# THE THEORY AND PRACTICE OF FUTURES TRADING

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## SUMMARY

This paper presents a theory of futures trading. It points out that the function of all market organization is to permit co-ordination of sellers and buyers. This co-ordination has two dimensions, space and time. The activities necessary to achieve co-ordination are—establishment of buyer-seller communication, transportation, financing, storage, price formation and uncertainty bearing. The increasing refinement in market organization from primitive markets to futures markets has resulted from the achievement of economies in the cost of these activities. Economies have come from improvements in market technology and from specialization in market functions. Futures markets have developed to facilitate co-ordination through time. As a result, they allow handlers, processors and producers of the commodity to transfer the functions of price formation and uncertainty bearing to speculators. In well-established markets, this division of labour allows hedgers to specialize in their particular role as storers, processors and producers; it similarly allows speculators to specialize in their own particular functions. In smaller and less developed markets, transaction costs are too high to permit routine hedging, but the co-ordination they achieve allows the transference of uncertainty bearing in particular situations.

The differential between price quotations for any two periods represents the price of storage between the two periods and is simultaneously determined by the supply and demand for storage from one quoted period to the next. The supply of storage is a function of the net marginal cost of providing hedged storage; the demand for storage is derived from the expected difference between the marginal value of supplies in the two periods, less the marginal cost of the financial holding of stocks.

The use of futures markets by various groups of traders varies according to their particular objectives and functions. Speculators seek to profit

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from correctly anticipating price changes and from supplying communication facilities. Hedgers use futures for a variety of reasons, most of whose benefits derive from the transfer of price formation and/or uncertainty bearing to speculators.

The division of labour between the functions of storage, processing or production and of price formation and uncertainty bearing which futures markets allow has produced, mainly through specialization and increased scale of operation, economies in each and so a reduction in their supply price to the community. There is also some reason to believe that it improves the allocation of resources through time.

Woolgrowers may use the futures market to fix the price of their clip in advance and so improve the efficiency of short-term resource use. The resultant benefits will depend largely upon the flexibility of their production and resource use programmes. Growers with ability to predict prices may also use the market to profit from this ability. Only a small percentage of New South Wales woolgrowers have used the futures market. The main reason for doing so was to attempt to gain from outguessing the market. The attempt was generally unsuccessful.

## THE PROBLEM

This paper has two aims. The first is to present a theory of the nature of futures markets; the second is to investigate the actual and potential use of futures by woolgrowers. The function of futures markets is the first subject for enquiry. In order to interpret this aspect correctly it was found necessary to examine the reasons for and the development of markets in general. The function of futures markets is presented in the context of this analysis. The next problem is the nature of the relationship between spot and futures prices. The third section is concerned with a classification of various trading practices according to the functions and objectives of different trading groups. The effect of futures markets on economic efficiency is the fourth subject for discussion. The final section examines the benefits and costs of futures markets to woolgrowers and presents the results of a questionnaire to growers on their use of the market.

## I. THE THEORY OF FUTURES MARKETS

### 1. The Development and Functions of Futures Markets

In order to understand fully the essential functions of futures markets it is necessary to discuss their development in relation to other forms of market organization. In so doing it is shown that there are six functions inherent in all marketing activity and that the process of market development results from the achievement of economies in these functions. It is appropriate to begin this inquiry with a brief statement of the functions of markets in general.

#### The Functions of a Market

A market may be described as the organization which permits exchange between buyers and sellers. This organization consists of all the functions necessary to allow for the co-ordination of buyers and sellers which

exchange requires. These functions comprise the establishment of communication between traders, transport of the commodity, financing, storage, price formation and uncertainty bearing.

In various stages of market development these co-ordinating functions have been performed with varying efficiency. In the following sections it will be seen that the increasing refinement in market organization has come about as a result of the achievement of economies in co-ordination. A part of these economies has come from improvements in market technology; the other part is due to increasing specialization in the performance of market functions.

### The Refinement in Market Organization

In the process of market evolution five distinct developments can be recognized:—[1]

(1) Systems of gift giving.
(2) Barter.
(3) Cash (spot) markets.
(4) Forward markets (for specific delivery).
(5) Futures markets.

Within these steps there can also be seen various modifications and degrees of refinement. In examining this process in detail it is appropriate to begin with the development of cash markets from barter markets.

### Developments Up To and Within the Cash Market

The first major development in market efficiency was the invention of money. The use of money as a medium of exchange has reduced the costs of communication between buyers and sellers and the costs of transport and uncertainty bearing.[2] The next development was the entry of middlemen into the cash market. The supply of more economical communication facilities, specialization in price formation and uncertainty bearing and provision of large-scale storage by middlemen has reduced marketing costs. This assumption of marketing functions by middlemen has reduced production costs by enabling the producer to concentrate on his main activity and realize the economies of specialization and larger scale of operation. A further refinement was the establishment of centralized exchanges. These exchanges have overcome a great deal of the problems of buyer-seller communication inherent in a market composed of many independent middlemen.

### Cash to Forward Markets

The economies in co-ordination outlined in the previous section relate mainly to co-ordination of buyers and sellers at a particular point of time, and in relation to goods already produced. This aspect can be called the "space dimension" of market organization. There is, however, another

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[1] H. H. Bakken, "Historical Evaluation, Theory and Legal Status of Futures Trading in American Agricultural Commodities", in *Futures Trading Seminar* (Wisconsin: Mimir Publishers Inc., 1960), I.

[2] H. S. Houthakker, "The Scope and Limits of Futures Trading", in Abramovitz *et al, The Allocation of Economic Resources* (Stanford, California: Stanford University Press, 1959), pp. 146-147. Also Adam Smith, *The Wealth of Nations* (London: George Routledge and Sons Ltd., 1890), pp. 17-18.

aspect to co-ordination which derives from the fact that account must be taken of the future when making any decision to supply or demand goods or factors of production. This aspect can be called the "time dimension" of market organization.[3]

This need to take cognizance of the future involves both storage and production. Production and storage, then, involve uncertainty because the future cannot be seen with certainty. In order to reduce this uncertainty, producers and storers with access only to a cash market will have to spend considerable time in estimating future demands and supplies at the expense of their main activities. The presence of uncertainty will also result in restricted capital use, as a result of either internal or external capital rationing.

The forward market developed as a means of reducing these costs arising from the time factor. By allowing market participants to tie up in advance planned purchases and planned sales, the functions of price formation and its concomitant, uncertainty bearing, can be transferred, as in the cash market, to those willing and better situated to specialize in undertaking them. The transfer of the price formation function enables the producer to concentrate on his main activity and realize the associated economies.[4] The transfer of uncertainty bearing obviates internal and/or external capital rationing and so increases the efficiency of the financing function. The forward market is, in fact a financial institution.[5] The transfer of uncertainty bearing by the producer to the forward buyer or seller means that the forward buyer or seller now supplies the capital necessary to meet uncertainty, that is, he stands ready to meet changes in the value of the commodity with his own capital in place of the forward seller. The assurance given by the forward contract that the forward buyer or seller will stand by his commitment allows banks to provide capital over and above what would normally be loaned on a product not sold or bought forward.

Such are the advantages of co-ordination in time achieved by the development of forward markets in general. Futures markets represent a further development in these economies.[6] In considering futures markets, forward markets other than futures markets will be grouped under the general heading, forward markets. Discussion of forward markets will be restricted to those characteristics in which they differ from futures markets.

