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NORMAL BACKWARDATION AND HEDGING ASYMMETRY

by

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ABSTRACT

Two important questions have been raised in academic discussions on commodity futures markets: (1) Do speculators receive positive return for the risk bearing services they provide? and (2) Why are hedgers net short and speculators net long?

This paper reviews the theory of Normal Backwardation and Hedging Asymmetry theories, which provide theoretical explanations to the questions stated above.

The econometric investigation of eight Indian futures markets reported in this paper provides evidence: (a) to show that long speculators have received positive return in most Indian futures markets and (b) to support that hedgers are net short.

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1. INTRODUCTION

It is customary for traders and processors, who carry stocks and are 'long' in the cash market to hedge or insure in the futures market for the commodity by sale of requisite amount of futures contract. They are 'short' in the futures market. If they have made forward sale commitments as processors do of manufactured goods, without necessary stocks of the raw material, they are described as being 'short' in the cash market. They are 'long' in the futures market, if they hedge their short position in the cash market by purchase of requisite amount of futures contract. A 'long' cash market position corresponds to holding of positive stocks and a 'short' cash market position corresponds to holding of negative stocks. In addition to short and long hedgers, the other participants in futures markets are long and short speculators.

Keynes and Hicks, who were the first to lay the theoretical foundation for futures trading, explained that under normal conditions in commodity markets, when demand and supply conditions are expected to remain unchanged, the current futures price will be below the current spot price. They called it normal back-

wardation.[1] Long speculators who purchase futures contracts from short hedgers according to Keynes-Hicks theory find their long position profitable over a period of time because there is general an upward trend in futures prices as the futures contract approach maturity. The profit received by speculators this theory holds is their reward for providing risk insurance to hedgers by purchase of futures contracts.

An important question that has been raised, to which expert have provided different answers, is whether speculators do receive positive return for the risk bearing services they provide. Hardy was the first to raise the doubt by stating that "it does not seem probable that --- speculators as a class receive any compensation for their services."[2] Houthakker's empirical analysis leads him to conclude that long speculators received a positive return.[3] Telser and Dusak conclude from following different empirical approaches that speculators in futures markets received no positiv

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[1] J. M. Keynes. A Treatise on Money, Volume II, London, 1930. J. R. Hicks. Value and Capital, Oxford, 1939

[2] C. O. Hardy. Readings in Risk and Risk Bearing, Chicago, 1923, p. 225.

[3] H. S. Houthakker. "Can Speculators Forecast Prices? The Review of Economics and Statistics, Volume XXXIX, 1957, pp. 143-151.

return.[4] A second important question relates to finding a satisfactory theoretical explanation on why in the futures markets hedgers are short and speculators are long.

The purpose of this paper is two-fold: a) to summarize the theoretical arguments of Houthakker[5] and Telser[6] on the hedging asymmetry and to examine empirically whether the reasons they have adduced for the asymmetry[7] hold good for a number of futures markets in India. The econometric investigation of Indian futures markets includes not only primary agricultural commodities like Groundnut Kernels, Black Pepper and Turmeric but also processed commodities

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[4] L. G. Telser. "The Supply of Speculative Services in Wheat, Corn and Soybeans," Food Research Institute Studies, Supplement to Volume VII, 1967.

Katherine Dusak. "Futures Trading and Investor Returns: An Investigation of Commodity Market Risk Premiums," Journal of Political Economy, Vol. 81, No. 6, Nov./Dec. 1973, pp. 1387-1406.

[5] H. S. Houthakker. "Normal Backwardation," in Value, Capital and Growth. Papers in Honour of Sir John Hicks (J.N. Wolfe ed.) Edinburgh University Press, 1968.

[6] L. G. Telser. op. cit.

