

Organized Futures Markets: Costs and Benefits

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A futures contract is to a forward contract as payment in currency is to payment by check. An organized market facilitates trade among strangers. Such a market trades a standardized contract under appropriate rules. The equilibrium distribution of market clearing prices is asymptotically normal with a standard deviation that varies inversely with the volume of trade, given underlying supply and demand conditions. Empirical relations giving the commission and margin per contract as a function of the volume of trade and outstanding commitments for 23 commodities support the theory. Also, comparisons of pertinent aspects of 51 commodities divided into active, less active, and dormant groups are consistent with the theory.

I. Introduction

Of all of the hundreds of thousands of commodities in the economy only a few have ever been traded on an organized futures market. This is a puzzle. The basic idea we use to give an answer to this puzzle draws on the theory of money. An organized futures market creates a medium of exchange, a futures contract, with many of the attributes of money. A futures contract facilitates trade in the commodity in the same way that the use of money in exchange has advantages over trade by barter under normal conditions. Nor is this all. A futures contract is a temporary abode

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of purchasing power in terms of the commodity. It is these aspects of a futures contract and not the more common view that futures contracts enable hedgers to avoid risks that explain the benefits of an organized futures market.

A transaction in a physical commodity in the real world has many unique characteristics stemming partly from the identities of the parties to the transaction, their reliability, credit worthiness, promptness, honesty, and flexibility; the qualities of the good; and the circumstances of the trade. These particulars make a transaction in the physical commodity resemble a barter trade. The two parties in a mutually acceptable trade have costs like those that arise in the double coincidence of trade by barter. The introduction of a standard futures contract by an organized futures market creates a financial instrument that can be traded without knowing the actual identity of the two parties in the transaction. The seller of the futures contract incurs a liability to the organized futures market, and the buyer acquires an asset from this market. Neither need have concern about the integrity of the other in the same sense that one who accepts a \$10 banknote in payment for something need not worry about the credit rating of the buyer. This argument implies that any commodity not made to order can benefit from the introduction of an organized futures market. The latter has a cost. Therefore, the use of this commercial invention, the futures contract, appears only for those commodities where the benefits outweigh the costs.

The development of a formal theory of these costs and benefits begins with a stochastic model of market clearing prices which has its roots in the economics of information and search. This model shows that the distribution of market clearing prices is asymptotically normal. The standard deviation of the limiting normal distribution depends on certain properties of the underlying schedules of bids and offers. Also, the realized market clearing price approaches the asymptotic market clearing price in probability as the number of traders increases. This theory is a marriage of economics and probability.

The standard deviation of the distribution of market clearing prices measures the liquidity of the market. There is a cost of lowering the standard deviation and there are benefits. The optimal amount of liquidity takes both the costs and benefits into account and results in some positive value of the standard deviation.

Although the standard deviation is an important element in our theory and seems to be a roundabout way of introducing risk, our emphasis is different and leads to different implications than a theory of futures markets based on the concept of reducing risk. An organized futures market is not necessary in order to obtain the advantages of hedging. These can result from a system of long-term contracts. However, an organized futures market can reduce the costs of moral hazards by the

introduction of a standard contract. A long-term contract between two parties depends on their integrity. In a situation with many participants, a standard contract with the backing of the organized market has less moral hazard. Ours is not a theory of why there may be advantages in long-term contracts; it is a theory of the net benefit of an organized exchange. There is some common ground since a long-term contract and a futures contract both refer to dates in the future. Hence an organized futures market is more likely to occur in commodities where the timing of transactions is more important. This only gives a set of necessary conditions, and it does not furnish sufficient conditions for the emergence of an organized futures market.

More generally, this theory asserts that a necessary feature of an organized market is a standard contract traded in that market. This standard contract need not be a futures contract. It may be a certificate that allows the bearer to obtain on demand a specified quantity of a good. Certain forms of certified warehouse receipts, gold and silver certificates, and similar financial instruments, such as shares of stock, have these properties. If the standard contract represents a physical good, then some legal entity is liable for fulfilling the terms of the contract on demand. This person would hold sufficient reserves to maintain the probability of default at an optimal level. Reserves equal to a fraction of the outstanding commitments of the standard contracts may suffice. These standard contracts may circulate among the traders at market determined prices, and the participants may never wish to convert their standard contracts into the physical good. This is plain in the case of shares of stock since rarely do the shareholders wish to liquidate the corporation.