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[3] An excellent discusion of this aspect is given by P. H. Wicksteed, *The Commonsense of Political Economy* (London: Routledge & Kegan Paul Ltd, 1957), I, pp. 229-236. Also Holbrook Working, "A Theory of Anticipatory Prices", *American Economic Review, Papers and Proceedings,* Vol. XLVIII (May, 1958), pp. 188-208.

[4] Production is taken in the remainder of the paper to include all forms of transformation of the commodity, including storage. See A. P. Lerner, *The Economics of Control* (New York: Macmillan and Co., 1949), pp. 69-70.

[5] This aspect is treated at some length in A. B. Paul and W. T. Wesson, "The Future of Futures Trading in Our Changing Agriculture", in *Futures Trading Seminar* (Wisconsin: Mimir Publishers Inc., 1960), I. pp. 205-221.

[6] This statement does not imply that forward markets for all commodities can and will develop into futures markets. Succesful establishment of futures markets requires a perfect or semi-perfect market and low carrying costs. It is obvious that not many commodity markets meet these requirements. See N. Kaldor, "Speculation and Economic Stability", *Review of Economic Studies,* VII (1939-40), p. 1.

FORWARD TO FUTURES MARKETS

The economics effected in forward markets by the development of futures markets are in the functions of buyer-seller communication, price formation, and uncertainty bearing. Communication between buyers and sellers in forward markets occasions the same difficulties as does producer peddling in the cash market. In each case a good deal of effort is required to find a trading partner with matching requirements and to ascertain what is the going price. The first of these costs is reduced in futures markets by the standardized contract, the entry of outside speculators and the existence of a centralized exchange. Standardization of the contract with exact differentials as to grade, location and time of delivery and the consequent entry of outside speculators mean that large transactions in any grade of the commodity can be made readily and economically.[7] The centralized exchange results in further economies, as noted on page 45. The second cost, ascertainment of the going price, is reduced considerably by the wide publicity given to current futures quotations.[8]

The economies in price formation brought about by futures markets result from specialization in the function by speculators.[9] In forward markets, price formation is carried out by forward buyers and sellers in association with their other activities. Specialization in the function results in its supply at lower cost.[10] Again, the standardized contract means that speculators' knowledge need be less detailed than otherwise, thereby reducing further the cost of price formation.[11] Economies in uncertainty bearing *per se* result from the ability of speculators to spread their risks over a number of commodities. Also, the greater liquidity of futures markets enables transactions to be made without delay, a factor which diminishes the burden of uncertainty bearing to individual traders.

Thus it is seen that refinements in market organization are the result of effort to achieve economies in co-ordination of buyers and sellers in space and in time. Refinements in cash (spot) markets relate to co-ordination in space; refinements in forward markets relate to co-ordination in time. Futures markets are the most advanced development in the accomplishment of economies in co-ordination through time.

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[7] In this respect the standardized contract is analogous to money. See H. S. Houthakker, *op. cit.*, p. 147; also p. 45 of this paper.

[8] This publicity has an external economy in that it attracts more speculators, thereby reducing transaction costs further.

[9] The existence of the two functions of uncertainty bearing and price formation in speculation is apparent when we consider the employment of price forecasters by firms of professional speculators. In this general connection see J. K. Mehta, *A Philosophical Interpretation of Economics* (London: George Allen and Unwin, 1962), Ch. XI.

[10] This is not meant to imply that, with a futures market, price formation is taken over *entirely* by outside speculators. The extent to which this is so depends on the quality of the price judgments of long hedgers and other operators and on the amount of long hedging. See Holbrook Working, "Speculation on Hedging Markets", *Food Research Institute Studies,* Vol. 1, No. 2 (May, 1960), p. 197 and pp. 202-203.

[11] Kaldor, *op. cit.*

## 2. The Relation Between Spot and Futures Prices

As can be seen in Figure 1, futures prices are sometimes at a discount to spot prices and sometimes at a premium.[12] This section is devoted to an explanation of these premiums and discounts. The interpretation presented here is that they represent the price of storage between the two periods, and can be analysed in terms of the demand for and supply of storage.[13]

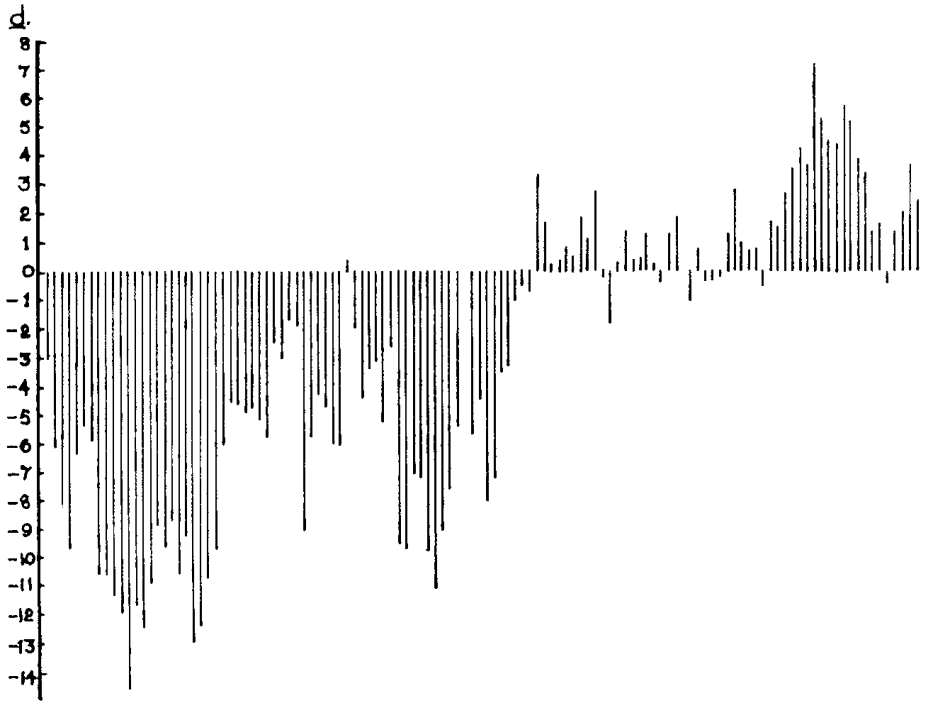


**Figure 1. Weekly Differentials Between Spot and Seven Month Futures 1963-1965**

### Supply of Storage

The supply schedule for storage between two periods is determined by the marginal net cost of storage, a composite of the marginal outlays for physical storage and the marginal yields of storage. Outlays for physical storage comprise rent, handling charges, interest on capital, insurance and deterioration.[14] The yield of stocks to processors derives from the ability they give to meet variations in demand without rapid and costly interruptions to the production flow and from avoidance of loss of customer

[12] In this discusion it is mainly the relation between spot and futures prices that is discussed. This treatment is purely for convenience, as the same considerations apply to the relation between two futures prices. The spot price is, in effect, one end of a series of futures quotations.

[13] This exposition considers a market with hedgers, merchants and speculators alone and takes no account of the complications introduced by including "mixed traders" as is done by M. H. Peston & B. S. Yamey, "Intertemporal Price Relationships with Forward Markets", *Economica,* Vol. 27, No. 108 (1960), pp. 355-367.