[7] Yamey provides a good critical review of the Houthakker and Telser explanations. See B.S. Yamey "Short Hedging and Long Hedging in Futures Markets: Symmetry and Asymmetry" The Journal of Law and Economics, Vol. XIV (2) October 1971, pp. 413-434.

like Groundnut Oil, Hessian Cloth and Sacking (B. Twill) Bags,[8] (b) to examine whether long speculators would have received positive return in the Indian futures markets as implied in the Keynes-Hicks theory.

Short hedgers, who are traders and manufacturers, can reduce the price risk in the holding of unhedged stocks by hedging or selling in futures.[9] The basic risk they run on hedged stocks is lower per unit than the corresponding risk of keeping the stocks unhedged. Long hedgers are manufacturers or exporters, who have sold forward the manufactured commodity or raw material, to be delivered at a later date, without holding stocks of the commodity. They seek to avoid the risk of rise in price of the manufactured commodity or raw material between the time they made the forward sale and the delivery of the commodity in fulfillment of the contrac

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[8] Futures Markets in several of these commodities have been banned by the Indian Government and they have not functioned for a decade on the ground that futures trading accentuates price fluctuations and aggravates rising trend in prices. Pavaskar and Venkataramanan in separate articles have criticized the action of Government in banning these markets. See M.G. Pavaskar "Does Future Trading Aggravate Price Trends?" Forward Markets Bulletin, Vol. VIII, October 1965 and L.S. Venkataramanan, "Speculation, Profitability and Price Stability in Commodity Futures Markets," Economic and Political Weekly, Vol. VI, No. 18, May 1, 1971.

[9] Lower risk is not the only advantage from hedging. Hedging enables traders to borrow more and possibly also at lower interest from Banks. Hedgers, for example, could borrow 90 percent of their capital requirements in holding stocks, if hedged, but much less if they had not hedged.

by purchasing an equal amount in futures. They could eliminate this risk by holding the necessary amount of inventories. A long hedging position, when the alternative of spot purchase exists, expresses the preference of the long hedger to buy futures. This would happen if spot price is high and stocks are limited as in the case at the end of the crop year. Following this general introduction on the basic features of commodity futures markets, we present in the next section a review of Houthakker's and Telser's theories on hedging asymmetry.

2. HEDGING ASYMMETRY THEORIES

The reason for the asymmetry between short and long hedging according to Houthakker is that short hedgers have a limited risk while long hedgers face an unlimited risk of adverse changes in the basis, that is the futures - spot price spread. This arises because while there is an upper limit to the basis, that is the amount by which futures price can exceed the spot price, there is no corresponding downward limit indicating the level below which futures price cannot fall in relation to spot price. The upper limit is set through arbitrage operations, which can ensure that futures price cannot exceed the current spot price by more than the cost of carrying stocks. The arbitrage operation cannot similarly ensure a lower limit because arbitrage cannot be reversed.[10]

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[10] H. S. Houthakker. "Normal Backwardation," p. 196

In most Indian futures markets there was backwardation of futures price below the spot price. This generally occurs under normal level of stockholding. This is because the seller's delivery options relating to grade, quality, place and date of delivery make the futures contract less attractive to the buyers. Since there is uncertainty regarding what they will receive, the buyers could be persuaded to buy futures only under a price discount. Large stocks of the commodity as in some U.S. grain futures markets, on the other hand are held when there is a contango or positive basis, that is when futures price is above the spot price. While the opportunity for arbitrage hedging increases with the size of the positive basis, the need for insurance hedging is more dominant when backwardation exists. The possibility of arbitrage, of course, does not rule out the need for insurance. The more favourable the opening basis, the lower most likely the insurance cost in holding stocks and contrariwise. In practice hedging is in part motivated by arbitrage and in part by insurance.[11]

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[11] See B. S. Yamey, Addendum to "An Investigation of Hedging on an Organized Produce Exchange" in P.T. Bauer and B.S. Yamey Markets, Market Control and Marketing Reform: Selected Papers Weidenfield and Nicolson, London, 1968.

L.S. Venkataramanan. The Theory of Futures Trading. Asia Publishing House, Bombay, 1965, pp. 22-28.

