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Comment Aaron Smith

Speculation

Does speculation cause high food prices? When phrased this way, as it often is in the public discourse, the answer to the question is obviously "yes." Every decision made by producers, consumers, merchants, processors, and arbitrageurs requires some degree of speculation. For example, merchants and processors speculate about how much the commodity will be worth in the future when deciding how much they are willing to pay for it now. If the collective expectation of these economic agents is that the commodity is likely to be relatively scarce next year, then they act to place more inventories in storage, thereby bidding up the current price. We observed this phenomenon in action in July and August of 2012. Corn and soybean prices jumped

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as a severe drought reduced the expected size, not of available supply, but of the upcoming crop.

When presented with these market features, critics of commodity speculation qualify their critique. The issue, they say, is whether excessive speculation drives prices, to which the natural response is "what is excessive speculation?"

The phrase "excessive speculation" has been used in connection with regulating commodity trading since at least the Grain Futures Act of 1922. Peck (1980) reports that the phrase appeared repeatedly in the hearings leading to the passing of that legislation as well as in the act itself. It also appears in the Commodity Exchange Act of 1936, the Commodity Futures Trading Act of 1974, and the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010, which constitute the three major revisions to commodity trading legislation in the United States since 1922. In each case, the legislation states that excessive speculation causes "an undue and unnecessary burden on interstate commerce" and that it can be rectified by imposing "limits on the amounts of trading which may be done or positions which may be held by any person" in commodity futures markets. Thus, excessive speculation is defined by a remedy rather than a disease; it is a solution in search of a problem.[1]

Most economists, if asked to define excessive speculation, would define it as trading that causes prices to differ from "fundamentals." To be operational, this definition requires that the fundamental be defined. Here, I define as fundamental the price sequence that would result from competitive markets populated by equally informed traders with rational expectations. Gustafson (1958) first formalized this concept, which we now know as the competitive rational storage model. Wright (2011) provides an accessible summary of the model and its application to food price volatility. Estimating the path of prices implied by the competitive rational expectations model is notoriously difficult, which means that quantifying excessive speculation by this metric is similarly difficult.

The "Masters Hypothesis," which Aulerich, Irwin, and Garcia (AIG)[2] address in this chapter, takes a simpler approach and defines excessive speculation by the actions of a particular type of trader, namely index funds that take long (i.e., buy) positions in commodity futures markets. Proponents of the Masters Hypothesis allege that this trading behavior is not based on current or future expected supply and demand for the commodity and causes prices to increase dramatically. Aulerich, Irwin, and Garcia reject this hypothesis emphatically, showing that there is little relationship between futures positions held by index traders and prices. They test the hypothesis

1. I credit Craig Pirrong for this last phrase. On his blog, he used the phrase "a solution in search of a problem" to describe position limits. See http://streetwiseprofessor.com/?p=4627.

2. I considered not using this acronym because of its association with excessive speculation but irony demanded that I keep it.

for twelve agricultural commodities over several trading periods (e.g., roll and nonroll periods). In the few cases with a statistically significant relationship, it is small and often of the opposite sign to that predicted by the Masters Hypothesis. When combined with other papers by Scott Irwin and his coauthors (e.g., Irwin and Sanders 2011, 2012; Sanders and Irwin 2011; and Irwin, Sanders, and Merrin 2009), these results refute the simplistic yet popular notion that index funds cause high commodity prices.

In this chapter, AIG use even better data than in prior studies to measure index fund positions. Their empirical work is thorough and convincing, so I see little value in asking them to run more regressions or make any other changes. Rather, in this comment I step back and comment more generally on excessive speculation and its effect on commodity markets.

Potential Effects of Excessive Speculation on Food Commodity Markets

Tales of speculative excess are typically associated with assets such as equities or houses. Commodities differ from these assets because they are produced and consumed. This means that the price of a commodity always equals its marginal consumption value. This feature adds an anchor to prices; if the price gets too high then consumers will stop buying the commodity and producers will expand production, thereby increasing inventory.