[14] M. J. Brennan, "The Supply of Storage", *American Economic Review,* Vol. XLVIII, No. 1 (March, 1958), pp. 54-56.

goodwill in having to refuse an order.[15] The yield to merchants derives from the second of these factors. This yield is called the "convenience yield".[16] The marginal convenience yield will decrease as the level of stocks increases; the marginal cost of physical storage will increase as the level of stocks increases. The supply of storage schedule is determined by subtracting the marginal convenience yield from the marginal physical storage cost, at each level of stocks. The resultant schedule and its components are illustrated in Figure 2.[17]

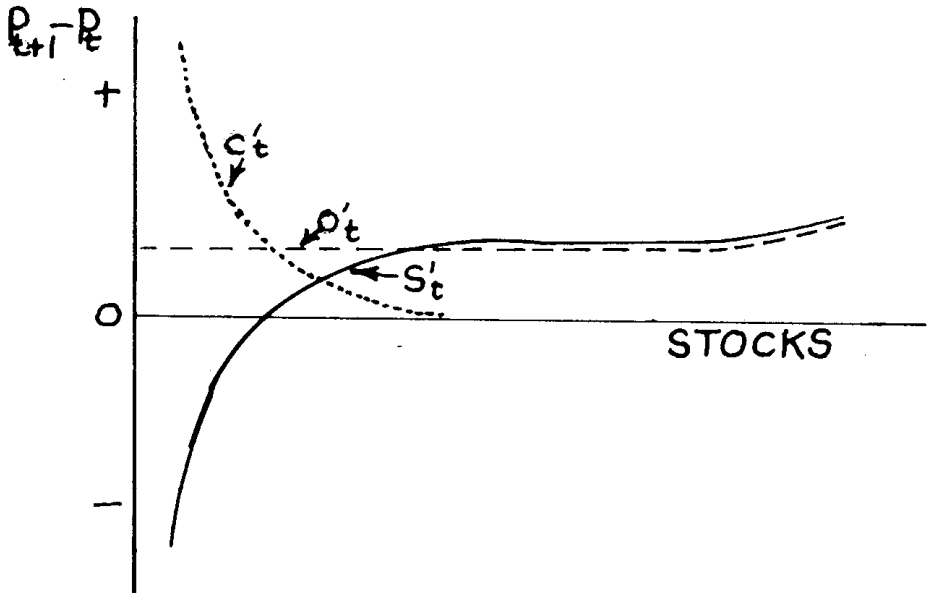


**Figure 2. The Supply Curve for Storage**

$c'_t$ marginal convenience yield
$o'_t$ marginal physical storage cost
$S'_t$ marginal net storage cost
$P_{t+1} - P_t$ futures-spot differential
$S'_t = o'_t - c'_t$

It is seen that the marginal net cost of storage can be negative or positive, depending on whether the marginal convenience yield exceeds or falls short of the marginal physical storage cost. At low levels of stock it is negative and at high levels it is positive.

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[15] L. G. Telser, "Futures Trading and the Storage of Cotton and Wheat", *Journal of Political Economy,* Vol. LXVI, No. 3 (June, 1958), p. 235.

[16] Kaldor, *op. cit.* Also, Holbrook Working, "The Theory of Inverse Carrying Charges in Futures Markets", *Journal of Farm Economics,* Vol. XXX, No. 1 (Feb., 1948), pp. 1-28.

[17] This supply curve differs from Brennan's (Footnote 14) in that there is no allowance for a marginal risk premium. When *hedged* storage is supplied, this cost is eliminated and the supply curve of storage is lower than that for unhedged storage at each level of stocks by the marginal risk premium. This difference represents the reward paid to speculators for assuming price formation and its concomitant risks. See page 53. It must also be noted that this supply curve is a short run curve.

DEMAND FOR STORAGE

The speculative demand for storage between two periods is determined by the difference between the level of demand in the first period and the expected level in the second period and by the difference in actual and expected supplies in the two periods. It is derived from the expected excess demand in the second period over the reservation demand of consumers for successive units of the first period supply, less than the marginal costs of assuming the financial holding of stocks.[18] The first factor can be seen more clearly in Figures 3 and 4, which show the Period 1 situation reverse to the normal presentation. The demand for storage curve is derived from the expected price difference between the two periods as successive transfers of Period 1 supply are made into Period 2. Figure 3 shows the situation with a variable supply, demand being the same in both periods. Figure 4 shows the converse situation.

In each diagram the SS curves are the reversed demand curves of Period 1 and represent the reservation demands of consumers in that period for successive transfers of stock to Period 2.[19] In each, *cd* equals *ab* which is the initial difference between the marginal values of the supplies in each period.

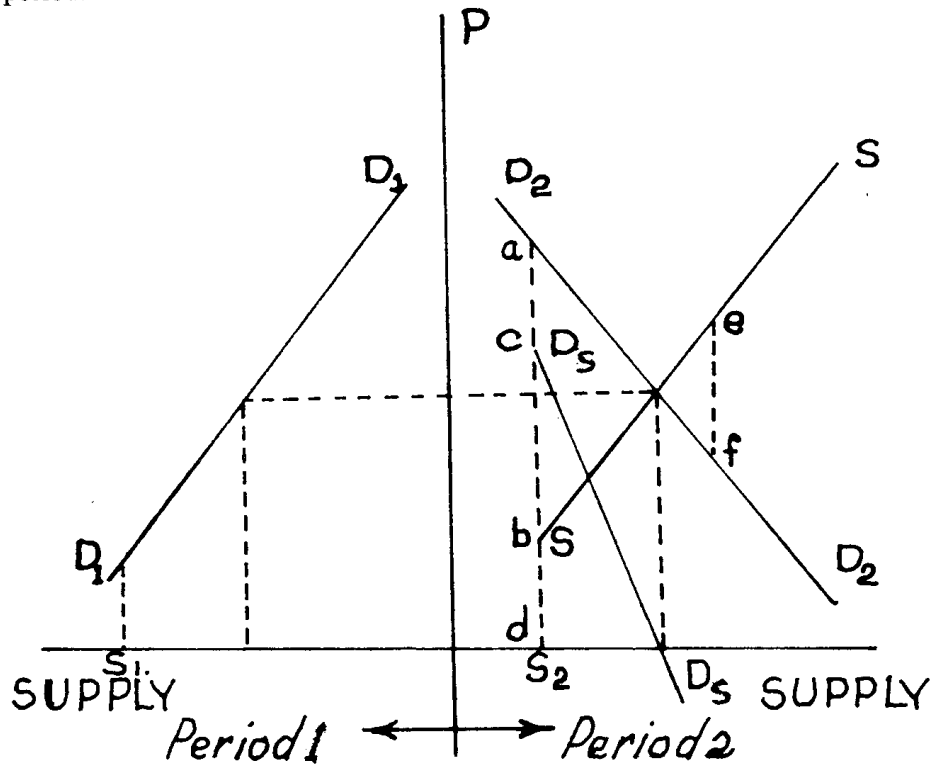


**Figure 3. Derivation of Demand for Storage**

| | |
|---|---|
| $D_1D_1$ and $D_2D_2$ | consumption demand curves in Periods 1 and 2 |
| $S_1$ and $S_2$ | production in Periods 1 and 2 |
| P | price |
| $D_sD_s$ | "demand" curve for storage which equals $D_2D_2 - SS$ |

[18] This statement, as presented, applies only to a two-period situation. If, however, the first period is taken as the average of supplies and demand schedules in all other periods than the second, it is true.