This argument implies that the number and identity of the participants in a potential organized market is important. If this number is small, if the potential participants know each other, and if there is little turnover of these participants, then they may not need a standard contract to deal with each other. If there is a large number of potential participants and a rapid turnover of these traders, then this raises the benefit of a standard contract as well as the benefit of having an organized exchange. The members of the exchange meet certain requirements so that those who deal with them can rely on their integrity. The members of the organized exchange also face the problem that their clients may lack integrity. That is, as the number of potential participants in an organized market increases, the cost of having them all trade on their own account in the organized market may rise more than proportionally. This is not only because of the increasing congestion this would cause but also because there may be increasing costs of having one organization certify all of the potential traders.

Even without an organized market in a standard contract the traders

may have confidence in each other if each is a legal representative of well-known principals. This is an important consideration when the trade is in financial instruments that represent actual goods or assets instead of trade in the physical goods or assets themselves. The latter does occur in, say, a flea market. Even if the buyer is a good judge of the commodity before him in the flea market, there is still the problem that he must know that the seller is the legal owner of the good or is the agent of the legal owner. These are important problems in the real world that are often overlooked in some formal theories of market exchange.

The theory herein owes a debt to some important contributions by others. Most notable is Holbrook Working, who always put the emphasis on the functions of a futures market aside from its advantages to hedgers. In some of his work he came close to regarding a futures contract as a temporary abode of purchasing power in the physical commodity (1953, 1967). H. S. Houthakker also points out the similarities between money and futures contracts in his 1959 article. In contrast, most of the economists who have written on the subject, beginning with Marshall's *Industry and Trade* (1920), follow the convention of focusing their attention on hedging and speculation, which loses sight of the more fundamental properties of an organized exchange.

There is another important aspect of the subject that is peripheral to our main interest, and we do not discuss it. This refers to the actual rules of the exchange and the operation of the market. This topic deserves the close attention of economists because it deals with the practical problem of creating a set of conditions that can make a real market function according to the theoretical model of a perfectly competitive market. Informed observers of actual futures markets know that this is a difficult task. An organized futures market cannot survive unless it does approximate a perfectly competitive market.

II. Properties of an Organized Exchange

Before presenting a theory of the costs and benefits of an organized futures market, it is helpful to describe some of its important properties. Trade occurs in one physical place, the floor of the exchange, during specified hours, called the trading session. The traders cry out bids and offers, making a bilateral auction market. Only members of the exchange may trade on the floor, and no member of the exchange may make transactions off the floor of the exchange. Members of the exchange either trade for themselves or under the instructions of their clients who are typically not members of the exchange. Many organized exchanges are responsible for ensuring that the terms of a transaction are fulfilled. The two parties in a transaction agree on price and quantity of the given futures contract. All other terms of the contract are specified by the rules of the exchange.

The exchange determines the number of members who may trade on the floor. A membership is often called a seat on the exchange. A member may sell his seat to a nonmember. However, this is subject to some control by the exchange. The exchange investigates the character of potential members, and it may refuse permission to a potential buyer of a seat. The price of the seat is mutually agreed upon by the seller and buyer and is not subject to control by the exchange.

The exchange can discipline its members by imposing fines, suspending their trading privileges, or by expelling them. The oldest organized futures exchanges, such as the Chicago Board of Trade, have evolved elaborate rules as a result of their long experience. These rules intend to give those who trade on the exchange confidence in the reliability of the transaction executed on the exchange. Members of the exchange must execute the orders of the public, that is, nonmembers, before they execute their own trades. Exchange members who make fictitious trades are subject to penalties. Such fictitious trades intend to record prices that will mislead others. The exchange defines the terms of a contract such that all contracts of a given class are perfect substitutes and such that the validity of a transaction in that contract does not depend on the identity of the principals. Thus, a standard contract for the delivery of 5,000 bushels of wheat in July 1976 executed on the floor of the Chicago Board of Trade in January 1976 at a price mutually agreeable to the parties is as well defined as currency. A futures contract is to a forward contract as currency is to a check drawn against a demand deposit in a commercial bank. The validity of a genuine \$10 bill, one printed in the U.S. Bureau of Engraving, does not depend on who offers it in payment, while the validity of a \$10 check depends on the identity of the person who writes or presents it and on the identity of the bank. Similarly, the validity of a July futures contract on the Chicago Board of Trade is as good as the faith and credit of the Chicago Board of Trade, while the validity of a forward contract for July delivery depends on the integrity of the buyer and seller in the transaction.

