FUTURES MARKETS AND PUBLIC POLICY

Fischer Black
Sloan School of Management
Massachusetts Institute of Technology

James M. Stone
Commodity Futures Trading Commission

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Summary. We feel that the volume of trading in securities and futures markets can be explained only by assuming that there are many "noise traders" in the market. This means that "information traders" can buy information and make money trading on it at the expense of the noise traders. The "economic efficiency" of the market and the allocation of resources will be improved if we can find a way to restrict noise traders without restricting information traders.

Introduction

How should we regulate futures markets?[1] Should we regulate them at all? Should we regulate futures markets and markets for stocks and bonds in the same way? These are the questions that motivated this paper. They are not the questions that are answered in this paper.

To answer these questions, we must ask another: why do people trade? In futures markets, there is a short position for every long position. If someone makes money by trading, someone else must lose money. Total trading profits are always exactly zero.

If everyone behaves rationally, and takes into account the fact that others may be trading on information not currently reflected in futures prices, at least some people must expect to lose money by trading. If they expect to lose money, why do they trade?

In some models, the answer to this question is that they trade because a change in circumstances has made their existing portfolios non-optimal.[2] The trouble with this answer is that it seems too weak to explain the volume of trading in securities markets and futures markets. It might explain a certain amount of trading in mutual fund shares, but does not seem to explain trading in individual securities or futures contracts. Moreover, almost no one gives this as the main reason for trading.

Most trading seems to be on information. People with favorable information buy, and people with unfavorable information sell. They do this even though their information may already be reflected in prices. They do it even though the people they are trading with may have information that is not yet reflected in prices. In short, people seem to trade on information even when they should expect to lose money doing it.

To model this kind of trading, we have to assume that people trade for some reason other than maximizing a rational expected utility of wealth or consumption. Either they are irrational or they enjoy trading. They are fools or gamblers. Their utility functions depend on the amount of trading they do as well as on their consumption of more conventional goods and services.

Let's assume that some people are fools or gamblers, while some trade only to make profits. Of those who trade only for profit, some buy information and trade on it, while others don't buy information and don't trade at all. We ignore "liquidity trading," or trading for non-information reasons, because we feel there is not enough of it in the world to make much difference. We assume that both kinds of traders are rational, so the fools or gamblers expect to lose money, while the information traders expect to make money.

We assume that information is costly. That's why not everyone has a given piece of information at the same time. We assume that it is as costly to transfer information to someone else as it is to buy it in the first place. That's why the government doesn't buy all the important information and give it away. It's why an individual doesn't resell information after buying it.

Moreover, we assume that the cost of information is higher for some people than for others. (We obtain similar results when we assume that the cost of some pieces of information is higher than the cost of other pieces of information.) Thus the people who buy information are those who can buy it at lowest cost.

Everyone is risk averse. That's why a person who buys information does not take a larger and larger position until the price fully reflects the information. In fact, we assume that people are so risk averse and have so little wealth that no one person's trading has a significant effect on the price.[3]

For simplicity, we assume that everyone has the same wealth. All fools or gamblers have the same utility function, and all information traders have the same utility function. In fact, we assume that the fools or gamblers act just like information traders, except that they trade on random noise rather than on correct information. They do not pay for their noise, but they decide how large a position to take based on their wealth, risk aversion, and the value the noise would have if it were correct information. Except for the fact that they like to trade on noise, their utility functions are the same as the information traders' utility functions.

The fools or gamblers must trade on noise if the information traders are to make any money. If the fools or gamblers take predictable positions, there is no equilibrium except one where the price reveals all that the information traders know. But in that equilibrium, the information traders don't make any money. Thus they don't buy information and they don't take positions. The only equilibrium is one with no trading at all. Let's call the three kinds of traders noise traders, information traders, and non-traders.

We assume that some information is available to everyone at no cost. Even when there is no information bought and no trading, the price reflects that information. At any other price, some people would want to trade, though no one would want to take the other side. Thus there is an equilibrium price even without any added information.

We assume that producers use the price to guide their decisions. The more information the price reveals, the better those decisions are. The more noise there is in the price, the worse those decisions are.

Thus noise traders have two kinds of effects on producers. They put noise into the price by trading on it. But the fact that the price is noisy induces other traders to buy information. Their trading causes that information to be partly reflected in the price. Does the noise have the largest effect on the price? Or does the information have the largest effect?

