Lester G. Telser
University of Chicago

Futures and Actual Markets: How They Are Related*

The underlying theme of the argument is the isomorphism between the theory of money and the theory of futures markets. This is established by showing the presence of a number of correspondences between the two. Among these are borrowing and lending in monetary theory and short and long hedging in futures theory. There is a real and nominal interest rate implicit in futures like those in monetary theory. Futures contracts themselves correspond to bank notes. Inventory firms are like banks. Open contracts are like the total stock of money, and hedging commitments are like reserves. Developing the full implications of the isomorphism will enrich both subjects.

I

In order to explore how futures markets affect the market for the commodity or asset underlying the futures contract, this study takes as its central theme the analogy between futures and money. The relation between monetary and real phenomena is isomorphic to the relation between a futures contract and the underlying asset. Success in establishing the validity of this isomorphism will have several advantages. First, it will throw new light on some important aspects of futures trading by pointing out the analogies with the corresponding monetary phenomena, which are better understood. This enables students of futures to learn from the lessons of the monetary branch of economics. Second, students of money also can learn from that knowledge about futures, which has been more thoroughly analyzed than the corresponding monetary phenomena. By demonstrating that there is an isomorphism between money and futures, these two branches of economics can illuminate each other. This ap-

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proach is especially useful for the analysis of hedging. Though it may seem a long way around to approach the subject in this way, I believe that the end, a better understanding of how futures trading affects the underlying actual commodities, justifies the means.

I begin with a brief review of how the modern banking system began and of how the use of money and credit developed. Because my primary interest lies in futures, this survey focuses on those events most closely related to the corresponding ones in the history of futures trading.

Certain commodities became widely used during the evolution of human society. Those who had these commodities found they could readily trade them for other goods. As a consequence, the widely used commodities acquired an additional attribute—they became mediums of exchange. The more a commodity is used as a means of payment, the more widely acceptable it becomes. The earliest examples of such commodities are believed to be copper, silver, and gold. Once a commodity becomes widely acceptable as a means of payment, it obtains yet another important attribute—it becomes used as a store of value. Some people use such commodities as the asset in which they will hold their savings, savings being the excess of their receipts over their current expenditures. They are willing to have their savings in this form because they believe they can exchange these commodities later for the particular goods they will want then. In this way, the commodity used as a means of payment also becomes useful as a temporary abode of purchasing power.

Using certain commodities as a store of value is an important stage in the history. The owner of such a commodity may store it himself in a safe place under his own control, or he can seek some trustworthy person who can store it for him. Silversmiths and goldsmiths are common examples of the latter. They had to store silver or gold for their own trade. We may well imagine that it would soon occur to others and to the smiths themselves that they could offer their facilities as a safe place to store precious metals. Moreover, they could do so at a lower cost than the owners of gold or silver would incur by storing the goods themselves.

The next step in this development was the discovery by these storage firms that they could lend some of the gold or silver left on deposit with them to borrowers who were willing to pay them interest for the loans. The owners of the gold or silver who had deposits at the inventory firms regarded their assets as a store of value available for later use or to trade for other goods later on. The inventory firm learned that it could lend some of these deposits of the precious metal, without risk that it would be unable to return the precious metals to their owners when the time came for doing so. Instead of allowing these stocks to lie idle, the inventory firm could lend them to those who could make

better use of these stocks and were willing to pay for this. Not only would this allow the inventory firm to obtain some additional revenue, but it would also have some other important consequences. Instead of being a burden to store these assets so that the inventory firm would demand payment from the owners for doing so, the storage of the precious metals would become a source of gain to the inventory firm. Consequently, such firms would actively seek those who would be willing and able to deposit such commodities with them. As evidence of the deposit, the inventory firm would issue a warehouse receipt to the owner. Nor is this all. The goldsmith would not need to lend actual gold to a borrower. Instead he could give the borrower a warehouse receipt for the gold that the borrower could use in exchange for the commodities he wished to acquire with the proceeds of his loan. The evidence of ownership, the warehouse receipt, or, stated differently, the certificate of deposit would be just as useful as a store of value or a medium of exchange as the actual gold or silver, and it would be cheaper to make than the actual precious metals. Of course, the warehouse receipt is not useful for making jewelry or coins. For this, one needs the physical commodity. But for the commercial purposes of the inventory firm that borrows and lends, the certificate is just as good as the actual commodity. In these ways the physical stock of gold and silver could support a mass of bills of deposit greater than the underlying stock of the physical inventories themselves.

