic determinants. Oil prices were high in 2004-06 in large part due to booming demand from China and feared supply disruptions in the Middle East, Russia, Nigeria and Venezuela. There may now also be a premium built in to the convenience yield arising from the possibilities of supply disruption to terrorism, uncertainty in the Persian Gulf, and related risks. Yet another factor concerns the proposition that the world supply of oil may be peaking in this decade as new discoveries lag behind consumption (Hubbert's Peak), not withstanding that such predictions have in the past been proven wrong (Deffeyes, 2005). This would imply that the long-run equilibrium real price of oil has shifted upward. Other factors apply to other commodities. In coffee, the large-scale entry of Vietnam into the market lowered prices sharply a few years ago. Corn, sugar, and cotton are heavily influenced by protectionist measures and subsidies in many countries. And so on. If we look at aggregate indices of commodity prices, many of the idiosyncratic factors in individual markets wash out.

Our results show that the significant negative relationship between commodity prices and interest rates is robust across commodity price indices.

An effect on inventories?
Since one of the hypothesized mechanisms of transmission from real interest rates to real commodity prices run via the demand for inventories, it may be instructive to look at inventory data. We ran a regression for oil inventories and found that the coefficient on the real interest rate is negative, as hypothesized, and statistically significant, provided we control for three other standard determinants of inventory demand. The three other determinants are:

- Industrial production, representing the transactions demand for inventories
- Risk (political, financial, and economic) among a weighted average of 12 top oil producers
- The spot-futures spread. Intuitively the spot-futures spread reflects the convenience yield to holding inventories.

We know that inventory holdings are positively related to convenience yield (which is in turn determined by industrial production and geopolitical risk), and negatively related to the interest rate and the spot-futures spread (two components of the opportunity cost of holding inventories). Our results show the hypothesized sign on all variables, usually with statistical significance. They thus generally support the model.

Implications for Monetary Policy
The advice that monetary policy makers should "look at everything" sounds easy to give and hard to reject. But not everyone would consider it obvious that an index of agricultural and mineral commodity prices belongs on a useful list of variables to reveal current monetary conditions, alongside short and long-term interest rates, the exchange rate, housing prices, and the stock market. The conventional practice is to throw the volatile "food and energy" sector out of the price indices, concentrating instead on the core CPI if one wants a good indicator of likely future inflation. It is certainly true that if one is looking for the single standard statistic that best predicts future inflation, the core CPI will do better than the headline CPI. But that is not the question. The question is, rather, if one is free to look at lots of information, are agricultural and mineral prices on the list of variables worth paying attention to? Our perspective places commodity prices on a plane with central banks paying attention to housing prices or the stock market.

The theory and empirical results reported in our paper suggest that the answer is "yes, commodity prices belong on the list of monetary condition indicators". Real commodity prices reflect monetary ease, more specifically real interest rates, among other factors. We can never be sure what the real interest rate is, because we do not directly observe expected inflation. Thus it is useful to have additional data that can be expected to reflect real interest rates.

Jeffrey Frankel is Harpel Professor, KSG at Harvard University.

This article is based on the NBER working paper No. 12713, "The Effect of Monetary Policy on Real Commodity Prices", December 2006. ***<Insert References & Figures>***

Figure 1: US Real Commodity Prices and Real Interest Rates

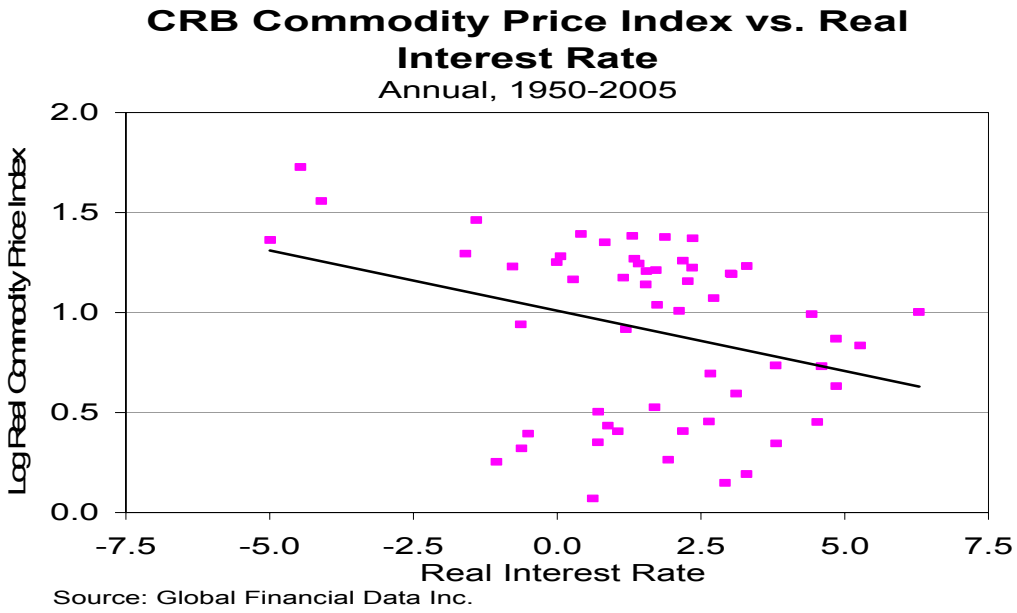

Table 1: Regression of log real commodity prices on real interest rates

Over whole sample (1950-2005)

Results for three commodity indices.

Log Real Commodity Prices and Interest Rates sample: **1950-2005** (56 annual observations) *real interest rate in % and real commodity prices in log units*			
	Coefficient	**Std error**	**sig. 5%**
Goldman Sachs (1969-)	-0.080	0.029	*
Dow Jones	-0.070	0.023	*
CRB	-0.060	0.024	*

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