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EDITORIAL COMMENTARY

Does the Market Have a Mind of Its Own, and Does It Get Carried Away With Excess Cash?

It has become an article of faith that the "invisible hand" of the free market sets prices with the collective wisdom of the body of traders. The success of the free market in providing stable consumer prices has enhanced the confidence in this idea. Within a very abstract sense, the price theory of consumer goods is similar to that of financial assets. Both are set by supply and demand for the item. Yet there is a profound difference between the two in that financial assets are often bought with the sole purpose of selling at a higher price later, while consumers rarely buy for that reason. For the consumer, the market offers a local optimization problem. A consumer must exercise a relative preference for different items each of which provides some utility. Modern portfolio theory is based largely upon the idea that one purchases a portfolio of stocks, bonds and other financial instruments in a similar way, by using a utility function that balances reward with risk, just as a consumer balances expenses with needs and desires.

Price Evolution in the Asset Markets

For many decades, consumer prices have been very stable in the US and in most free market countries. This contrasts sharply with prices for many assets such as stocks, which have experienced large bubbles and crashes (Dreman [2001]), (Shiller [2000]). A fundamental difference between consumer markets and equity markets is that everyone (not just the middleman) purchases the latter with the sole objective of selling at a higher price at a later time. While a consumer may be interested in the price trends for a computer, for example, as he times his purchase, the trend is generally a minor concern. Usually the consumer has little incentive to examine the motivations and preferences of other consumers. There is often little opportunity to resell a product so that the preferences of others are relatively unimportant for the consumer.

In the equity markets, however, there is every reason to be concerned with the expectations and motivations of others. One could sell short a high-flying stock that is overvalued by a factor of ten only to see it soar to twenty times its valuation. Thus a failure to anticipate others' actions (and mistakes) could be costly. Traders are often aware of this phenomenon so that overvalued stocks draw more commentators than short sellers.

Experimental asset markets offer an important perspective into price evolution (Davis and Holt, [1993]), where participants trade an asset designed by the experimenter using real money through a computer network. In many of these asset experiments there is no uncertainty in the payout of the asset, so that any uncertainty necessarily involves the potential actions of the other traders, as noted early on (Smith, Suchanek and Williams [1988]).

An important issue that can be tested in experimental markets is the extent to which a market can assimilate information from different groups and yield a price that reflects all of that information. For example, suppose that one group has information on the finances of a particular company, another has information about its product reliability, and another on current sales levels. If these groups do not share information freely, is it nevertheless possible for that the stock price will accurately reflect all of the information that is available, even though no one has access to the complete set of information? Often in a competitive market situation, participants are not always eager to share the information they have accumulated, and look to price movements for hints on the information of others.

Market Intelligence Experiments

A simple test of this in the experimental setting can be performed by informing all participants that the asset traded will have a single payout value of either $1, $2 or $3 at the end of the experiment. For example, some participants are given the information that the payout is not $1 (so it must be $2 or $3); some participants are given the information that it is not $2, and others are given no additional information. If the participants could share their "private" information, they would conclude that the payout would be $3. But if they cannot share their information, will the market evolve toward this $3 price due to the aggregate knowledge that the market assimilates intelligently? Will this happen under all conditions? How quickly will the price evolve toward a steady state price? Will a surplus or shortage of cash in the experiment influence the steady state price?

In order to examine these questions, pilot experiments were designed and performed at a graduate student workshop attended mainly by economics students from various universities (July 2001 at George Mason University). The setting provided an opportunity to test these ideas under the following conditions most favorable to market efficiency. (i) The participants were all knowledgeable about markets, game theory and economic strategy. (ii) The auctions were oral double auction with prices cleared after each trade. This allowed participants to discover the identity of the traders and note persistency in trading patterns of specific individuals. (iii) There were four periods during each experiment lasting approximately five minutes each, allowing substantial time for implicit discovery of the information held by others. (iv) Experiments with the identical design were repeated using the same group of participants five times. Experience is known to be an important factor in asset market experiments. Thus by the third experiment the group was highly sophisticated in the strategy required for the experiment and eagerly looking for clues from traders who were implicitly revealing their information. (v) There was no uncertainty in the information given to each subset of the participants.

In each experiment the eighteen participants were each given an endowment of six shares of the asset and a number of laboratory francs that varied among experiments but not among participants in any single experiment. All participants were told that there would be a single payout of either one, two or three francs for each share at the end of the experiment. They were also told not to disseminate the additional "private" information. The laboratory francs were converted to dollars at the end of all experiments. During the first experiment six traders were given the private information that the payout is not one franc, six others were given the information that it was not two francs, and six were given no additional information. Each participant received eight francs (see Table 1). The average price during the fourth period was 2.56 francs, which is not far from the midpoint between two and three. Hence, the relative scarcity of cash appears to have resulted in a trading price that is considerably lower than the three-franc payout incorporated into the aggregate information given to the participants.