Up to this point in this idealized history there is no mention of money or of a monetary unit. The warehouse receipt for the gold or silver states the quantity, the name of the firm issuing the receipt, and the name of the person entitled to claim the actual commodity. As an interesting aside, recall that the term "pound sterling" refers to a physical quantity, a pound of silver. The value of the certificate of deposit depends on the rate of exchange between 1 unit of the commodity to which it is a claim and other goods. There would not be a single price for this physical commodity. Instead there would be a separate price for each commodity for which it could be exchanged. We may also imagine that it would soon occur to everyone that, by stating all prices in terms of a physical quantity for one of these precious metals, it would become easier to calculate exchange rates between any pair of goods. Hence the physical unit of the precious metal would become the numeraire for all commodities. In this way the value of the certificate of deposit would depend on how much people are willing to pay in exchange for 1 unit of the precious metal. This certificate of deposit is a private money that depends on the faith and credit of the firms holding the physical stocks of the precious metals. Neither the king nor the state need enter the scene in order to determine the validity of the money or of its value in exchange.

The warehouse receipt would be useful as a medium of exchange

primarily to the larger merchants. For most ordinary transactions the medium of exchange was the coin of the realm. These small coins could also serve as a store of value for those people who wished to accumulate savings. Even among the larger merchants, use of the certificates of deposit would pose some difficulties. There must be trust in the validity of the certificate itself, meaning confidence both in the genuineness of the certificates themselves and in the reliability of the firm that issues the certificate so that potential depositors will believe that the issuer will convert the certificates into the underlying asset according to the conditions it promised. The asset itself that underlies the certificate must be well defined and of an ascertainable quality. Assuming these conditions are satisfied, these warehouse receipts become a private money with general purchasing power. The stock of this money results from the deposits of the owners of the precious metals and from the loans made by the inventory firms to those who borrow from them. Although each inventory firm holds enough reserves to prevent insolvency, the total stock of money is a multiple of the stock of the underlying physical asset. This reminds us of a similar fact about futures where the stock of open commitments is a multiple of the stock of the asset underlying the futures contracts. What causes the multiple expansion of the certificates of deposit?

Let anyone with a valid warehouse receipt for the physical commodity come to the inventory firm. The latter would be willing to accept this receipt for deposit and to open an account (or to credit the existing account if this person has one) for the total quantity of physical units represented by this warehouse receipt. The inventory firm is willing to do this on the basis of a slip of paper presented to it and does not require the physical good itself as evidence before doing these things. The claim to the asset is just as good for this purpose as is the asset itself. The depositor entering this "bank" (for brevity it is now convenient to refer to the inventory firm as a bank) neither needs nor wishes to know whether the warehouse receipt that he wants to deposit in the bank represents a previous direct deposit of the physical asset itself by someone else in some other bank or whether it originated as a loan from the issuer of the certificate of deposit. In either case the circulation of these warehouse receipts among the merchants and the transfer back and forth from the banks to the merchants can and does result in a stock of claims to the physical assets that is a multiple of the actual quantity of the physical assets underlying these claims. The ratio of the total claims to the physical inventory depends on the reserve ratios of the individual banks.

It is well-known in monetary theory that the excess of the claims to the assets over the actual physical quantity of these assets is not the result of imprudent behavior by any individual bank. On the contrary, as far as each individual bank knows, it has enough reserves in the

form of its own physical assets to meet the claims of its depositors. One who owns a warehouse receipt for the physical asset regards this receipt as equivalent to the actual commodity itself for the purpose of using it as a store of value or as a medium of exchange. Of course, it is not equivalent to the physical good for the purpose of making jewelry or coins. Each individual bank that receives a deposit in the form of a warehouse receipt regards this slip of paper as equivalent to the physical commodity for its purposes of establishing its own reserves. That is, a bank receiving a warehouse receipt drawn on another bank can regard this as a claim to the physical commodity underlying the warehouse receipt. Hence it can treat this deposit as equivalent to a deposit of the physical good itself. Moreover, it can use this warehouse receipt to obtain the actual commodity from the bank that issued this receipt if it so desires. It is this perception of the individuals that the claims to the underlying physical asset are equivalent to the possession of the physical good itself that lies at the root of this argument explaining why the stock of claims can be a multiple of the stock of the physical good. Remember, it is less costly to use the paper claims as a store of value and a medium of exchange than it is to use the actual underlying physical commodities.

