First published in 1972, this book provides an important critical review on the theory of futures trading. B. A. Goss looks at the work and ideas of Keynes and Hicks on futures, and considers how these have also been developed by Kaldor. He discusses the evolution of the concept of hedging in the context of buying forward into the markets, and considers theories of market and individual equilibrium. Goss draws on the work of other economists in this field, including Stein, Telser, Peston and L. L. Johnson, in order to illustrate the development of theory in futures trading. The book includes fifteen figures that illustrate diagrammatically the concepts involved, and the concluding section contains a series of problems for examination by the student.
The Theory of Futures Trading

B. A. Goss
The Theory of Futures Trading
Although all economists would agree that decision-making under risk and uncertainty was central to their subject, and that the role of special markets dealing with these phenomena are of vital importance in analysing the working of a decentralized economic system, there is no good elementary treatment available of this subject. In particular, while there is often a discussion of risk and uncertainty as such, this is not coupled with a discussion of its market consequences. The most important phenomena are, of course, the insurance industry on the one hand and, on the other, the subject of this book, forward markets and futures trading.

In this book, Dr Goss shows how these markets can be analysed using the basic tools of economic analysis. In particular, the student will be able to trace the connections between spot and futures prices, and to see what role futures and forward markets have in determining present price. He will then be able to go on to see how the existence of these markets helps to overcome the potential welfare loss due to risk and uncertainty.

The book fills a gap in the literature in an admirable way, and will enable teachers to introduce this topic into their lectures at the undergraduate and graduate level. In particular, they will be able to use it in an area in which techniques taught in other parts of the subject are relevant and helpful.

M. H. P.
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Introduction

Nature of futures trading

There are two current prices for any commodity: a price for delivery now, the spot price and a price for delivery at a later date, the forward price.

Consider the case of a farmer with a growing crop, with a period of production of, say, nine months; suppose that the current spot price is $10 per bushel. His risk is that the price of the commodity will fall before the crop is ready for delivery. If a buyer were to offer, say, $9.50 per bushel for delivery in nine months' time and the farmer accepts, the crop would be sold forward, and the farmer would have hedged his position against the risk of a price fall. That is, the farmer would have obtained certainty, and the price risk would now be borne by the buyer.

On the other hand, consider the case of a flour-miller who has contracted to deliver a quantity of flour in six months' time, at an agreed price. His risk is that the price of wheat will rise before he purchases his requirements, in, say, five months' time. If he were to purchase wheat forward currently at an agreed price, then the flour-miller would have hedged his position against the risk of a price rise in wheat. That is, he would have acquired certainty, and that risk would now be borne by the seller of the wheat.
Hedging, then, is defined as the activity of a trader who enters the forward market with a spot market commitment, and hence a spot market price risk, and who, by forward dealing, makes his position certain and transfers the risk to another party.

In the first example the farmer possessed the growing crop, i.e. he was 'short' in the forward market. He is thus said to be a short hedger. In the second example, the flourmiller sold forward flour which he did not possess; in terms of the wheat equivalent of that flour, he was 'short' in the spot market. He bought wheat forward, i.e. he was 'long' in the forward market for wheat, and is said to be a long hedger.

These examples, while being cases of forward trading, are not instances of futures trading. A future is a contract which refers to a specific later date, for a fixed quantity of the standard grade of a commodity. The future, rather than the commodity to which it refers, is the unit of trading. Delivery is possible, optional, but is seldom made. Futures market positions are usually closed out by reversal of the transaction.

The procedure for a short hedger, say a stockholder of wheat, who took his hedge in a wheat futures market, would be as follows:

At time $t_0$ the stockholder would buy wheat spot at a unit price of $S_0$, and would hedge by selling futures contracts for an equivalent quantity of wheat, at a unit price of $F_0$.

At $t_1$ he would sell the wheat spot at a price $S_1$, and would close out the futures market position by buying a quantity of futures (equal to the quantity initially sold) at a price $F_1$.

His total profit on the hedged position can be expressed as:

$$(\text{profit on spot}) \text{ minus } (\text{loss on futures})$$

$$= (S_1 - S_0) - (F_1 - F_0)$$

$$= (S_1 - F_1) - (S_0 - F_0),$$

which may be $\geq 0$. 

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That is, a short hedger makes a profit if backwardation (a market term to describe a situation in which $S > F$) increases.

Equation (1) may be written as

$$(F_0 - S_0) - (F_1 - S_1),$$

which may be $\geq 0$.

That is, short hedgers make a profit if contango (a market term to describe a situation in which $F > S$) declines.

If the price spread or 'basis' (the difference between $S$ and $F$) remains constant, i.e. $S$ and $F$ move in the same direction and by the same amount, the profit on the hedged position is zero. The hedge is said to be perfect.