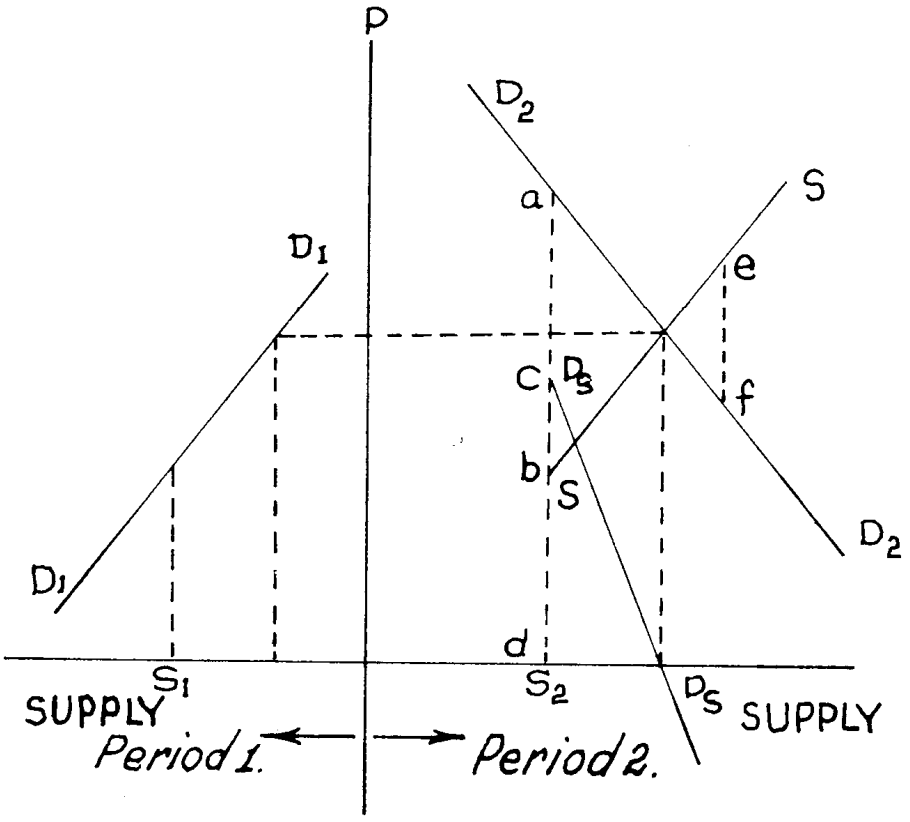


**Figure 4. Derivation of Demand for Storage**

| | |
|---|---|
| $D_1D_1$ and $D_2D_2$ | consumption demand curves in Periods 1 and 2 |
| $S_1$ and $S_2$ | production in Periods 1 and 2 |
| P | price |
| $D_sD_s$ | "demand" curve for storage which equals $D_2D_2 - SS$ |

The demand schedules for storage in both diagrams are given, starting at origin $S_2$, by the vertical differences between schedules $D_2D_2$ and SS as units of the commodity are transferred from Period 1 to Period 2.[20] The resulting schedule $D_sD_s$, already drawn in Figures 3 and 4, is shown in Figure 5.

The origin 0 is equivalent to $S_2$ and *ab* and *ef* are arithmetically equal to *ab* and *ef* in Figures 3 and 4. As conditions change, the demand curve will, of course, change position, moving to the right as expected demand increases (current demand decreases) or expected supply decreases (current supply increases), and conversely.

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[19] The SS curves are drawn from a perpendicular at $S_2$ starting at a height equal to the ordinate of $D_1D_1$, at abscissa $S_1$ and maintaining a slope equal to that of $D_1D_1$. For a discusion of this procedure, see P. H. Wicksteed, *op. cit.*, pp. 498-516.

[20] This method is similar to that used by Marshall, *Principles of Economics* (8th ed.; London: Macmillan & Co., 1961), p. 318.

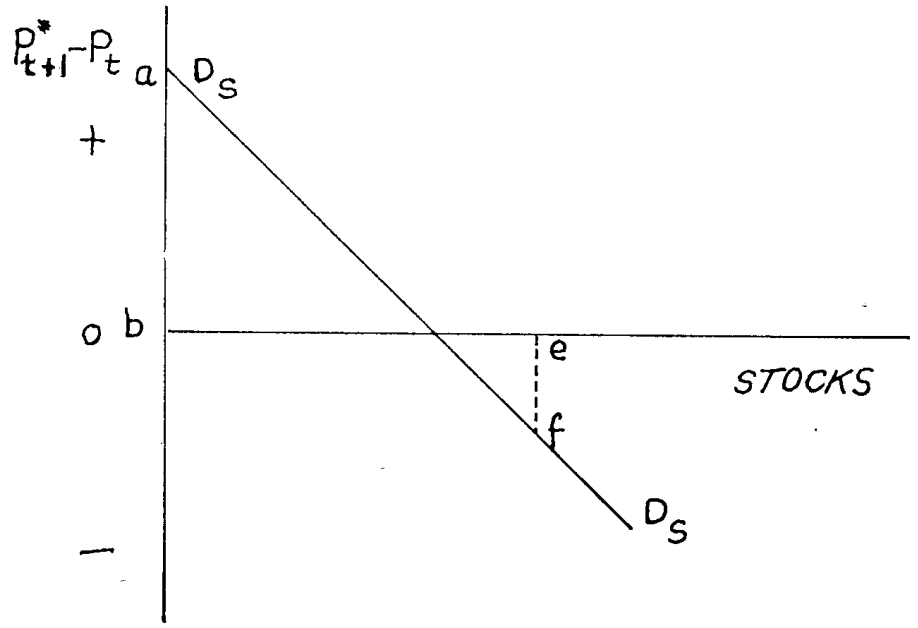


**Figure 5. "Demand" Curve for Storage**

$P^*_{t+1} - P_t$ expected price difference between Period 1 and Period 2

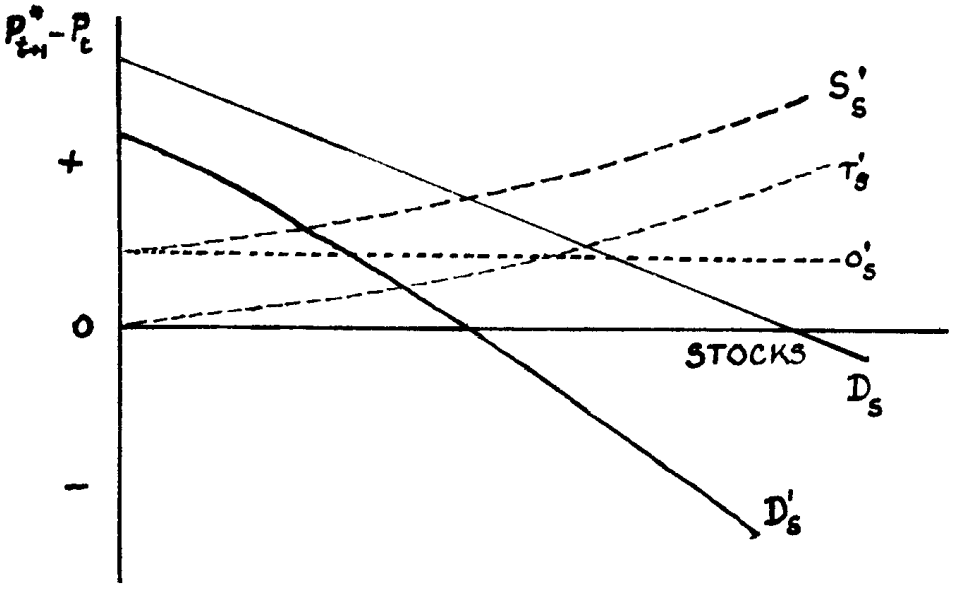


**Figure 6. Demand for Storage**

$D_sD_s$ "demand" curve for storage.
$D'_sD'_s$ true demand curve for storage.
$S'_s$ total marginal cost of the financial holding of stocks.
$r'_s$ speculators' marginal reward for price formation and uncertainty bearing.
$o'_s$ marginal operating cost of speculators.
$S'_s = o'_s + r'_s$
$D'_s = D_s - S'_s$

The second factor, the marginal cost of assuming the financial holding of stocks, must be subtracted from this demand curve to obtain the true demand schedule for stocks. This cost includes the price which must be paid to speculators to cover their operating and opportunity costs, their reward for price formation and their remuneration for uncertainty bearing.[21] The derivation of the true demand curve ($D'_s$ $D'_s$) is shown in Figure 6.[22]

THE PRICE OF STORAGE

The interaction of the demand and supply schedules, Figures 6 and 2, results in a price for storage, which may be positive or negative, as shown in Figure 7.