In order to see more clearly the correspondence with futures, it is necessary to examine more closely the nature of the transaction between the lender, who is the bank, and the borrower, who is a merchant. The parties to the loan agree on the terms, which include when the loan will be repaid and how much the borrower will pay the lender for the loan. Although the latter is usually thought of as an interest rate, for the purpose of showing the isomorphism between money and futures it is now convenient to express the cost of the loan to the borrower in a different way. The interest rate is implicit from a comparison between the initial quantity that is lent and the quantity that the borrower agrees to repay the lender. Thus if the borrower obtains 1 unit for a period of 1 year and agrees to repay 1.1 units, then the interest rate is 10% per year. This transaction is equivalent to the following. Let the borrower buy 1 unit of the commodity and simultaneously sell 1/1.1 units of the commodity for delivery in 1 year. Hence borrowing is equivalent to a pair of transactions composed of a purchase of the spot commodity and the simultaneous sale of the future commodity. An annual interest rate of 10% is equivalent to a futures price of 0.9090. This alternative way of describing a loan implies that a loan is equivalent to a short hedge.

A short hedge is a pair of transactions in which a purchase of an actual commodity accompanies a simultaneous sale of an equal quantity of futures contracts. However, according to the description above of a loan, the borrower repays the loan. In a short hedge this would be equivalent to delivering the actual commodity in fulfillment of the obli-

gation incurred by the sale of futures contracts. It may, therefore, be objected that, since actual delivery on a futures contract is uncommon, the analogy between a short hedge and borrowing is invalid. In the usual short hedge, the buyer of the actual commodity lifts his hedge well before the maturity of the futures contract. He does so in this way. When he sells the actual commodity, he buys back the futures contract at the then-prevailing price. However, there is a loan transaction that does correspond to the usual form of a short hedge. It is one in which the borrower can repay the loan according to prescribed terms at any time up to the final date when the loan becomes due. This is known as a call loan. Before describing this in more detail, it is useful to consider some other similarities between money and futures.

In this idealized history the banks originate as inventory firms that store precious metals for others. The warehouse receipts issued by these banks to the owners of the metal may not specify the name of the owner. Instead it may be payable to the bearer. If so, such warehouse receipts have a special name—they are called bank notes. However, the bank notes issued by the different banks are not necessarily perfect substitutes for each other. If bank notes issued by different banks were perfect substitutes, then they would have the same price. In this case a note issued by one bank would be as acceptable as one issued by another. But since the bank notes are private money secured by the faith and credit of the individual bank, it does not necessarily follow that all banks are equally acceptable sources of these notes. A bank that is less likely to redeem its obligations would find that its notes command a lower price than would another bank regarded as being more reliable.

The banks also make loans on terms mutually acceptable to themselves and to the borrowers, who receive bank notes from them. The price for a loan implies an interest rate. Equivalently, the terms of a loan determine the quantity of bank notes that a borrower must return to the bank in fulfillment of his debt. These terms imply the future prices of bank notes. That is, if a person who borrows 1 unit today must return 1.1 units in 1 year, then the futures price of a bank note of the particular bank is 1/1.1. Although these futures prices for loans are not determined in one location on an organized exchange, they are the result of competition between borrowers and lenders. Different banks issue their own notes, which are not necessarily acceptable at par for notes issued by other banks. Each bank in this history constitutes its own market, in which it deals with potential customers for loans. Nevertheless, it would seem, therefore, that there is a difference between the credit market, which is composed of many local markets, and the futures market, which is a central market.