So a stockholder, initially facing the risk of a fall in the spot price, hedges by selling futures; his risk is now that the spot and futures prices will not move in parallel: he has substituted a basis risk for a price risk.

The hedge described above is a pure hedge: the trader sold a quantity of futures contracts equal to the quantity of wheat involved in his spot market commitment, neither more nor less. Such a trader will always hedge his spot market position, even if the spot price is expected to rise: a pure hedger is assumed not to back his expectations, or alternatively, not to have any expectations.

We may also consider the case of a long hedger who hedges in a futures market. For example, suppose a flour-miller sells flour forward at time $t_0$, at a price $S_0$. The price $S_0$ is assumed to be deflated by the cost of converting wheat to flour: that is, it refers to the commodity content of the finished product. It is usually interpreted as the spot price of the wheat equivalent of the flour sold forward. The miller hedges by buying an equivalent quantity of wheat futures at price $F_0$.

At $t_1$ he buys wheat spot at the price $S_1$, and closes out his futures position by selling wheat futures at a price $F_1$. His profit on the hedged position is seen to be:
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\[(S_0 - S_1) - (F_0 - F_t)\]
\[= (S_0 - F_0) - (S_1 - F_t)\]  
\[= (F_t - S_1) - (F_0 - S_0)\]  

which may be \(\geq 0\).

Hence the long hedger is said to make a profit if backwardation declines (equation 3) or if contango increases (equation 4). So the short hedger's gain is said to be the long hedger's loss, and vice versa; and their actuals and futures transactions are of opposite sign. For these reasons the long hedger's position is often regarded as the negative or mirror image of that of the short hedger.

This is not strictly true, however, because the long hedger's actuals transaction at \(t_0\) is a forward transaction, and '\(S_0'\) in equation (3) is really a forward price. It is therefore likely to be closer to \(F_0\), than to the spot price at \(t_0\): hence ('\(S_0' - F_0)\) in equation (3) cannot be interpreted as backwardation.

Pre-conditions for futures trading

The following would appear to be the necessary conditions for commodity futures trading to be possible. The first condition is that there must exist rigidities in production which give rise to spot market commitments, either on the long or on the short side of the market. Once such a commitment exists it can be avoided only at considerable cost to the party concerned. For example, a farmer with a growing crop is committed to harvesting and selling the crop. To avoid this commitment by destroying the crop would involve him in considerable loss. Similarly, a builder who has contracted to build a brick house is committed to buying bricks at some time in the future: to avoid this commitment he must give up the contract.

Second, the price of the commodity must fluctuate, or be
expected to fluctuate. Hence persons with a spot market commitment face a price risk. As a consequence of these first two conditions taken together there will be a demand for hedging facilities. It is conceivable that a futures market could exist without hedgers, that is with arbitrageurs and speculators alone.\textsuperscript{3} Hedging activities, however, are regarded as an important part of futures trading in practice.\textsuperscript{4}

The third condition is that the commodity must be homogeneous or, alternatively, it must be possible to specify a standard grade and to measure deviations from that grade. This condition is necessary if a futures exchange is to deal in a standardized contract. In some commodities there may be two or more standard contracts; for example, in copper at the London Metal Exchange there are three standard contracts: one each for Wirebars, Cathodes and Fire Refined. Frequently, however, trading tends to concentrate in one contract.

Discounts and premia are fixed by the exchange to correspond to grades of the commodity ‘below’ and ‘above’ the standard grade. If delivery of a non-standard grade is made, then this discount or premium is applied to the price of the contract at that time (maturity).

Fourth, delivery of the commodity must be possible under the contract. If this condition is fulfilled, then theoretically the price of a future at maturity will equal the spot price at that date; that is, maturity basis will be zero, because it will be a matter of indifference to a buyer of the actual commodity whether he purchases the commodity spot or purchases a future at maturity and obtains delivery. In practice, the maturity basis may not be zero; for example, the buyer may be a user of a particular grade and may be uncertain which grade will be delivered. The spot commodity may then command a premium over the maturing future.\textsuperscript{5}

If this condition were not fulfilled, the price of a future at maturity would bear no necessary relation to the spot price at that date.\textsuperscript{6}
The fifth condition is that storage of the commodity must be possible. In the absence of this condition, arbitrage of the type referred to in the section 'Categories of transaction' of this Introduction would not be possible. There would then be no necessary relationship between spot and futures prices before maturity.

The fourth and fifth conditions would appear to rule out the possibility of futures trading in services, because specific performance (i.e. 'delivery') cannot usually be legally insisted upon in the case of services, and storage of services is not possible.

Although the holding of stocks must be financed whether the commodity is the subject of futures trading or not, it would appear that futures trading requires that sufficient liquid funds be available to facilitate market settlement. This is the sixth condition.