A forward contract shares with a futures contract the important property that the buyer and the seller agree in the present on the terms of a transaction that will be completed at a specified time in the future. The important distinction between the two kinds of contracts lies in this. In a forward contract the actual identity of the buyer and seller is important. Neither has recourse in case of dispute to a third party other than a court of law. The validity of the forward contract depends on the good faith of the two parties themselves. A futures contract has a third party, the organized exchange or its designated representative, that guarantees the validity of the contract and will enforce the terms. When A sells forward to B, the consummation of the transaction depends on their honesty. When A sells a futures contract to B, A incurs a liability to the organized exchange and B acquires an asset from the organized exchange. The

exchange, or its clearinghouse, enters the transaction as a third party. It records the sale by A as an asset on its books and the purchase by B as a liability on its books. The outstanding commitments in a futures contract constitute the open interest in that contract and correspond to the stock of money. This analogy with money is important.

It follows from these arguments that the introduction of an organized futures market has consequences resembling those that occur when money is introduced into an economy to facilitate trade. Before the introduction of money we may assume there is trade by barter with all of the disadvantages of trade by barter. Money provides a means of making trades at a lower cost and it is a temporary abode of purchasing power. Similarly, a futures contract facilitates trade in the commodity and it is a temporary abode of purchasing power in that commodity. A futures contract in wheat is to actual wheat as a \$10 banknote is to a market basket of \$10 worth of actual commodities.

Price quotations on an organized exchange convey reliable information about mutually agreed upon terms of genuine transactions. Some individuals may contrive to gain from deception by violations of the rules or by exploiting defects in their wording, thereby violating the spirit of the rules. The result of long experience leads the exchange to make more elaborate rules in order to reduce the expected return to potential violations. In an organized market with bona fide transactions among honest men, the transaction prices convey such information as would approximate the equilibrium of a competitive market. Departures from a competitive equilibrium, called corners, cannot occur unless there is a violation of the rules of exchange. It appears that a necessary condition for a corner is the ability of one or more traders to deceive others by having the record show false transactions and false prices.

The conditions for the emergence and survival of an organized exchange are costly to bring about. Without these costs every commodity would have an organized market since surely such markets are beneficial. Therefore, to explain the presence or the absence of an organized futures market in a commodity requires a theory of the costs and benefits of such a market.

III. The Distribution of Market Clearing Prices

A futures contract enables trade to occur in the present with reference to dates in the future. It is equivalent in its effects to a means of classifying different grades or qualities of a commodity. It sorts trades with respect to time. Without futures trading a given set of spot transactions would be more heterogeneous with respect to the preferred timing of the traders. The set includes trades that may have taken place earlier or would take place later and which do occur now because the traders lack the alternative of

trading in futures contracts. The use of futures contracts sorts the transactions with respect to time so that transactions in contracts of a given maturity date are more nearly alike with respect to those attributes that are correlated with time.

This sorting out of transactions with respect to time that results from the possibility of trading futures contracts has several effects. It can lower the dispersion of the distribution of market clearing prices without necessarily changing the mean price of this distribution. Therefore, a given number of transactions can occur at more nearly equal prices. Also, the traders incur less delay in making their transactions at mutually acceptable prices. For these reasons futures trading increases the liquidity of the market.

An organized market has another important property. It tends to attract trade from a wide geographical territory. Since characteristics and qualities of a commodity are correlated with their location in space for reasons similar to those giving a correlation between timing and relevant aspects of the good, the pooling of trades from many locations into a central market increases the heterogeneity of the potential transactions in the market. This in turn increases the dispersion of the distribution of market clearing prices. An offsetting force is the larger volume of trade attracted to the central market that reduces the dispersion of the distribution of market clearing prices.

Underlying these arguments is a basic theory about market clearing prices. The traders present in a market at a given moment can be regarded as if they were a random sample from the underlying population of traders. The latter has a distribution of minimal acceptable prices for offers and maximal acceptable prices for bids. The distribution of offers is given as follows:

$$U(p) = \int_0^p u(r) dr \quad (1)$$

where $U(p)$ is the cumulative distribution of the offers that would accept a price not less than p . Similarly, the pertinent distribution of bids is

$$1 - V(p) = \int_p^\infty v(r) dr, \quad (2)$$

giving the cumulative proportion of the bids willing to pay a price equal to or greater than p . Observe that in this theory the asymptotic supply curve has a slope given by $dU(p)/dp = u(p) \geq 0$, and the asymptotic demand curve has a slope given by $(d/dp)[1 - V(p)] = -v(p) \leq 0$. The equilibrium price in the population, p_e , is the solution of the equation