In the development of futures markets, the storage firms—the warehouses—correspond to the private banks. The warehouse receipts of

these storage firms resemble the certificates of deposit of the banks. Warehouse receipts payable to the bearer are like bank notes. Just as notes issued by different banks are not necessarily equally acceptable, so too the warehouse receipts of different warehouses are not equally acceptable. Therefore, warehouse receipts are not a fungible, liquid instrument, whether they are notes of different banks or warehouse receipts for wheat of different storage firms. Moreover, it is interesting to note that, at an early stage in the history of the grain trade, grain terminals in Chicago made transactions like those described above by the banks in, say, Renaissance Italy.[1]

The history of money and banking shows that the emergence of a common medium of exchange resulted from actions of the state. The decisive event at the end of the seventeenth century was the establishment of the Bank of England. Though legally a private bank, it had close ties to the government. It was one of the first central banks to appear on the scene. The Bank of England, by virtue of the functions it performed for the government and by becoming the lender of last resort, had a major effect on money, credit, and commerce. The liabilities of the Bank of England became the reserves of the private merchant banks. The role of gold bullion, while becoming increasingly less important, did not finally disappear as a major factor until 1930. The important point is this. The bank notes issued by the Bank of England were universally acceptable throughout the realm and became the standard monetary unit. This means that a holder of a Bank of England note could use it as a means of payment, and it would be acceptable to the person to whom it was offered without regard to the credit standing of the payor. The importance of a universally acceptable medium of exchange is very great. A note issued by a private bank was not necessarily universally acceptable. It would depend on the credit standing of that bank. This was true in England throughout the nineteenth century. It was also true in the United States until the National Bank Act, which became law in February 1863 and allowed the creation of National Bank Notes. Even to this day there is an important vestige of individual bank notes—a certified check. A check, certified or not, is not legal tender. Your creditor need not accept your personal check or a certified check. He can require payment in cash. A traveler's check is another example of a financial instrument similar to a bank note because, like a bank note, a traveler's check is a liability of the issuer.

For futures markets the appearance of an instrument equivalent to currency is not the result of governmental intervention. The futures

1. There is an excellent history of the development of futures trading in the United States in U.S. Federal Trade Commission (1920). See also the articles by Williams (1982, 1984). Carlton (1984) contains a history of futures trading.

contract, perfectly fungible and liquid, valid without regard to the identity of the buyer or the seller, was the invention of a private enterprise, namely, those who established the first organized futures market. Had the banks formed an exchange in which they could trade their bank notes among themselves in terms of a standardized contract, there may well have arisen a private common monetary unit similar to a futures contract. The organized futures market, entering the scene about a century and a half after the Bank of England, got no inspiration from banking history. This market evolved in order to satisfy the needs of the traders for an instrument that would serve as a trading vehicle in a particular commodity (the first was, in fact, wheat but would not be actual wheat). Each contract is a perfect substitute for another of the same maturity. Such substitutability is not true of different warehouse receipts for wheat. By restricting trade in these contracts to the members of the exchange who must satisfy prescribed requirements of financial integrity and moral character and by defining the terms of the contract appropriately, there came into being a medium of exchange and a store of value in terms of the agricultural commodities first traded on these exchanges similar in its essential traits to currency. However, the particular futures contracts are denominated in units of wheat, corn, or oats instead of units of gold or silver.

A futures contract in wheat, for instance, is both a temporary abode of purchasing power and a store of value in wheat. For both these purposes it is superior to actual wheat because the transaction costs for wheat futures contracts are lower than for actual wheat. There are several reasons for this. A trader in wheat futures can avoid the cost of inspection or grading. The faith and credit of the organized market stands behind each futures contract in this sense. Each transaction between a buyer and a seller, who must both be members of the exchange, is binding on them. Though they may act as agents on behalf of their customers, who are the principal parties to the contract, it is the agents, the buyer and the seller, the exchange members, who are responsible for fulfilling the contract's terms. Even if their customers default, it still remains the responsibility of the members, the agents of their customers, to carry out their contractual obligations. Subsequently, the members have the right to require customers in default to make good. Because the futures contracts of the same maturity are perfect substitutes for each other and are valid without regard to the identity of the buyer and seller, futures contracts correspond to currency with respect to the asset underlying them. Thus a futures contract in wheat is to a warehouse receipt for wheat as currency is to a check of an equal amount. Admittedly, for large transactions it is inconvenient to use currency—a certified check is better. The point is that the check must be certified before it can become nearly as acceptable as currency.