If the noise effect dominates, investment decisions and thus the allocation of resources are hurt. If the information effect dominates, investment decisions and thus the allocation of resources are helped.

What regulatory scheme minimizes the amount of noise and maximizes the amount of information in futures prices? While the answer to that question does not tell us everything we want to know about regulation, that is the question we emphasize in this paper

The Equilibrium

To model the equilibrium in this world, we assume a single infinitesimal interval. In a more general model, this would be just one in a series of intervals. We assume that the payoffs from securities and futures contracts follow a joint normal distribution.

We focus on the investor's position in a single futures contract. In a more general model, we would look at the investor's entire portfolio of securities and futures contracts.

The payoff is the sum of two random variables with zero mean and equal standard deviation. An investor who buys information learns the value of one of these random variables.

An information trader learns the value of the first random variable. No one learns the value of the second random variable. To an information trader, the mean payoff for a futures contract is the value of the first random variable minus the price. The standard deviation for a futures contract is the standard deviation of the second random variable. The larger the mean payoff, the more contracts an information trader takes on.

Once an information trader has bought information, the amount paid is a sunk cost. The size of the trader's position does not depend on the cost of the information. It depends only on the value of the random variable and the futures price.

For a non-trader, the futures price must equal the mean payoff conditional on the futures price. If it were different, investors without information, who are numerous, would take positions. This potential forces the price to be equal to the conditional mean for an investor without information who can observe the price.

Noise traders act like information traders, but they act on noise rather than on information. Those with positive noise values take long positions, and those with negative noise values take short positions. Each trader has a different piece of noise. Thus noise traders may trade with one another, and noise traders may trade with information traders. All information traders have the same information, so they don't trade with one another.

The price is set by the fact that the sum of all long positions must equal the sum of all short positions. The higher the price, the more people want to shift from long positions to short positions. There is a single price that balances long and short positions for given numbers of noise traders and information traders.

The number of noise traders depends only on the number of potential noise traders and the kind of regulation we have. The number of information traders depends on profit opportunities and the kind of regulation we have.

For a given regulatory scheme, the number of information traders depends on the number of noise traders. More noise traders means more noise, which attracts more information traders.

But the added information traders have higher information costs. They come in only if the mean gain from their futures positions covers these higher costs. More noise traders means higher mean gains for information traders.

Thus more noise traders means more noise, net of the impact of the added information traders. The price reveals less of the information that the information traders have.

This happens because the number of information traders is affected by the extent of profit opportunities, while the number of noise traders is not. There is a lack of symmetry between the impact of the two kinds of traders.

The Effects of Regulation

If the futures market is banned, producers must use zero for the mean payoff, or must buy the information. Those producers with high information costs use zero. The variance of the estimate error for a producer without the information is twice the variance of the estimate error for a producer with the information.

High variance means less efficient production decisions, so consumers suffer along with producers that have high information costs. In a multiperiod version of the model, a producer with high information costs for most relevant information simply goes out of business, and the other producers expand to take up the slack. But this process does not solve the problem if information costs are constantly shifting between producers and over time.

Suppose, then, that the futures market is allowed. The price reveals some of the information to producers who do not buy it. Fewer producers buy the information. Production decisions are more efficient. The variance of the estimate error for a producer without the information who looks at the price is between the variance for a producer who has the information and the variance for a producer who does not have the information and does not look at the price.

Now imagine that there is a way to reduce the number of noise traders without affecting the information traders. There is less noise in the market. Fewer information traders buy information, but the price reveals the information more fully. Production decisions are more efficient.

The noise traders may feel unhappy about being blocked. Others, though, may feel that noise trading is unhealthy, and may feel happy that such traders are partially taken out of the market. Making production decisions more efficient need not in itself help all consumers, but there will always be a way, in principle, to transfer wealth between consumers so they are all better off.

Imagine also that there is a way to reduce the number of information traders, or the size of their positions, without affecting the noise traders. This means that the cost of information rises more quickly as information traders are attracted to the market by noise in the price. The process stops before the noise has been reduced as much as it is with no restrictions on the information traders.

Taking information traders out of the market means there is more noise. The price does not reveal as much of the information to producers who don't buy it. Production decisions are less efficient.