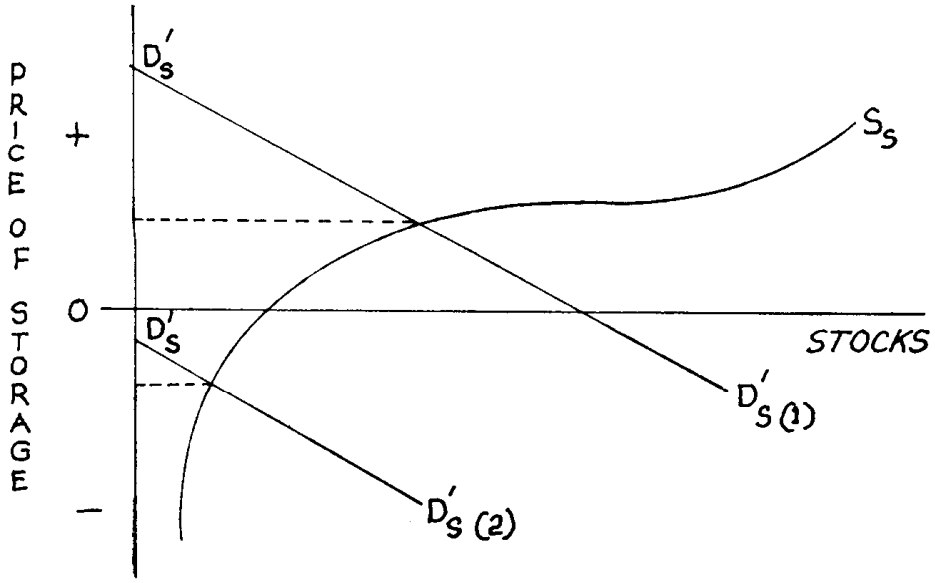


**Figure 7. The Price of Storage**

$S_s$ supply schedule for storage
$D'_sD'_s$ and $D'_{s(1)}D'_{s(2)}$ demand curves for storage in different situations

EMPIRICAL EVIDENCE

The relation between the price of storage and the level of stocks just postulated has been shown to hold true in the wheat futures markets in the United States and Liverpool. Moreover, the correlation between stocks and futures-spot differentials tends to be highest when the price of storage is negative.[23]

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[21] These factors explain the "bias" in "thin" and "lopsided" markets. In "thin" markets speculators' rewards must be higher to cover their higher overhead costs resulting from the lower volume of transactions. In "lopsided" markets, the costs of attracting capital are higher because of special risk situations or lack of knowledge of the commodity by speculators. R. W. Gray, "The Characteristic Bias in Some Thin Futures Markets", *Food Research Institute Studies*, Vol. 1, No. 3 (November, 1960), pp. 296-312.

[22] See Footnote 20.

[23] Working, *op. cit.*, pp. 19-20 and "Price Relations Between July and September Wheat Futures at Chicago since 1885", *Wheat Studies* (March, 1933), pp. 187-238. Also Sidney Hoos and Holbrook Working, "Price Relations of Liverpool Wheat Futures", *Wheat Studies* (November, 1940), pp. 101-143.

A further implication of the theory of the price of storage is that a change in market prospects in a future period has a similar effect on distant and near futures prices. This has similarly been shown to be true in the United States wheat futures market.[24] As Professor Working says:

> "The results from all lines of investigation concur, in indicating that prices quoted at one time, in a futures market, for two different dates of delivery, stand in a relation which in general *does not* reflect expectations regarding events that may occur between the two delivery dates. This conclusion holds whether the dates be in separate crop years . . . or in the same crop year".[25]

Thus it is seen that differences between price quotations for different delivery periods represent the price of storage from one period to the other. The co-ordination of buyers and sellers over time is illustrated by the transactions between speculators, acting on behalf of consumers in each period, and producers and merchants supplying the commodity to these periods.

### 3. The Use of Futures Markets by Various Trading Groups

The general principles underlying the use of futures markets were presented in Section 1. This section discusses their particular use, according to the functions and objectives of the different groups of traders who use them.

#### Types of Traders

Traders on futures markets can be classified after the event into two groups, hedgers and speculators. In this discussion a hedger is described as a trader who has taken opposite positions in the cash or forward market and the futures market. In either case he has made a simultaneous purchase and sale and so is in a position of zero ownership with respect to the particular hedged transaction.[26] A speculator is a trader who has bought and

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[24] Holbrook Working, "New Concepts Concerning Futures Markets", *American Economic Review,* Vol. LII, No. 3 (June, 1962), pp. 443-444.

[25] Holbrook Working, "The Theory of the Price of Storage", *American Economic Review,* Vol. XXXIX (December, 1949), p. 1255.

[26] H. H. Bakken, *op. cit.,* p. 26.

The hedger will, of course, still have to take action on the forward sale or purchase to consummate the transaction even though he is in a position of zero ownership. If he has sold forward on the futures market he may deliver the commodity on the futures contract or he may make an offsetting purchase of futures to cancel out his position in the futures market and at the same time sell the commodity he holds in the cash market. If he has bought forward on the futures market he may insist on delivery or make an offsetting sale on the futures market and at the same time purchase the appropriate quantity in the cash market. In both cases he receives the difference between the value of the initial sale and purchase. That this is so is easily seen when delivery is made or accepted because the two initial transactions are the only ones made. When offsetting sales and purchases are made in the delivery month to finalize the hedge, the futures price becomes equal to the spot price (because of the possibility of delivery) and so the offsetting sale and the offsetting purchase at the same price cancel each other out and the hedger is left with the difference between the value of the initial sale and purchase, the same result. In the case of the forward buyer, this statement must be modified to the extent that he also has to pay for the cost of storage of the commodity until he actually buys it. He does this by paying the premium, the carrying charge, on the initial futures purchase.

sold at different times. Thus he has assumed a positive or negative ownership position, depending on whether he has bought or sold.[27]

(a) USE BY SPECULATORS

The aim of speculators in taking a net ownership position is to obtain the rewards for participating in the functions of price formation and uncertainty bearing which this position entails. Professional speculators also seek to obtain the rewards for the organizational skill and capital employed in providing for communication between buyers and sellers.

(b) USE BY HEDGERS

It was demonstrated in Section 1 that storers, processors or producers of the commodity, who are the hedgers, use futures markets to transfer the functions of price formation and uncertainty bearing to speculators.[28] They do this in order to be left free to specialize in the details of storing, processing or producing the commodity. Such hedging is called routine hedging. The routine transfer of uncertainty bearing, however, is not economically feasible in all futures markets. It is only in long-established and widely used markets with low transaction costs that such hedging is practised. In smaller and developing markets, with higher transaction costs, hedging is done only when the producer believes that a price fall is likely or if he is unable to form any definite expectations.[29] Such hedging is called "selective" hedging.[30]

*Routine Hedging.*—It must be pointed out at the outset that the term routine hedging is somewhat misleading. It implies that hedging of commitments in the cash or forward markets takes place automatically and without reference to the relation between the price of the cash and the forward market transaction. In fact, the two decisions are made in conjunction and, unless the relation between the two prices is satisfactory, neither transaction will take place.[31] There are two kinds of routine hedging, "carrying charge" and "operational" hedging.[32]

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[27] These definitions, according to the net market position of a trader *after* he has carried out a transaction in one or both markets, is for expositional convenience only. It will be seen that, *ex ante,* the *decision* to hedge sometimes involves taking quite definite account of price prospects and so is, in effect, speculative.