II

To verify the claim that hedging in a futures market corresponds to a loan, we must carefully examine what occurs in a hedge. It is convenient to begin by confining attention to short hedging, which corresponds to borrowing, and then to discuss long hedging, which corresponds to lending. At the outset it is necessary to recognize that hedging is not a literal loan in the sense that a short hedger borrows a commodity and subsequently returns exactly the same thing with interest to the lender. A short hedger buys the actual commodity in the spot market and at about the same time sells an equivalent quantity of futures contracts. This pair of transactions does have the essential features of a loan since the short hedger frees himself from much of the risk of a change in the price of the commodity. An owner of an asset bears the risk of a change in its price because, when he buys it, he does not know at what price he can later sell it. In contrast, the borrower of a good does not bear a risk of a change in its price during the period of the loan. This is because the terms of the loan specify how much the borrower must repay, which is equivalent to determining the futures price of the borrowed good.

A numerical example helps to illustrate the argument. I shall follow Keynes, who, in turn, attributes the concept of the "own rate of interest" to Sraffa.[2] Assume that the spot price of wheat is $4.00 per bushel and the futures price for delivery in 1 year is $4.30 per bushel. The money rate of interest is 12%. The sum of $4.00 will obtain $4.48 in 1 year that can be used to buy 4.48/4.30 bushels of wheat for delivery in 1 year. So 1 bushel of spot wheat becomes 1.042 bushels of wheat in 1 year, and the own rate of interest in wheat is 4.2%. Hicks gives another example, which, for the sake of variety, shows how to lend a commodity, say, coffee, for 1 year. This corresponds to a long hedge. In Hicks's example, you can lend the commodity for 1 year by making three transactions as follows: (*a*) sell coffee spot; (*b*) lend money proceeds for 1 year; and (*c*) buy coffee futures. If a long hedger begins as the owner of an asset that he lends by selling spot and buying futures, it follows from this argument that, insofar as he is an owner, a long hedger does bear the risk of an adverse change in the price of the asset when he is repaid the loan with interest. The repayment occurs when he lifts the long hedge by buying spot and selling futures. Therefore, in contrast to short hedging, which corresponds to borrowing and removes price risk from the short hedger, long hedging, which is lending, does not remove price risk from the long hedger. The motive for long hedging is the same as the motive for lending. People lend when their actual receipts exceed their desired expenditures at the prevailing in-

2. The mature views of Keynes on the analogy between monetary theory and futures trade is in Keynes (1936, ch. 17). The analysis of Hicks is in Hicks (1946, ch. 11).

terest rate. The same considerations explain why there is long hedging. The higher is the spot price relative to the futures price, the greater is the interest rate obtained from a loan of the commodity. Hence the incentive for long hedging increases with the excess of the spot price over the futures price. This explanation of long hedging suggests the importance of seasonal factors. For agricultural commodities one would expect long hedging to be greatest toward the end of the crop year. For commodities for which the demand is subject to seasonal variation while the supply is not, one would expect long hedging to peak when consumption is at its peak relative to the output rate. For example, long hedging of gasoline would be highest during the summer according to this argument since this is when gasoline consumption reaches its seasonal maximum. By the same argument, long hedging of fuel oil would be highest during the winter, which is when consumption of this commodity is at its maximum.

Like money interest rates, there are two own-interest rates—the nominal and the real. The real own-interest rate equals the nominal own-interest rate minus the expected percentage rate of change of the price of the underlying asset. Therefore, this corresponds to the real money rate of interest, which is the nominal interest rate less the expected percentage rate of change in the price level. Hence, in this respect as well, there is a correspondence between monetary theory and the theory of futures.

The examples above seem to require actual delivery on the futures contract. In fact, delivery on futures contracts is uncommon even when it is feasible, and it is unnecessary in any case. A hedge lifted before the maturity date of the futures contract is still equivalent to a loan, albeit not an ordinary one but instead a call loan. The latter is one for which the interest rate adjusts continuously and always equals the current shortest term rate. Therefore, the loan is continuously renewable at each instant in time at the currently prevailing instantaneous interest rate. Such loans are equivalent to hedges that can be lifted at any time up to the maturity date of the futures contract.