Table 1. *Summary of Pilot Experiments*

Experiment	Value	Liquidity Price	Avg. Trading Price	Avg. Price in 4th Period
1	3	1.33	2.6	2.56
2	2	2	2.2	2.04
3	2	4	2.06	2.05
4	1	4	1.88	1.87
5	1	1	1.6	1.3

In the second experiment the setup was similar except that the payout was two francs and the cash endowment twelve francs per participant. Defining the "liquidity" or "excess cash" price of the asset as the number of francs per share (see Caginalp and Balenovich, [1999]), we see that the liquidity price is equal to the payout price incorporated in the total information. Here, the resulting average trading price in the fourth period was very close to two francs.

The third experiment was identical to the second except that each participant was endowed with twenty-four francs, resulting in a liquidity price of four, i.e., double the payout value. Nevertheless, the average price near the end was once again near two francs.

The fourth experiment was identical to the third except that the payout was one franc (with analogous information given to participants). In this experiment there was a liquidity price of four (24 francs/6 shares), so that there is a ratio of four between the liquidity price and the fundamental value that is implicit in the given information. The resulting average price near the end of the experiment is 1.87 francs, which is nearly double the payout value and half the liquidity price.

Note that experiments three and four, which are identical in the cash level, differ by a factor of two in payout, are fairly close in terms of trading prices.

The effects of cash level are manifest in the results of these experiments. In particular, even with experienced and knowledgeable traders within a relatively transparent setting, a high cash level that is four times the fundamental value of the shares results in a trading price that is nearly double the value implicit in the given information. In other words, when the cash level is comparable to the value level of shares (as in Experiment 2), the trading price converges to the payout value. However, when the cash level is quadrupled, with no change in the information given, the trading price is nearly doubled. Note also that there is almost no movement toward the fundamental value during Experiment 4 as prices were only slightly higher during the first period.

The Role of Excess Cash in Distorting the Market Intelligence

These pilot experiments suggest that under the most favorable conditions (including a balanced cash level), the trading price ultimately reflects all of the information. However, as more cash is added to the system, the prices become inflated. If more extensive experimentation bears out this conclusion, the implications would cast more doubt on the basis for efficient markets.

They would also suggest a much stronger role for the excess cash argument in bubbles. Caginalp and Balenovich [1999] noted that in addition to the fundamental value and the trading price, there is an additional important quantity with units of price per share (within a single asset model). In terms of the differential equations theory, this liquidity price (i.e., L above) is a natural price that would be attained in the absence of value and momentum (i.e., price trend) considerations.

The spectacular rise in high-tech stocks during 1999 and 2000 may be viewed in this context. A large pool of additional cash entered the stock market due to several coincidental events (i) Participation by a wider segment of society that was drawn in by rapidly rising prices; (ii) An easy monetary policy by the Federal Reserve, partly in response to potential crises such as the Long Term Capital Management and the Year 2000 Problem; (iii) Tax changes and demographics that led to increased wealth for the more affluent groups who are most likely to invest. In other words, policies favoring the affluent tend to result in higher asset prices in the same way that policies favoring the less affluent lead to higher consumer inflation.

The crucial question that underlies these experiments is the extent to which one can rely on market prices of assets to reflect the aggregate of all known information. If the excess cash argument is borne out in further experimentation and data analysis, it would suggest, for example, that using a nation's stock market index as a barometer of economic health is almost circular reasoning, since high market prices may be reflecting the effects of an easy monetary policy. Furthermore, there would be serious implications at the more theoretical level if the level of cash turns out to be as important as the content of the aggregate information.

The pilot experiments involve the conditions (i)–(v) above that are highly favorable to market efficiency. Variations on this design could include uncertainty in the information given to participants. For example, the information that the payout is not two francs could be stated as a 75% probability event. There could also be some conflicting information with differing probabilities, as is often the case in world markets.

Toward a Theory of Price Evolution

Classical economics is largely concerned with equilibrium pricing. Yet information, valuation and cash positions of investors change with time, and just as equilibrium is being restored, these changes require an evolution to a different price. An important question involves the time scale on which prices return to equilibrium (if they move in that direction at all), even when the excess cash is not a significant factor. In particular, is this time scale smaller than typical intervals between such events? Does the time scale increase significantly with the uncertainty of the information given to subsets of participants? In other words, if there is 75% certainty given to the participants, is there a slower convergence to the equilibrium price compared to the complete certainty case?

Experimental asset markets with incomplete and asymmetric information may be the key to understanding fundamental aspects of price evolution through a behavioral perspective (Davis and Holt [1993], Richards and Hays [1998]). If one knows that other participants have additional information, then the astute trader will pay careful attention to trading patterns in order to obtain clues on the additional information.