[28] This is not to imply that outside speculators undertake all market price formation, but only that part which would otherwise be performed by *routine* hedgers, short or long. See Footnote 10.

[29] As Professor Working says, "The most noteworthy special characteristic likely to be present in a young futures market is a tendency for short hedging to be done selectively, according to the price expectations of potential hedgers. Dealers in such a commodity tend to persist for a time in making their own appraisals of price prospects and hence to hedge stocks only when they expect a price decline, rather than to hedge routinely." "Speculation on Hedging Markets", *Food Research Institute Studies,* Vol. 1, No. 2 (May, 1960), p. 201.

[30] Holbrook Working, "New Concepts Concerning Futures Markets and Prices", *American Economic Review,* Vol. LII, No. 3 (June, 1962), p. 440.

[31] In practice, trading is done purely in terms of the basis, that is, the difference between spot and futures prices. No reference is made to the actual price level.

[32] Working, *op. cit.,* pp. 438-439.

Carrying charge hedging, which is done by merchants to earn the market established price of storage, illustrates the role of futures in permitting hedgers to transfer price formation and uncertainty bearing to speculators so as to be able to concentrate their attention on the minutiae of storage. When making a decision to store, a merchant need only look at the current futures-spot differential, the carrying charge, and adjust his stockholding so that his particular marginal cost of storage is equal to the carrying charge.[33] Being removed from uncertainty, the merchant can concentrate on organizing his storage resources in the most efficient manner and on using his specialized knowledge of grades, quality and location of stocks to recognize unwarranted divergences in the carrying charge and profit from them.

Operational hedging, which is done by processors to fix in advance their processing margins, is analogous to carrying charge hedging in purpose and in form. When making a competitive bid for a forward sale of his product, a processor consults the relation between the futures price of the raw material and possible price quotes for the forward sale, with appropriate adjustments in each case for quality differences. He then makes a bid according to his marginal cost of producing the particular output. If the bid is successful, he makes a purchase on the futures market equivalent to the amount of raw material required to fulfil the contract. This fixing of the processing margin, through a forward sale and purchase, removes uncertainty and enables the processor to concentrate on the minutiae of production and to use his special knowledge of grades, location and quality in timing his purchase of the commodity in the cash market to cover the forward sale.

*Selective Hedging.*—As was pointed out previously, selective hedging according to the price expectations of producers is practised in futures markets whose transaction costs are too high to allow routine hedging. In such markets, co-ordination through time is permitted when it would not otherwise be possible. However, insufficient economy has been achieved to make economically feasible complete division of labour between the functions of price formation/uncertainty bearing and production.

*Finance Hedging.*—The transfer of uncertainty bearing from storers, processors or producers to speculators is also done to obtain extra credit from banks. In the United States, a bank might loan 60 per cent of the collateral value of the unhedged commodity, whereas it could loan up to 90 per cent of the value of the hedged commodity. This increase of 50 per cent in the loan rate would mean that a firm could increase fourfold the amount of capital at its command if it hedged.[34] Firms may also hedge to enhance their credit status so as to be able to take maximum advantage of an unexpected business opportunity.[35] Although they may not make use of the credit available, the opportunity to do so increases flexibility at low cost.

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[33] The marginal return per unit of storage will be equal to the carrying charge because the futures price becomes equal to the spot price in the delivery month when the hedger will sell the stored commodity in the cash market and buy back the futures contract. So he will be left with the difference between the value of the initial sale and purchase—the carrying charge.

[34] Paul and Wesson, *op. cit.*, p. 218.

[35] *loc. cit.*, pp. 215-216.

*Speculative Use of Futures by Handlers and Producers.*—The use of futures by processors to make forward purchases of raw materials and by producers to make forward sales of projected output, each without an offsetting commitment, is termed "anticipatory hedging."[36] This practice is, in fact, speculation, but it is discussed as hedging to avoid confusion with outside speculation.

Forward purchases of raw materials in the futures market by processors to take advantage of the current price are effected in futures rather than in the cash market to avail themselves of the economies of futures trading. If, for instance, the processor believes the price will rise but the procurement of stocks would be expensive because of the shortage of immediately deliverable supplies, he will buy on the futures market. Even if stocks are available, the purchase of futures may be more economical because he is left free to exercise his particular merchandising skill at leisure in procuring the required supplies on the cash market. Similarly, forward sales by producers to take advantage of the current price when a fall is expected are made in the futures market when there is no alternative means available, or, if there is an alternative means, futures are the most economical medium.

It is seen that the purpose underlying all these forms of hedging is the transfer of uncertainty bearing and/or price formation from hedgers to speculators. This co-ordination through time is permitted by the economies achieved in futures markets.

### 4. The Effect of Futures Markets on General Economic Efficiency

In analysing the effect of futures markets on overall economic efficiency, three aspects are considered—the cost of carrying stocks through time, the efficiency of processing and the efficiency of allocation of resources over time. It is shown that futures markets result in increased efficiency in at least the first two of these three areas.

#### Cost of Carrying Stock Through Time

The economies in storage costs effected by futures markets result from the specialization and economies of scale and from the lower level of transaction costs which they make possible. The transfer of price formation and uncertainty bearing by storers allows them to realize the economies of specialization and larger scale of operation. The latter is reinforced by the increased use of capital made possible by the removal of internal capital rationing and, more importantly, by the increased availability of external credit.[37] In turn, specialization by speculators in price formation and uncertainty bearing results in a reduction in their costs.[38] All these economies, together with the lower transactions costs,[39] result in a reduction in the supply price of storage to the community. The net effect is illustrated in Figure 8 which shows the short-run marginal storage costs per unit of time with ($c^1$) and without (c) a futures market.

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[36] Working, *op. cit.*, pp. 441-442.

[37] See pages 46 and 56.

[38] See page 47. This statement is not meant to imply that the function of price formation is performed more accurately, only that it is performed at lower cost. Its accuracy is the subject for discussion in the third part of this section.

[39] See page 47.

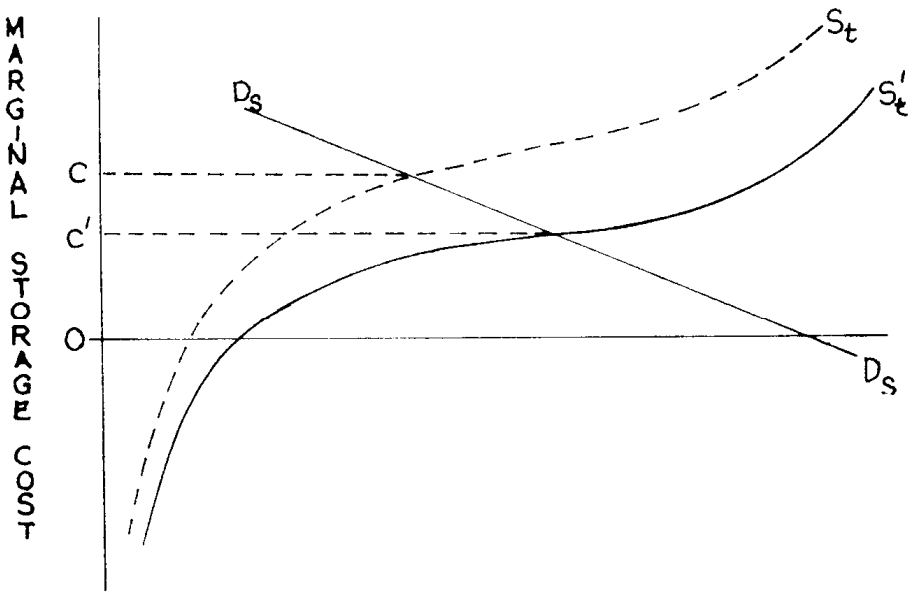


**Figure 8**

$S^1_t$ and $S_t$ are the marginal net storage cost schedules with and without a futures market.