The competitive rational storage model provides a way to formalize the connection between the consumption value of a commodity and the speculative effects on prices. Equilibrium in this model implies a kinked total-demand curve, as shown in figure 6C.1 (Wright 2011). When prices are low,

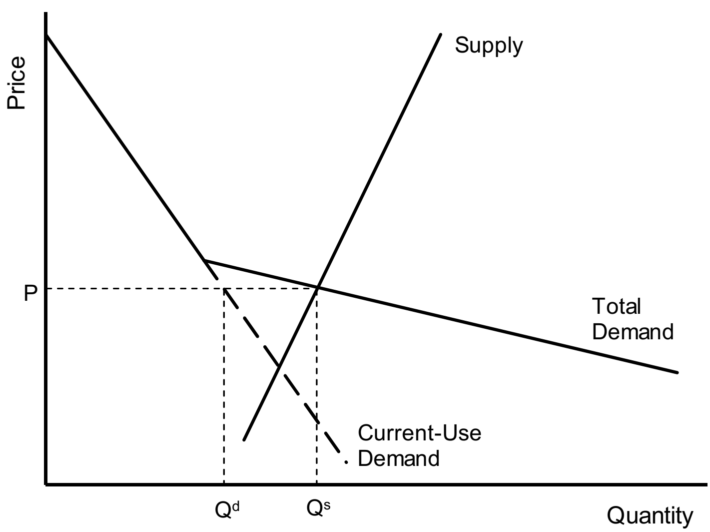

Fig. 6C.1 Equilibrium in rational storage model

rational firms choose to place some units of the commodity in storage, and total demand equals demand for current use plus demand from inventory holders. Thus positive inventory implies that total demand is more elastic than demand for current use. When prices are high, storage is unprofitable, inventory goes to zero, and total demand equals current-use demand.

Figure 6C.1 depicts an equilibrium in which inventory is positive. If excessive speculation were to push prices above this equilibrium, then the quantity in storage would increase. The magnitude of the inventory increase depends on the elasticities of demand and supply; the smaller are these elasticities, the smaller would be the inventory increase.

Are the relevant elasticities large enough that we would see the traces of a speculative food price increase in accumulated inventory? To answer this question, I use estimates of the supply and demand elasticities for US corn. Given that inventory equals quantity supplied minus quantity demanded ($I = Q^s - Q^d$), the elasticity of inventory supplied to the market is

$$\frac{P}{I}\frac{\partial I}{\partial P} = \frac{Q}{I}\left(\frac{P}{Q}\frac{\partial Q^s}{\partial P} - \frac{P}{Q}\frac{\partial Q^d}{\partial P}\right).$$

Between 1990 and 2010, the average ending stocks to use (I/Q) was 0.15. Hendricks, Sumner, and Smith (forthcoming) estimate that the annual elasticity of supply of US corn equals about 0.3, and Berry, Roberts, and Schlenker (2012) report a similar estimate (chapter 2, this volume). On the demand side, Adjemian and Smith (2012) estimate that the annual flexibility (inverse elasticity) of total demand equals –1.35 on average between 1980 and 2010, but had increased steadily in the past few years as corn-ethanol production increased. Based on a conservative interpretation of their estimates for recent years, I choose a demand flexibility of –3.3, that is, an elasticity of –0.3.

Plugging in these numbers yields an elasticity of inventory supply of

$$\frac{P}{I}\frac{\partial I}{\partial P} = \frac{1}{0.15}(0.3 - (-0.3)) = 4.$$

Consider a 30 percent speculative price spike. The standard deviation of annual price changes since 1980 is about 30 percent, so such a shock is not extreme. With an inventory supply elasticity of four, crop-year-ending inventory would increase by 120 percent in response to such a speculative shock. At lower inventory levels, such as those seen in the past two years, we would expect the percent inventory response to be even greater. Since 1980, corn inventory has increased by more than 100 percent in only three years: 1985, 1996, and 2004. In each of those years price declined; that is, inventory accumulated because of high production. Thus, a 120 percent inventory increase coinciding with a 30 percent price increase would be very obvious in the data if it had occurred.

