Chapter 32

BUBBLES AND CRASHES IN EXPERIMENTAL ASSET MARKETS: COMMON KNOWLEDGE FAILURE?

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As described earlier in this volume, experimental markets for long-lived assets have a tendency to generate price bubbles, which are prices much higher than fundamental values, and crashes, which are rapid drops in price. This result, originally due to Smith, Suchanek, and Williams (1988), is one of the most striking of modern experimental economics. Smith, Suchanek, and Williams (1988) offer the following insightful conjecture about the origin of the bubble phenomenon. "What we learn from the particular experiments reported here is that a common dividend, and common knowledge thereof, is insufficient to induce initial common expectations. As we interpret it, this is due to agent uncertainty about the behavior of others." The authors thus posit a lack of common knowledge of the rationality of market participants as the origin of the bubble phenomenon. Although the experimenter can control much of the underlying structure and some parameters of the market, he cannot control the beliefs participants have about each other. If some subjects believe that there are irrational traders in the market who might make purchases at high prices, speculative demand can push prices above fundamentals. Thus, even if all traders are rational, departures of prices from fundamental values could be observed, if the rationality is not common knowledge.

On the other hand, the bubble and crash phenomenon may also be due in part to actual decision errors on the part of subjects. That is, some of the purchases at high prices may not be due to speculative demand, but rather to other reasons that are inconsistent with rational behavior of purchasers. If this is the case, the rationality of traders is not common knowledge because some traders will in fact fail to act rationally when inexperienced with asset markets. Lei, Noussair, and Plott (2001) construct an asset market in which errors in decision-making on the part of the subjects in the experiment are the only way that bubbles can arise. The experiment differs from the other asset market experiments described in this section of the volume in that each participant is assigned one of two possible roles, a "buyer" or a "seller," in a continuous double auction market for the asset. A buyer is endowed with cash but no units of the asset. He has the capacity to purchase, but not to make sales. A seller is endowed with units of the asset and the capacity to make sales, but has no initial cash and no ability to make purchases. Purchase for resale is not possible, so there can be no speculative demand for the asset. Any

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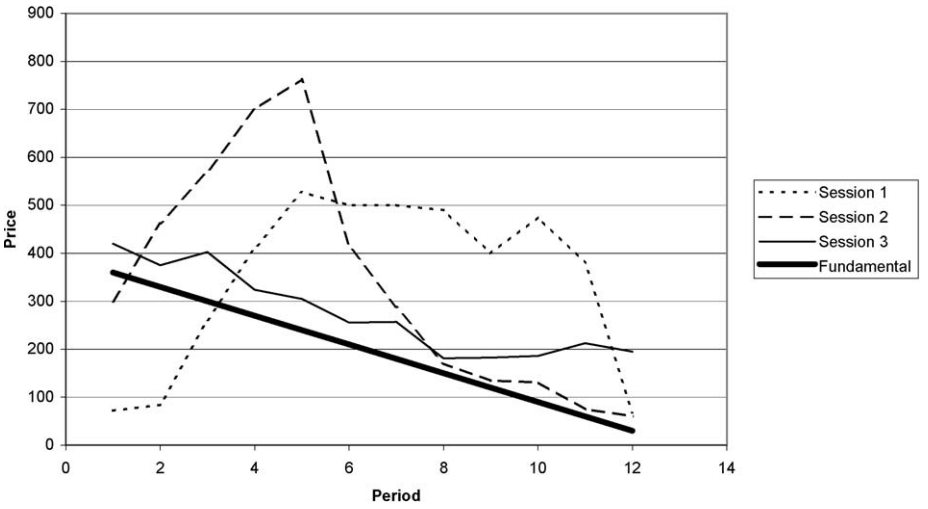

Figure 1. Median transaction price by period: Markets with speculation prohibited.

purchase at a price higher than the maximum possible realization of the future dividend stream results in certain losses and is therefore a dominated transaction. Even if a trader believed that there might be irrational traders in the market, it would be irrational on his own part to make such a purchase.

In the experiment, subjects have tables at their disposal that indicate the expected future dividend stream, which corresponds to the fundamental value, at any time. Subjects take a quiz on how to read the table before the market opens. Thus the fundamental value of the asset is common knowledge at all times during the experiment. Nonetheless, a considerable fraction of total transactions (45.3%, 41.6%, and 27.5% in the three sessions) take place at prices higher than the maximum possible realization of the future dividend stream. These are dominated purchases that can only be classified as errors on the part of the buyer. Furthermore, the time series of transaction prices exhibits the bubble and crash pattern, suggesting that the errors are of a type that has a role in generating bubbles in markets when resale is allowed.

Figure 1 displays the median transaction price in the three sessions of the "NoSpec" treatment of Lei, Noussair, and Plott (2001). The bold black line indicates the fundamental value and the bold gray line the maximum possible realization of the future dividend stream. The figure illustrates the bubble and crash pattern in sessions 1 and 2. In session three prices remain too high throughout the time horizon as a crash fails to occur. The presence of bubbles in the NoSpec treatment indicates that the possibility of speculation is not necessary to cause the bubble and crash price dynamics. It also shows that in fact there is no reason for the rationality of traders to be common knowledge, since subjects are indeed prone to making errors in their trading decisions.