$D_sD_s$ is the "demand" curve for storage in a particular situation and is equivalent to that in Figure 5.

### The Efficiency of Processing

The routine transfer of price formation and uncertainty bearing from processors to speculators results in economies of specialization and scale in the same way as in storage. These economies result in a reduction in the supply price of processing to the community.

### The Allocation of Resources Over Time

Before examining the particular problem at hand, it is appropriate to consider some general principles governing the efficiency of allocation of resources through time. The most efficient intertemporal allocation of resources occurs, as always, where the marginal revenue of each resource supplied to a particular period equals the marginal cost of its supply to that period. This implies that the price which is realized in the period is that which was expected to rule therein.[40] If the price is different from what was expected, a situation of disequilibrium, resources will have been supplied to a period where their marginal cost exceeds or falls short of the actual marginal revenue (the realized price). As Professor Hicks has said:

> "Whenever such a divergence occurs, it means (retrospectively), that there has been malinvestment and consequent waste. Resources have been used in a way in which they would not have been used if

[40] J. R. Hicks, *Value and Capital* (London: Oxford University Press, 1961), p. 132.

the future had been foreseen more accurately; wants, which could have been met if they had been foreseen, will not be satisfied or will be satisfied imperfectly. Thus disequilibrium is a mark of waste, and imperfect efficiency of production."[41]

Hicks mentions four possible causes of disequilibrium, that is, divergence of expected from realized price:

(1) Inconsistency of different people's price expectations;
(2) Inconsistency of plans to buy and sell even if price expectations are consistent;
(3) Wrong estimates of future wants or supplies even when price expectations and plans are consistent;
(4) Curtailment of output as a buffer against uncertainty.

If all those in the market participated in forward selling, the first two problems would be eliminated. In a competitive forward market the disparate schedules and expectations of participants would be reconciled into one equilibrium price, which would be the price on which expectations were based. In other words, complete co-ordination of buyers and sellers would be achieved. The situation is illustrated in Figure 9 with a simple case of three producers and one (collective) buyer.

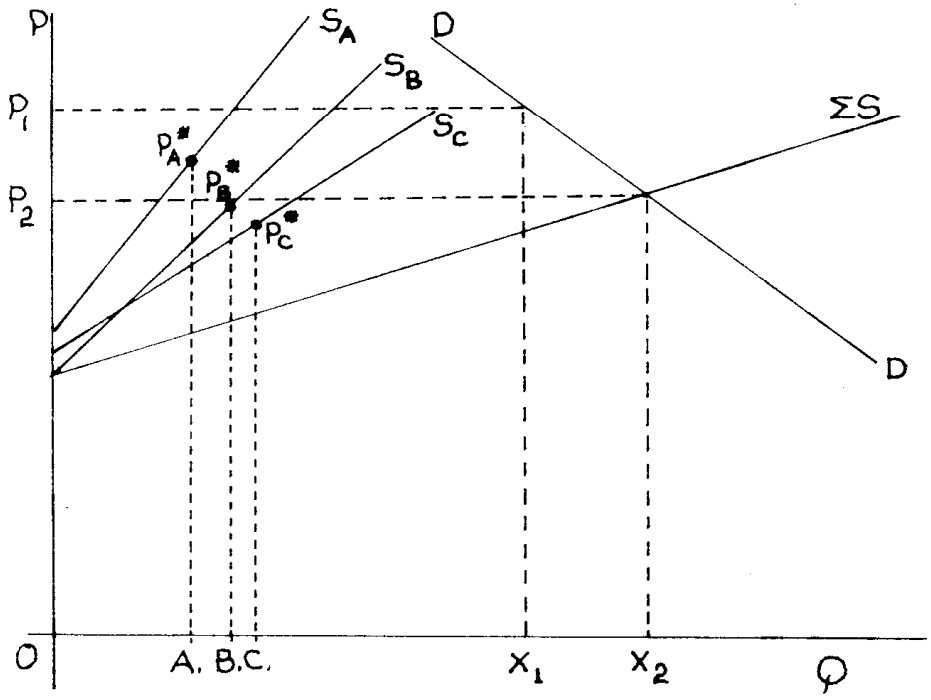


**Figure 9. Market Equilibrium With and Without Co-ordination**

| | |
|---|---|
| DD | demand schedule of buyer. |
| $S_A$, $S_B$, $S_C$ | supply schedules of producers A, B and C. |
| ΣS | total supply schedule. |
| $P^*_A$, $P^*_B$, $P^*_C$ | price expectations of producers in the absence of co-ordination. |
| OA + OB + OC = $OX_1$ | |

[41] *Ibid.*, p. 133.

In Figure 9, ($P_1$, $X_1$) is the unco-ordinated price-quantity outcome; ($P_2$, $X_2$) is the co-ordinated price-quantity.

However, in the real world, the third problem, that of foreseeing correctly wants the results of production, remains. This brings the discussion back to the central problem—do futures markets promote greater efficiency of allocation of resources through time by foreseeing more correctly future wants and future supplies?[42] This question is critical because the economies achieved in storage and processing may be more than outweighed by inefficiencies in allocation through time as a result of inefficient speculation. The problem has two aspects, efficiency in storage and efficiency in production.

Efficiency in storage is at a maximum when supplies are distributed through time so that the marginal revenue of the supply in each period is equal to the marginal cost of bringing it to that period. The marginal cost of a unit of stock supplied to a given period is its marginal revenue elsewhere plus the marginal storage cost of its supply to the period. It is the function of speculators, as specialists in price formation, to estimate the marginal revenue in each period. The point at issue is whether this function of price formation is performed better in futures markets than in spot markets. The answer to this question depends on whether prices are in fact more stable for a commodity with a futures market than without. If prices are more stable, it means that supplies are being brought in greater volume from periods in which their marginal revenue is initially low to those periods in which their marginal revenue is initially higher.

The empirical test consists in comparing price variability of a commodity before and after the establishment of a futures market. Three such tests which have been carried out lend some support to the view that futures markets do reduce price variability. Gray's study of the onion market and Working's study of the potato market showed that intraseasonal price variability was reduced when a futures market had been established.[43] In the case of onions, the reduction was of the order of 50 per cent. A similar study by Gerda Blau suggests that the introduction of futures trading in the wool market reduced interyear variability in wool prices.[44]

The evidence, then, though by no means conclusive, provides support for the view that futures markets do increase the efficiency of allocation of stocks through time.

In so far as futures markets reduce price variability, they also increase the efficiency of production. Lower price variability means that producers can make more accurate estimates of future prices when using past prices as a basis and so allocate their resources in a more efficient manner.