This analysis would overstate the observed change in inventory if speculative shocks are correlated with prices. For example, suppose speculators follow momentum strategies; they observe prices rising in response to poor weather and move into the market on the long side exacerbating the price rise. Under rational expectations the poor weather would cause a reduction in inventory, but the excessive speculative offsets that decline. The effect of excessive speculation is therefore that inventory declines by less than it otherwise would have. However, the lack of inventory depletion in the face of a temporary weather shock would be just as large an error as the 120 percent inventory accumulation in the previous paragraph and appears inconsistent with the path of annual corn prices in the United States.

This analysis applies to the annual horizon. At shorter horizons, such as weeks or days, supply and demand respond much less to a price shock and the corresponding inventory buildup would be smaller. Put another way, the physical forces that would act to correct speculative excess over a year are less powerful at short horizons. Conceivably, speculative trading could cause prices to be more volatile than those implied by competitive rational expectations equilibrium and this excess volatility could come without large quantity effects.

Price Discovery

The discussion above suggests that any effects of excessive speculation on food prices likely occur at high frequencies. Such effects would imply that futures markets do not function efficiently as venues of price discovery. For this reason, studying price discovery provides a promising path for future research on the connection between futures market trading and prices. In other words, how do markets aggregate information and opinions?

In contrast, much of the previous literature on futures market speculation focuses on risk premia. It asks how speculation affects the price hedgers must pay to reduce risk. In the past thirty years, average payoffs on agricultural futures have been close to zero, which suggests that average risk premia are very small. Thus, for risk premia to be important in price determination, they must sometimes be negative and at other times be positive. Moreover, to have significant effects on spot prices, risk premia must have significant effects on quantities consumed, produced, and stored. There is little evidence in the agricultural risk literature that risk premia are volatile enough to have large enough quantity effects to noticeably affect prices. For example, Acharya, Lochstoer, and Ramadorai (2012) show that hedging demand (driven by default risk) and speculator supply (driven by broker-dealer balance sheets) have statistically significant but small effects on risk premia in energy markets. But would anyone attribute a 30 percent price spike to a change in risk premia?

If prices were to differ significantly from the fundamental over a period of days or weeks, it seems that a more likely source than risk premia is a failure of efficient price discovery. Promising veins of price-discovery research focus on differences of opinion among traders and limits to arbitrage. In difference-of-opinion models, traders do not believe that prices fully incorporate the available information about fundamentals. Rather, they trust their own information. Banerjee (2011) shows that prices tend to underreact to fundamental shocks in this setting, which generates price drift toward the new fundamental. This kind of model appears consistent with the results of Hong and Yogo (2012), who find that futures market open interest (total number of positions held) predicts future prices better than do current prices. They infer that traders act on fundamental shocks, thereby increasing open interest, but that prices underreact to these shocks. Thus, open interest provides a better signal of future demand than does price.

Interestingly, this difference-of-opinion equilibrium implies that trading reduces rather than amplifies volatility. Most of the discussion about excessive speculation assumes the opposite. Limits-to-arbitrage models tend to imply increased volatility relative to the unlimited arbitrage case. In such models, fully informed rational traders exist but are unable to correct pricing errors because of the risk that in future periods irrational traders may drive the price further from its fundamental. Some sources of limits to arbitrage in financial markets do not apply to commodity futures markets (notably short sales constraints), but others such as noise trader risk (De Long et al. 1990) may be quite relevant. There is scope to explore the potential for differences of opinion and limits to arbitrage to hamper price discovery in commodity markets.

In conclusion, I commend AIG for emphatically refuting the Masters Hypothesis. It is important for economists to bring facts and rigorous data analysis to bear on issues that have received such publicity, especially if they appear to be influencing policy. I hope that their work allows us to move the discussion toward the efficiency of the price discovery process in the short run.

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