The Effect of Futures Markets on the Price Dynamics in Commodity Markets

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Abstract:
Do futures markets have a stabilizing or destabilizing effect on commodity prices? Most early theories suggest a stabilizing influence (Keynes, 1930; Friedman, 1953) and this is supported by empirical evidence on the introduction of futures markets in the 1960s and 1970s (Working, 1960; Gray, 1963; Powers, 1970; Taylor and Leuthold, 1974). However, futures markets can also facilitate uninformed speculation, a practice that would increase the volatility of futures prices and there is empirical evidence for that as well (Roll, 1984; Pindyck and Rotemberg, 1990).

A model that incorporates both the suspected stabilizing and destabilizing effects of futures markets on commodity prices could be a powerful tool to investigate the effects that changing future markets have on commodity prices. Between 2002 and 2008 commodity futures markets expanded almost 10-fold, an observation that was pivotal to the claim by Masters and White (2008) that the advent of index investing had been responsible for the surge in the commodity prices in first decennium of the 21st century. Even though most authors agree that the surge itself was due to other factors, empirical evidence regarding the effect of this 'financialization' on commodity price volatility remains mixed (Büyükşahin and Harris, 2011; Du et al., 2011; Algieri, 2012; McPhail et al., 2012; Bohl and Stephan, 2013; Brunetti et al., 2016).

Although a stabilizing effect of futures markets is easy to model realistically, for example by including a positive effect of futures markets on the flexibility of inventories, this will not be the case for the effect of uninformed speculation. There are many different ways in which the decisions of uninformed agents can deviate from the rational choice. Moreover, whether it deviates and in which direction are known to depend on the situation. In experimental cobweb markets, which feature negative feedback between price expectations and realized prices, participants quickly learned to coordinate on the rational expectations equilibrium (Hommes et al., 2007). By contrast, in otherwise very similar asset market experiments (positive feedback between expectations and realized prices) the participants coordinated on following trends, leading to bubbles and crashes (Hommes et al., 2005&2008; Heemeijer et al., 2009). A commodity market has mostly aspects of the first (negative feedback) market, while a futures market would be closer to a positive feedback market. The decisions of participants in a market setting that combines a futures and a commodity market is pivotal for the net effect of futures markets on commodity prices. We aim to address this open question with a coupled futures-commodity market experiment.

Our experiment, which is currently in progress, is a learning-to-forecast experiment featuring two markets, one commodity market and one futures market, and a coupling mechanism based on storage. On the commodity market producers automatically trade with consumers and inventory holders. Consumer demand is generally downward sloping

with price, but includes some IID noise. The producers face a cobweb type of production lag, meaning that one period before they can offer their goods on the commodity market, they need to decide how much to produce. Half of the participants in the experiment take the role of advisors to the producers. Their job is to forecast the price of the commodity *one period ahead*, which determines the producers' expectations. The rest of producer behavior is automated.

On the futures market speculators trade futures contracts among themselves and with inventory holders. The speculators form expectations about commodity spot prices two periods ahead and depending on the current futures price they go long or short a futures contract. The other half of the participants acts as advisors to the speculators. They therefore have to forecast commodity prices *two periods ahead*.

The coupling mechanism is formed by the inventory holders. They deviate, at a cost, from optimal inventory levels to profit from fluctuating prices without taking any risk (storage arbitrage). If price of a futures contract is higher than the spot price, they can buy in the spot market, and sell a future, but they have the cost of storing the good for one period. On the other hand, if the future price is lower than the spot price, they can sell in the spot market, and buy a future, thus re-stocking in the next period for a known, low price. Storage is completely automated in the experiment.

The participants, both those advising the producers and the ones advising the speculators, are aware of the existence of both the futures and commodity markets and are briefly explained how expectations in those markets affect prices. However, they are not told about the strength of the influence of the futures market. We have 3 different treatments. One features a very weak coupling such that the prices in the futures market hardly affect the commodity market spot prices. At the other extreme is a treatment in which the futures market dominates commodity spot prices, a situation that could for example arise when storage is very cheap and heavy competition in the futures market has brought the risk premium down. Finally, we have an intermediate treatment with moderate futures market influence on commodity spot prices.

Our calculations show that in the rational expectations equilibrium the commodity price volatility goes down as the influence of the futures market increases. This is due to fact that storage becomes more flexible in that case. However, if forecaster expectation formation involves any kind of trend following, big booms and busts will give commodity prices a very high volatility in the treatment in which the futures market dominates. In that case commodity price volatility as a function of futures market influence will be U-shaped: relatively high for very small influence, lower for intermediate values, and again (very) high in case the futures market dominates.

The experimental results will need to unveil if a futures market continues to have a stronger stabilizing effect when it gains influence, as the rational expectation hypothesis would predict, or if this trend reverses at some point. Our expectation is to find a U-shape: at first a futures market will stabilize prices as it grows, but if it becomes too influential it becomes a destabilizing factor.