This suggests that the government should allow futures trading, but should also look for simple ways to increase the ratio of information traders to noise traders. In the real world, professionals may be more like information traders, and small investors may be more like noise traders. The government might leave the professionals alone, but look for ways to keep small, unsophisticated traders out of the market.[4]

The Model

To be more specific, let us outline a simple model of the kind described above, and show some of its qualitative properties.

Write x for the first random variable, and y for the second random variable. The payoff to a futures contract is $x + y$. Each variable has a normal distribution with zero mean. The standard deviation of y is d . Thus the standard deviation of the payoff for an information trader who knows x is d .

Information trader i pays c_i to learn x . After learning x , the trader's conditional expectation of the payoff is just x . The conditional standard deviation of the payoff is d . All information traders have the same utility functions. They are risk averse.

Write p for the price. When $x > p$, the information trader will take a long position. When $x < p$, the trader will take a short position. The size of the position will depend on $x - p$, d , and the degree of risk aversion. Since these are the same for all information traders, all information traders will take the same position.

How are prices set?

A noise trader will choose a position in exactly the way an information trader does, but instead of $x - p$, noise trader i will use a variable z . The z_i 's are normally distributed with zero mean. All the z_i 's and x and y are independent.

A trader decides whether to be an information trader or a non-trader by comparing the expected utility of buying information and trading on it with the expected utility of not trading. When making this decision, the value of x is unknown, but the trader can observe the price p . The conditional standard deviation of x given p is s . The decision depends on the utility function, and on s , d , and the trader's information cost c_i . There will be a value of c_i above which no trader buys information.

The closer p is to x , the fewer traders will buy information. When fewer traders buy information, the total positions of information traders will be smaller. In equilibrium, net positions of noise traders and information traders must add up to zero.

A producer who buys the information will use a conditional mean x and a conditional standard deviation d . A producer with higher information cost will use a conditional mean p , and a conditional standard deviation that is larger than d . The conditional variance will be $s^2 + d^2$.

Increasing the number of noise traders will increase the amount of noise, which means p will on average be farther from x . This will attract more information traders, and existing information traders will take larger positions.

Raising information costs for the information traders (or restricting them in some other way) will also make p farther from x on average. This has no effect on the noise traders, because their behavior does not depend on p .

Closing the futures market completely will mean that producers cannot use p at all as a source of information about x . A producer will either buy x or will use an estimate of zero for the payoff. That estimate is the worst of all. Its variance is equal to the sum of the variance of x and the variance of y .

Market Efficiency

In this model, the market is not efficient with respect to the first random variable, because if the value of x were known to everyone, the price would change.

Using this "financial" definition of market efficiency, the market is perfectly efficient when everyone agrees and the price reflects the information that they all have. The market can be perfectly efficient (in principle) at various levels of information.

There is also an "economic" definition of market efficiency. Using this definition, the degree of market efficiency is measured by the standard deviation of the payoff conditional on the price.[5] Using this definition, the more information people have, the more efficient the market is likely to be. A market that is perfectly efficient in the financial sense can be more or less efficient in the economic sense.

Producers care about economic efficiency. The more efficient the market is in the economic sense, the less they pay for information, and the better their investment decisions are.

Our conclusions, then, can be restated as follows: the economic efficiency of a futures market is improved if we restrict noise traders, or if we remove restrictions on information traders.[6]

Footnotes

[1]For example, see Grossman and Stiglitz (1980) and Diamond and Verrecchia (1981). In their models, people may start with non-optimal proportions of a risky asset and a riskless asset. This gives them a reason for trading even when they expect to lose because they will be trading with people who have more information.

[2]This assumes that the market is organized in a way that makes corners impossible. Some restrictions on sophisticated traders have the effect of making corners less likely, which could improve the economic efficiency of the market. A simple way to avoid corners is to allow settlement of futures contracts in cash.

[3]Edwards (1981) has a general framework for analyzing regulation that is consistent with the views in this paper.

[4]Edwards (1981, pp. 21-22) discusses this kind of efficiency, in the context of a more general discussion of economic efficiency.

[5]Samuelson (1972) has a model in which traders with incorrect beliefs harm others. A key assumption in his model is that some traders are over-optimistic, and short selling by other traders is banned.

[6]Green (1973) has a model in which investment in information by some traders causes prices to reveal that information more fully. However, he assumes that investors start with differences in information, and do not take full account of the fact that others have valuable information. As a result, his uninformed investors trade on their beliefs.

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