Finally, it follows that in so far as hedgers are either net long or net short, there must be a speculative element present which is net short or net long respectively, to take up the balance of open positions.

Feasibility, however, is not the same thing as success. Although one may argue that all necessary conditions for futures trading are fulfilled, this is no guarantee that the market will be active. There appear to be three main reasons why this may not be so. The first is that the contract may favour one side of the market, for example, with respect to commodity description, delivery provisions or the testing procedure for deliverable stocks. Second, if in the commercial market power is concentrated on one side of the market, and the futures contract merely reflects this concentration, there may be no incentive for the group holding the power to use the market. Third, one group of traders may be traditionally accustomed to a particular form of market arrangement, and may be unwilling to break that tradition.
Categories of transaction

The purpose of this section is to classify transactions into three categories, hedging, arbitrage and speculation, and to indicate the aims of each of these different types of transaction. This classification of transactions is conceptual only, and in practice any one operator, or any one market transaction may fall into two, or all three, categories simultaneously.

Hedging

The aim of hedging as outlined in the section 'Nature of futures trading' (i.e. pure hedging) is risk reduction. Risk avoidance in an *ex ante* sense is not possible, because as was seen in this section, hedging in a futures market, where the futures contracts are closed out by reversal, substitutes a basis risk for a price risk. Risk avoidance in an *ex post* sense may occur if spot and futures prices move in an exactly parallel fashion.

Pure hedging, then, is based on the assumption that risks are smaller with hedging than without. Using the variance of price as a measure of risk, we can write the risk per unit of unhedged stock as $V(S)$, and the risk per unit of hedged stock as

$$V(S) + V(F) - 2Cov_{SF},$$

which is likely to be less than $V(S)$, since normally one would expect movements of spot and futures prices to be closely correlated.8

The question of whether hedging reduces risks *ex post*, that is, whether profits and losses are smaller with hedging than without is considered in chapter 2.

Arbitrage

Arbitrage is a position taken in both spot and futures markets simultaneously, the aim of which is a certain profit.
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The extent of this profit is normally known at the time the transaction is undertaken. For example, if the futures price exceeds the spot price by more than the cost of carrying the commodity until the maturity date of the future, a riskless profit can be made by buying spot, selling futures and making delivery under the futures contract. Similarly, if the spot price exceeds the futures price, it may be profitable for a stockholder who requires the commodity at a later date to sell the commodity spot, buy futures and take delivery under the futures contract (providing he can obtain delivery of a grade suitable for his requirements). In this way the user will avoid the carrying cost.

The first form of arbitrage aims to make a profit from contango, the second from backwardation. The two forms, however, are not symmetrical with respect to their effects on the price spread. They are further discussed in chapter 1.

Speculation

A speculator is one who, by virtue of his expectations and his willingness to take risk, aims to make an uncertain profit from his transactions in the market. This is so even though he holds his expectations with certainty (so called single-valued expectations), for there is no certainty that his expectations are correct.

A speculator may form his price expectations in terms of the futures price, the spot price, both spot and futures prices or in terms of the price spread alone. He may form his expectations in a precise manner, having in mind different expected prices for specific future dates with a definite idea of the likelihood that each will be achieved, or he may have only a vague notion that the price will change in a particular direction some time in the future.

A speculator may take a position in the spot market only, in the futures market only or in both spot and futures markets. A hedger who over- or under-hedges (or a stockholder who carries his stock unhedged) is, of course, taking
a speculative position with respect to the unhedged stock (or the futures contracts not covering a spot market commitment) for he is retaining a price risk and his expectation is one of uncertain profit.

A speculator may be risk-loving in the sense that he is willing to take a larger risk the larger his market position, or in the sense that he is willing to take a market position when he thinks the odds are against him, or he may be risk-averting in either or both of these senses.

Economists have used different behavioural assumptions to explain the market positions of speculators. They have sometimes assumed that speculators aim to maximize expected utility (see chapter 5), sometimes that they aim to maximize expected return subject to the constraint of risk minimization (see chapter 6), or that they aim to maximize expected net revenue (see chapter 4). In chapter 7 the author puts forward a theory where it is assumed that speculators adjust their market position so as to achieve a given risk of loss for any particular price expectation.

This book is based on a thesis accepted in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Economics at the University of London (London School of Economics) in 1967.

Notes

2 Ibid.
3 See ‘Categories of transaction’ in this Introduction.
5 See Yamey, op. cit.
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8 Let us assume here that the variances exist in an objective sense. This simplification is necessary because pure hedgers are usually assumed not to have any price expectations, or at least if they do, not to back them. Hence, the variances are not taken here to be the variances of subjective probability distributions of spot and futures prices.

The formula for the risk per unit of hedged stock is based on the notion that a hedge is a linear combination of spot and futures contracts. The formula is used by J. L. Stein and L. L. Johnson: see chapters 5 and 6.