On the basis of an early Illinois court decision (*Kerting v. Sturtevant* [Ill.] 181 A 517), futures contracts without provision for delivery were not legally enforceable contracts because the court found them to be gambles. Consequently, in order that a futures contract be legally enforceable, provision for delivery became a standard feature of futures contracts. However, delivery is not an essential economic trait of a futures contract. In principle, a futures contract settled on the basis of the prevailing spot price determined in a competitive spot market has the same desirable economic attributes as one that permits delivery. Futures contracts without a delivery provision are said to be settled on a cash basis. Put differently, whether or not there is actual delivery on a futures contract, the price of the contract at the maturity date equals

the spot price of the underlying asset. We can easily convince ourselves of the equivalence between futures contracts with and without provision for delivery by considering what would happen in case delivery is contemplated. The seller of the futures contract who does not have the actual asset could buy it or a claim to it in the form of a warehouse receipt in the spot market and transfer title of these assets to the buyer of the futures. (The clearinghouse facilitates the necessary details.) The buyer of the futures contract may or may not actually want delivery. Suppose not. Then he could sell the title to the asset he has acquired as delivered on his futures contract at the prevailing spot price in the spot market. Plainly, these transactions are equivalent to settling the futures contract at maturity by using the prevailing cash price. Provided there is a competitive spot market, cash settlement works at least as well as delivery. Moreover, settlement on the basis of actual delivery works well only as long as the spot (and futures) market is competitive. Actual delivery is unnecessary. A competitive spot market is sufficient to ensure smooth expiration at maturity of the futures contract whether or not it has an explicit provision for delivery.

Yet another alternative to an ordinary hedge is now available, namely, options. A put, an option to sell a futures contract of a given maturity at a preassigned price (called the strike price), is another way to accomplish the same purpose as a short hedge. A person may buy the spot commodity and buy a put with a suitable strike price. This pair of transactions corresponds to an option to borrow at a stipulated interest rate as an alternative to an actual loan. An option to sell affords price protection to an inventory holder similar to a sale of the futures contract under fairly general and plausible conditions. For a long hedge, the call, an option to buy futures at a stipulated strike price, supplies the alternative to buying futures. A forward purchase of the actual commodity combined with the purchase of a call gives a substitute for a long hedge. Just as a put combined with a purchase of the actual commodity gives an option to borrow, a call combined with a purchase of the actual commodity gives an option to lend. An active, competitive, liquid option market is one that facilitates trade in a close substitute for futures contracts as an alternative to hedging. Despite these advantages of options, full-scale options trading became a reality only within the past decade as a result of new federal regulations. An 1874 Illinois statute prohibited trade in options. Nevertheless, the compelling advantages of options led to active trade on an informal basis in the corridors of the Chicago Board of Trade. The options then went under an alias—they were called privileges. These privileges usually expired in, at most, 1 week and did not constitute a financial instrument like modern options.[3]

3. Mehl (1934) describes the trade in privileges on the Chicago Board of Trade.

In view of the argument asserting that options on futures furnish a substitute for hedgers, it is fair to ask in what respects, if any, options differ from futures. Consider a put, for example, that gives the buyer the option to sell a specified quantity of futures contracts at the strike price. A short hedger using a put as an alternative to a short position in futures contracts pays a certain, known amount for the put option. If the spot price is higher at the time he sells his stock than it was when he bought it, then his return on the spot position is reduced by the cost of the put option. If the spot and futures prices are both lower, then the loss on his spot position is offset by the gain on the futures position less the cost of the option. Had he placed the hedge using a futures contract directly instead of a put option, he would have obtained the same protection while avoiding the cost of the put. However, hedging by means of a put gives the hedger a guaranteed price on his short position. To get the same effect using a short futures commitment instead of a put the hedger would have to place orders to sell and buy futures at stipulated prices, equivalent to a stop-loss order. There is no guarantee that such orders can be executed precisely at the specified price. For this reason the hedger would have to place his price order above the equivalent strike price for a put option. He would then have a good chance of getting execution close to the desired price but no certainty of this. The cost of a put option is equivalent to an insurance premium paid for the certainty of execution at the specified price. The more liquid and competitive the futures market, the more likely is execution of an order from the hedger at the specified futures price and the lower must be the cost of a put option that would be as attractive an alternative as a traditional short hedge using futures contracts. It remains to be seen whether options and futures can both survive side by side.