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[42] It might be thought that co-ordination *per se*, in eliminating problems (1) and (2), would always result in improvement in efficiency, regardless of inefficiencies caused by (3). A little manipulation of Figure 9 demonstrates that it is not necessarily true.

[43] R. W. Gray, "Onions Revisited", *Journal of Farm Economics*, Vol. 45, No. 2 (May, 1963), p. 273. Holbrook Working, "The Price Effects of Futures Trading", *Food Research Institute Studies*, Vol. 1, No. 1 (February, 1960), p. 3.

[44] Gerda Blau, "The Theory of Futures Trading with Special Reference to Wool", (London University, 1942, Part 1).

So it can be seen that the economies of co-ordination in time achieved by futures markets result in lower storage and processing costs. There is some evidence that they also increase the efficiency of allocation of resources through time.

## II. THE USE OF FUTURES MARKETS BY WOOLGROWERS

Having discussed the general principles which govern futures trading, it is now appropriate to consider these principles in relation to woolgrower use of futures markets. In the first part of the enquiry, an examination is made of the benefits which growers might obtain together with the costs incurred in using the futures market. The second part presents the results of a questionnaire to growers on the reason for their use or non-use of the market.

### 1. Potential Use

(i) BENEFITS

There are a number of reasons why woolgrowers might want to use the futures market. Such use can be broadly described by most of the hedging classifications of Section 3. In all cases except one they involve the forward sale of the clip.

(a) *Routine Hedging.*—A grower can sell his next clip forward every year after shearing the previous clip, that is, at the start of the production process, and so know in advance the price of the final product. Thence he can plan his short-term (annual) resource use—fertilizer, supplementary feeding and disease preventatives—in the most efficient manner (*ex ante*). Also a wheat-sheep farmer is able to plan a more efficient combination of the two products for the particular year since he knows broadly the prices of both in advance.

In the first situation, the gain from this form of hedging will depend upon the proportion of total costs which are variable on an annual basis and upon the stability of input prices. In the second situation, it will depend upon the flexibility of the cropping-livestock programme.

(b) *Selective Hedging.*—Growers with ability to predict prices can use the futures market to gain from this ability and at the same time achieve a more efficient allocation of resources. In this case growers sell forward only when they expect a price decline, but still at the beginning of the production process. In so doing they profit from otherwise adverse price changes as well as from the increased efficiency in resource use through knowing the price in advance.

The gains from increased efficiency will depend upon the same considerations as outlined for routine hedging, though they will come less frequently. The gains from anticipating price changes will depend upon how successful is the grower's judgment of price movements.

(c) *Anticipatory Hedging.*—Anticipatory hedging is similarly a means for growers able to predict prices to profit from this ability. In its usual form, it differs from selective hedging in that the forward sale is made after most or all of the variable inputs have been put into the production

process. Hence there is no gain from increased efficiency of resource allocation. Another form of this practice serves as an alternative to withdrawal of the clip from sale in anticipation of a price rise. In this case the wool is sold as usual at auction and an equivalent quantity of futures is bought in its place.

In either case the gain will depend upon the grower's price predicting ability.

(d) *Finance Hedging.*—Hedging in order to obtain extra credit from banks, as is done in the United States[45] does not appear to be feasible under the present system of granting bank advances in Australia. In this country, advances to firms other than registered companies are granted mainly on the security of title to freehold properties.[46] Even for registered companies, titles to moveable assets, such as bills of sale or liens on wool, are acceptable only as supporting security and not much reliance is placed upon them.[47]

However, forward sales of a grower's clip may enable him to contract a short-term loan with safety. The extra capital use made possible may make the difference between adopting and not adopting a new production plan, especially where joint or lumpy inputs are required.

Thus it is seen that woolgrowers can use the futures market to enable them to plan their expenditure in a more efficient manner and also to realize on superior ability to predict prices.

(ii) Costs

There are three costs to be considered when evaluating the net benefits of hedging. The first is the direct cost of buying and selling. In the Sydney Greasy Wool Futures Market this amounts to approximately one cent per pound of wool. The second cost arises from the failure of spot and futures prices to come together at the time of closing out the hedge. The extent of this cost, however, cannot be predicted in any satisfactory manner, and it can be positive, negative or zero, depending on the particular situation. A consistent downward bias in the market would also result in a cost to routine short hedgers. To ascertain whether such a bias exists, a test of the profit from maintaining a continuous long position since the inception of the market was made. It was found that profits did not differ significantly from zero.[48] Hence no such bias exists.

## 2. Actual Use

In order to test the above considerations in actual practice, a mail questionnaire was sent to a random sample of one thousand New South Wales woolgrowers on the reasons for their use or non-use of futures markets. The results are tabulated below.

[45] In the U.S., the shift of cotton production from small-scale operation to large commercial operations has been financed directly or indirectly by hedging. Paul and Wesson, *op. cit.*, p. 236.

[46] H. W. Arndt, *The Australian Trading Banks* (Melbourne: F. W. Cheshire, 1960), pp. 39 and 40.

[47] Arndt, *loc. cit.*

TABLE 1
*Response to Futures Questionnaire*

| | Number |
|---|---|
| Response Rate | 560 |
| Have used Market | 6 |
| Have not Considered using Market | 249 |
| Have Considered using Market | 305 |
| *Reasons for not Using—* | |
| (a) Ignorance of Possible Benefits | 189 |
| (b) No Information on How to Use Market | 155 |
| (c) In Times of High Prices, Futures Are at too Large a Discount | 58 |
| (d) Not Prepared to Take Risk of Price of Wool Rising after Selling Futures | 98 |
| (e) Futures Markets Are Harmful to the Wool Industry | 113 |
| *Reasons for Using—* | |
| (a) Anticipatory Hedging | 4 |
| (b) Selective Hedging | 2 |
| (c) Finance Hedging | 1 |

The results appear to indicate that the main reason why futures markets are not used more extensively is that growers have insufficient knowledge of the benefits and mechanics of using them. There is, however, no necessary presumption that greater knowledge of these factors would result in increased use. The other considerations may still preclude this.

The main reason for using the market was to attempt to gain from predicting prices. In the seven times the market was used (one grower used it twice) the attempt was unsuccessful. Despite this, four of the six users expressed their intention of using the market again. The second reason was to be able to plan expenditure better, through knowing the price in advance and through being able to contract a short term loan. Detailed results are given in Table 2.[49]

TABLE 2
*Results of Grower Use of Futures Market*

| Type of Contract | Trading Result | Reason for Use | Size of Clip (bales) | Percentage of Clip Hedged |
|---|---|---|---|---|
| | $ | | | |
| Bought | — 800 | Anticipatory Hedging | 173 | 35 |
| Sold | — 600 | Selective Hedging | 50 | 67 |
| Sold | — 1,200 | Anticipatory and Finance Hedging. | 170 | 50 |
| Sold | — 1,400 | Selective Hedging | 160 | 75 |
| Sold | — 6,960 | Anticipatory Hedging | 7,350 | 14 |
| Sold* | — 7,600 | Anticipatory Hedging | 640 | 42 |
| Sold* | —10,400 | Anticipatory Hedging | 1,002 | 33 |

* Same firm.

[48] This test is described by R. W. Gray in "The Importance of Hedging in Futures Trading; and the Effectiveness of Futures Trading for Hedging", Part 2 of *Futures Trading Seminar* (Wisconsin: Mimir Publishers Inc., 1960), I, p. 77. Trading profits were non-significant in the period to the end of 1963 and for the whole period up to the end of 1965.

[49] It is not possible to ascertain what percentage of non-respondents used the market.