Why do these purchases at high prices occur? The excess volume of trade in the experiment suggests the origin of some of the errors. The sellers sell 85.5% of the total stock of units in the NoSpec treatment to the buyers. In contrast, if risk attitudes were on average the same among buyers and sellers, approximately 50% of the units would change hands on average given that there are an equal number of buyers and sellers.

One possible explanation for the excess volume is that the procedures of the experiment encourage participants to make too many trades. Consider a subject who is recruited to participate in an experiment, and is trained in the mechanics of buying and selling. The subject may be predisposed to participate actively in the experiment in some manner and to use his training. That is, the subject may believe that he is "supposed" to buy and sell because he is placed in a market environment in the role of a trader, and there is no activity available other than buying or selling. If that is the case, when faced with a choice between an unprofitable transaction and not trading, a subject may choose the unprofitable transaction. In short, some of the activity in the asset market may be due to the fact the protocol of the experiment encourages subjects to be active, and the only way to be active is to make trades in the asset market. Lei, Noussair, and Plott (2001) explore this possibility in their "TwoMarket/NoSpec" treatment.

In the TwoMarket/NoSpec treatment, there are two markets, both organized as continuous double auctions, and each market trades a different commodity. In one of the markets a commodity called Y with a life of one period, as in Smith (1962), is traded. The market for Y is repeated under stationary conditions for 15 periods. In the other market an asset called X, with the same structure as the asset in the NoSpec treatment, is traded. The asset market opens in period 4, has a life of 12 periods, pays an expected dividend of 30 each period, and has zero terminal value after period 15. The instructions to subjects emphasize that participation is optional and that it may be in their best interest to participate in none, one, or both of the markets. The second market and the language in the instructions are intended to reduce any feeling of compulsion toward active participation that subjects may have.

Overall, 54.7% of the units were sold to the buyers, indicating that the change in the procedures served to greatly reduce the excess volume. Figure 2 shows the time series of median transaction prices by period in the three sessions of the TwoMarket/NoSpec treatment. A bubble occurs in only in session one. In the other two sessions, only 2.8% and 4.9% of all transactions were at prices higher than the maximum possible realization of the future dividend stream. Thus it appears that the excess volume and the incidence of the type of decision error that accompany bubble formation are related. However, it is also clear that the particular techniques Lei, Noussair, and Plott (2001) employ to reduce the bias toward active participation do not totally eliminate the possibility of a bubble.

In these asset markets, departures of prices from fundamental values are not only due to the lack of common knowledge of rationality, but also to the existence of traders who actually do behave irrationally. It certainly does appear that other traders speculate when they realize that some participants are prone to errors. The findings presented here suggest that the appropriate modeling approach to explaining the bubble and crash

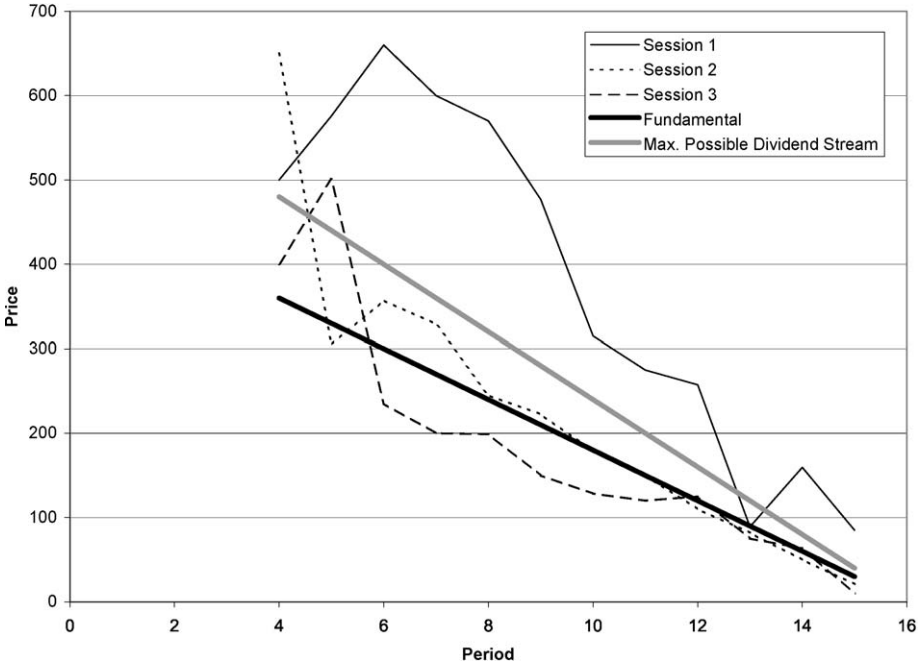

Figure 2. Median transaction price by period, TwoMarket/NoSpec treatment.

phenomenon requires the presence of errors in decision making on the part of agents, in addition to the absence of common knowledge of rationality.

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