There is still another interesting parallel between futures and money. An owner of a particular asset can often obtain good hedging protection from a futures contract in a different but related asset. For instance, if the correlation between the price of soy oil and the price of corn oil is high enough, then one can hedge a stock of corn oil by selling soy oil futures. As a result, the soy oil futures market attracts a broader range of transactions from all closely related food oils so that the soy oil market becomes more liquid (no pun intended) than if there were separate markets for each of the food oils. This makes the soy oil futures contract more fungible. As a result, a futures market based on one underlying asset becomes a useful trading instrument with a broader domain over a whole set of related assets. Each of these futures contracts becomes the currency of trade over a wider domain.[4]

The buyer of the spot commodity with a customer in hand needs no short hedge. Short hedging is useful only if the inventory holder uses

4. See Carlton (1983) for a thorough discussion of this argument.

the futures contract as a temporary substitute for the actual sale of the inventory. He can use the stock of the spot commodity for his business purposes in the same way that one who borrows money can use the proceeds in his business. A long hedger, the one in the example given by Hicks, is a lender of the commodity. He can use the purchase of futures as a temporary substitute for buying the actual commodity. For hedgers, short or long, the futures contract substitutes for a transaction in the actual commodity or asset. Similarly, options—puts and calls—substitute for short and long positions in futures contracts and thereby furnish an alternative to short and long hedges, respectively, using futures contracts.

By accepting the argument establishing an isomorphism between money and credit on the one hand and futures and hedging on the other, an important conclusion follows, showing how futures trading affects the underlying asset. Recall that a major purpose of borrowing and lending is to change a given stream of receipts into one that can better approximate a preferred stream of expenditures. Hedging does this. Consider this for the example of wheat. This commodity has two plantings, late fall and early spring, and two harvests, one for winter and the other for spring wheat. Therefore, there is a given stream of wheat "receipts" determined by the effects of the laws of nature on the cost of producing wheat. People want a steady stream of consumption of wheat products over time, given constant prices of these products over time. So there is the problem of changing the given stream of wheat production into the preferred stream of wheat consumption. By hedging the wheat inventory, merchants can accommodate these preferences. They sell wheat futures as a temporary substitute for the actual sale of their stocks of wheat. They are in effect borrowing wheat that they repay as they sell their actual stocks of wheat in the interval between harvests. All agricultural products subject to a seasonal pattern of production fit this argument. Nonagricultural commodities with seasonal production, such as metals, also fit this argument. Products that have a seasonal consumption pattern and can be produced at a lower total cost if the rate of production is steady also satisfy this argument. Petroleum products are examples. Apparent exceptions to this explanation are financial futures. What theory applies to them?

Consider the stock index futures. Here is a case in which the argument sketching the history of money and banking is relevant and that shows how the theory of futures illuminates monetary theory. A contract in a stock index futures traded on an organized exchange is equivalent to a special kind of money, one that has purchasing power over a bundle of stocks. We are accustomed to thinking of money as something with purchasing power over all goods. In fact, different components of the money supply have their own advantages for specific purposes. For instance, at current prices a 20-dollar bill is not useful

for buying the daily newspaper; neither is a 100-dollar bill useful to pay a taxi fare. Each of these transactions has a better component of money—a 1-dollar bill for the daily newspaper and a 20-dollar bill for the taxi fare. Similarly, the stock index futures contract is a type of specialized money useful for trading a bundle of stocks. Nor is this all. An owner of a portfolio of stocks can use stock index futures as a hedge. The higher the correlation between the value of his portfolio and the price of the stock index futures contract, the greater is the hedge protection.

If this argument about stock index futures is correct, then what explains the long delay before their appearance on an organized futures market? A large part of the answer to this question is the legal obstacles to stock index futures. For such contracts it is more convenient, if not imperative, to use cash settlement, not actual delivery at the maturity date of the contract. (Actual delivery would require a spot contract in the stock index, which is a feasible, though perhaps more costly, alternative than cash settlement.) This could not be without changes in the law, and the law is slow to change. In fact, the first futures contract permitted by the Commodity Futures Trading Commission (CFTC) to use cash settlement instead of delivery was the Eurodollar contract traded on the Chicago Mercantile Exchange.