The data obtained from experimental asset markets can be used in connection with differential equations or statistical time series models. Using a variety of experimental settings, one can understand, for example, how the uncertainty and asymmetry of the information interact with the psychology and strategy of the participants. Ultimately, a successful theory must incorporate the behavioral aspects as manifested in the experiments. The theory can then be tested against world market data.

What Is the Mechanism by Which Excess Cash Yields Excess Prices?

Suppose we consider the situation in which some participants know that the payout (of $1, $2 or $3) is not $2 while others know that it is not $3. Initially, the trader with information that the payout is not $2 knows that the payout is either $1 or $3, so that the expectation is $2. The information that it is not $2 is not especially helpful at the outset. However, as trading begins, the trader with this information can augment it with the hints obtained from the trading patterns. For example, if there are some eager sellers at $2.20, that may be an indication that others have information that the payout is not $3. Once they make this observation, the trader with the "Not $2" information can become more confident that the payout is in fact just $1. The group with the "Not $3" information initially would have an expectation of $1.50 payout, but would be more confident that the payout is just $1 as the sellers dominate the market near $2. There is a complicated interaction between the two groups as each group takes its clue from unknown traders from the other group. A theory of price dynamics based upon behavior and psychology must describe this complex interaction between the reliance one's own information and others' information that is suggested from price movement. For the group that is given no additional information, all of the conclusions must be drawn from the trading prices. These traders are similar to day traders in US markets.

In an experimental design such as the one described above, how can a higher level of cash ultimately mislead traders to trading the asset at much higher prices that the aggregate information would indicate? We suppose that there is a large amount of excess cash in the system with the same information structure (i.e., payout is again $1). The group with no additional information will have some distribution of bidding prices that will range from below $2 to above $2. Some of these will be on the higher end. If there is an excess of cash, there will be enough high bids to balance the asks (from the "Not $3" group) at a price that is on the high end of this range. In other words the distribution of bids might have an average of, $2 for example, but the top 25% of the bids might have an average of, say, $2.50. With a cash level that is four times the asset value, the top 25% of the bids may be adequate to meet the sellers, so that $2.50 becomes the relevant price rather than $2. In other words, in a cash rich situation it is the high end of the bidders that are relevant as the average becomes irrelevant.[1] A trader with the "Not $2" information is then misled by prices trading above $2.

The high-tech sector of the stock market in the late 1990's can be viewed within this perspective.[2] The average assessment of the value of a stock became increasingly irrelevant since the excess cash increased to the point that only the buyers on the highest fringe were needed to meet the sellers. According to classical economics, the price should reflect the aggregate knowledge of the participants. However, the excess cash in the marketplace (as discussed above) means that only the highest bidders are needed for the transactions. Several knowledgeable people made the clear and convincing case that the earnings, sales and other parameters of these companies did not merit the soaring prices. However, the existence of a sufficiently large pool of cash (controlled by people with little experience) meant that the knowledgeable investors were outbid and became nonparticipants since their bids were so much lower than the trading range. Similarly, any analyst questioning the quality of earnings and accounting could easily be ignored since those unconcerned had ample cash to bid prices higher.

As the high-tech market collapsed, some were surprised by the speed with which former giants (in terms of market capitalization) were reduced to penny stocks within months. Of course, this may also be attributed to the fact that the value-oriented investors would not be bidding on these stocks until the prices were less than one-tenth of the highs. As prices dropped, the available cash for investment in these companies declined very rapidly and further aggravated the decline in prices. Furthermore, some using momentum strategies may have joined the sellers due to the trend alone. One reason that aggressive accounting became an important issue early in 2002 (led by Enron) may be that the cash represented by the investors unconcerned with value became inadequate to meet the supply of shares. As shares of stocks and bonds sank in price, the focus on the details of the accounting became sharper. This aftermath of a speculative boom repeated the cycle observed in previous bubbles, most recently in Japan. When stocks were booming and cash was flowing into the market, there was relatively little concern about the quality of accounting and balance sheets.

An important link between available cash and the price inflation can be studied retrospectively in terms of this period, and presumably linked to the concept of excess cash as in the experimental markets. In this way one can test the hypothesis that excess cash allows the fringe to dominate the market and thereby allow the most exaggerated psychological characteristics to set market prices. For example, the effects of overreaction may be difficult to see on the upside when there is little cash but become dominant when the market is flush with cash. Experimental asset markets with asymmetry can be useful in understanding the effect of excess cash on the behavior and strategy of participants. The effect of excess cash may be important in terms of understanding psychological effects since theories can be carefully constructed through repeatable experiments and then tested with the data of this historic period.

Notes

1. A related point was made by Miller [1977] who argued that if a smaller fraction of investors were interested in a stock, the price would be lower.
2. J. K. Galbraith, other scholars and many practitioners have maintained that an easy money policy by central banks tends to inflate stock prices.

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