$$U(p) = 1 - V(p). \quad (3)$$

imparts a positive bias to the estimates of the coefficients of $\log x$ and $\log X$. It is also possible that N is correlated with the exogenous variables α and β . If N is negatively related to α and β , then this would impart a downward bias to the estimates of the coefficients of price variability. We do have a weak proxy for the scale variable given by the log of stocks, a variable which we regard with suspicion because of measurement error for some commodities. Nevertheless, we do find negative, albeit small, correlations between the three measures of price variability and the log of stocks. The simple correlations, denoted by $R(\cdot)$, are as follows:

$$R(\log \text{ stock, VPAV}) = -.149, \quad R(\log \text{ stock, STDERR}) = -.064,$$

$$R(\log \text{ stock, VPM2}) = -.045.$$

Observe that it is the variable with the correlation closest to zero that has a positive effect on the margin.

This econometric argument agrees with an economic argument. The size of the elasticity of the excess demand function increases with the stock of outstanding commitments. According to (4), this tends to lower σ . We believe that a closer investigation of the function $\sigma = g(x, \alpha, \beta)$ is desirable since these arguments suggest that the variable X should enter this function. Such research would directly study the determinants of liquidity in the market.

VII. Summary and Conclusions

In an organized market the participants trade a standardized contract such that each unit of the contract is a perfect substitute for any other unit. The identities of the parties in any mutually agreeable transaction do not affect the terms of exchange. The organized market itself or some other institution deliberately creates a homogeneous good that can be traded anonymously by the participants or their agents.

Although the discussion centers on organized futures markets, the basic theory applies equally well to any organized market. The benefit of an organized market is an increasing function of the number of potential participants. It is also an increasing function of the turnover of the potential participants in that market. It would not be necessary for a small group of traders who know each other well and who have had and will continue to have contacts with each other to bear the expense of organizing a formal market. In such markets the terms of sale often do depend on the identity of the parties in addition to the characteristics of the goods. An organized market deals in a highly fungible good that is readily traded among strangers. In an organized market the transactions prices alone convey a considerable amount of useful information to those who are not currently trading in the market. In those markets where

heterogeneous goods are traded and where the identity of the buyer and seller affects the terms of trade, the transaction price alone conveys only partial information to outsiders.

In addition to scale, price variability affects the benefit of having an organized market. It also affects the cost. There is more price variability for those goods that have an organized futures market than for the goods that lack such markets. It does not follow that futures trading causes greater price variability. The organization of a futures market is the response to an increase of price variability. For example, when the government allows the price of a good to fluctuate and abandons its attempt to control the price, this may create an incentive to organize a futures market if the potential scale of operation is large enough, as witness the creation of organized futures markets in some foreign exchange.

We find that the volume of trade increases relative to the open interest, the higher is the level of the open interest. As the open interest in a commodity declines, the volume of trade declines even more rapidly. According to the empirical results relating commissions to $\log x$ and $\log X$, commissions are higher, the less active the trade in the commodity. Let price variability be the driving force as represented by the parameter β . Let the price of some good become more stable. The open interest declines and the volume of trade falls relative to the open interest. This raises the commission and the margin. A sequence of events now begins that may well end in a corner equilibrium with no trade and no open interest in the commodity. In this way the theory predicts the disappearance of an organized market. Similarly, a rise in price variability may lead to the appearance of an organized market.

The best concise summary of the theory is as follows: An organized market facilitates trade among strangers.

Appendix

Description of Cross-Section Data and Sources

I. Trading activity and market structure variables

Seasonal of stocks. Average ratio of trough-month stocks to peak-month stocks, 1959-71, expressed as a percentage.

Open. Average number of open contracts, end-of-quarter, 1959-71 or subperiod of active futures trading. *Journal of Commerce and Commercial*.

Opnint. Open \times average dollar value of one contract, 1959-71 or subperiod of active futures trading, in millions of nominal dollars.

Stocks. Value of average privately held stocks in millions of nominal dollars, 1959-71 or subperiod of active futures trading. Computations are described in appendix II, Average U.S. Stocks. Conceptually, stocks are computed as pipeline stocks plus average intraseasonal inventories. They give the peak holdings during the year.

Volume. Average annual volume of futures transactions on all U.S. contract markets, 1959-71 or subperiod of active futures trading, \times average dollar value of one contract, expressed in billions of nominal dollars. Association of Commodity Exchange Firms, Inc.