Until recently, discussion of futures was usually confined to the agricultural commodities where futures trading orginated—wheat, corn, oats, rye, cotton, and so on. These are all storable goods. (The storability of a good varies inversely with the cost of storing it.) Important futures markets sprang up for other storable agricultural commodities as well, such as butter, eggs, lard, coffee, and sugar. Some metals were actively traded outside the United States, notably, on the London Metal Exchange. Owing to this, for many years theories of futures trading took it for granted that these were the only kinds of commodities suitable for futures trading. Two important developments in the past 20 years have changed these views. First, trading in live cattle and feeder cattle on the Chicago Mercantile Exchange shows that storability of the commodity underlying the futures contract is not necessary. The success of these cattle contracts owes much to the presence of highly competitive spot markets in these commodities. Given a wide interest in a commodity capable of supporting the expense of trade on an organized exchange and given competitive spot markets, it is now clear that successful trade can develop in a nonstorable commodity. Second, trade in financial futures, beginning with Government National Mortgage Association (GNMA) futures contracts in 1975 and going on to the recent Standard and Poors 500 futures contract, has become very successful. In fact, there were important interludes of active trade in financial futures, such as foreign exchange futures in the 1920s, when central banks allowed these rates to be set

by free market forces. I have given my reasons for the success of trading in stock index futures. Now consider financial futures where the underlying asset is a debt instrument, such as the GNMAs, Treasury bills, Treasury bonds, and so on. Here I believe the argument is straightforward. A necessary condition for successful trade of a futures contract is price variability of the underlying asset. This is a source of risk to owners of these assets and it creates a demand for hedging. It is a direct implication of the theory linking hedges to loans so that short hedgers are borrowers of the asset hedged. Borrowers can avoid the risk of changes in the price of the asset they borrow. The greater is the price variability, the greater is this source of risk. Starting in the early 1970s, interest rates in the United States and elsewhere became more variable and less predictable. Hence one of the necessary conditions for successful futures trading came into being. The other necessary condition had long been present, namely, a very large number of persons with positions in these financial instruments. Combining these two factors—greater interest rate volatility and the large number of potential traders in these assets—made conditions ripe for successful futures trading in financial instruments.

The argument claiming that there is an isomorphism between the theory of money and the theory of futures implies that there is an equivalence between the stock of money and the stock of open commitments of futures contracts. Much of the stock of money is the result of loans from lenders, the banks, to their customers on terms that include the interest rate, the duration of the loan, the size of the loan, and so on. The borrower gets a deposit in the bank that lent to him. He can write checks on this deposit. Similarly, commitments in futures contracts result from transactions between buyers and sellers on mutually agreeable terms, including the price and quantity of the futures contract. To the clearinghouse of an organized futures market, the short commitments are its assets and the long commitments its liabilities. The asset underlying the futures contracts corresponds to the reserves underlying the stock of money. One of the main differences between the stock of money and the stock of open commitments lies in this. In the case of money, the central bank can control the stock of high-powered money, while in the case of futures no governmental authority controls the size of the open commitments (save perhaps indirectly in the case of futures contracts in governmental assets such as Treasury bills, Treasury bonds, and so on). As I have argued above, one of the most important effects of the existence of futures markets on the underlying assets they trade is analogous to money. Just as money represents a means of payment and a temporary abode of purchasing power, so too do futures contracts. The futures contracts conserve real resources because they are financial instruments that are less costly to create and to use than are the underlying assets they represent. Such

uses of futures contracts and options obtain the benefits of specialization. The assets that the futures contracts can be said to represent become available for those purposes where they have a comparative advantage. For example, an inventory of wheat can be used to make flour instead of being used as a medium of exchange. For the latter purpose it is cheaper to use paper claims to actual wheat instead of the actual wheat itself. This benefit of futures trading depends on its existence but not on its actual magnitude. The actual size of the open commitments results from the trades of the individuals each pursuing his own interests as well as he can. By virtue of the saving in real resources made possible by trading futures contracts, organized futures markets have a real effect on the economy—they increase real income. Similarly, the saving in real resources made possible by the use of money also has a real effect on the economy and also increases real income.

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