Houthakker states that the willingness to hedge, long or short, basically depends on two factors:

(a) the correlation between changes in spot price and changes in futures price which determines the effectiveness of hedging, and

(b) the current level of the basis which determines the risk per unit.[12]

Following the Markowitz Portfolio approach,[13] Houthakker presents a model of hedger's behaviour, in which a hedger trader maximizes his expected return subject to the variance (risk)

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[12] As Yamey has explained the "relation between the volume of hedged stocks and basis will be the same whether the hedger is looking for a profit from the hedging itself or whether he makes the decisions on the basis (in part) of the likely cost of hedging the carrying of stocks." See Yamey, Addendum to "An Investigation of Hedging on an Organized Produce Exchange," p. 362.

[13] This portfolio approach has also been very usefully employed by Nicholas W. Schrock in his study of straddle (spreading) operations of speculators and by Anne E. Peck in her study of hedging of expected production by farmers to stabilize their incomes. Schrock rationalizes the behaviour of speculators who expect to suffer a loss in the holding of a particular futures contract but through which they reduce the risk associated with their overall position in the market. See Nichols W. Schrock, "The Theory of Asset Choice: Simultaneous Holding of Short and Long Positions in the Futures Market," Journal of Political Economy, V. 79, No. 2, March/April 1971 and Anne E. Peck, "Hedging and Income Stability: Concepts, Implications and an Example," American Journal of Agricultural Economics, V. 57, No. 7, August 1975, pp. 410-419.

constraint as follows:

$$E (x_p , x_f) - \lambda V (x_p , x_f), \quad \lambda > 0$$

or $(x_p \, dp + x_f \, df) - \lambda (x_p^2 \sigma_p^2 + 2x_p x_f \rho \sigma_p \sigma_f + x_f^2 \sigma_f^2)$

where x_p, x_f are units of stock in the cash market and hedged stock in the futures market respectively.

and dp, df are the changes in spot and futures prices respectively.

Solving the equations representing the first order conditions for maximum for x_p and x_f we get

$$x_p = \frac{dp - \rho \frac{\sigma_p}{\sigma_f} df}{2 \lambda \sigma_p^2 (1 - \rho^2)} \qquad (1)$$

$$\text{and} \quad x_f = \frac{df - \rho \frac{\sigma_f}{\sigma_p} dp}{2 \lambda \sigma_f^2 (1 - \rho^2)} \qquad (2)$$

The implication of the first determinant of short hedging is that the level of stocks hedged depends on the magnitude of ρ, the correlation coefficient between dp and df, that is the effectiveness of hedging.

The relation between x_f (level of hedged stocks) and ρ (effectiveness of hedging) can be derived by differentiating x_f

in (2) with respect to ρ

$$\frac{\delta x_f}{\delta \rho} = \frac{-(1+\rho^2)\frac{\sigma_f}{\sigma_p}\, dp + 2\rho\, df}{2\lambda\sigma_f^2\,(1-\rho^2)^2}$$

Solving (1) and (2) and knowing that $1 + \rho^2 < 2$ we can deduce that

$$\frac{\delta x_f}{\delta \rho} > \frac{-2\sigma_p x_p}{\sigma_f (1-\rho^2)} \qquad (3)$$

If $x_p > 0$, then it follows that x_f (short hedging) < 0

Relation (3) proves the first of the two propositions of Houthakker, viz., the willingness to short hedge depends on the correlation between spot and futures price (ρ). An increase in ρ will increase the amount of short hedging.

We now extend the Houthakker derivation to cover the relation between short hedging and basis, and similarly the relation between long hedging and correlation coefficient, and also long hedging and basis.

The relation between short hedging and basis can be derived by rewriting the expected return subject to variance constraint relation for the hedger trader as follows:

$(x_u dp + x_h db) - \phi\,(x_u^2\sigma_p^2 + 2x_u x_h \mathrm{cov}_{uh} + x_h^2\sigma_b^2)$ where $\phi > 0$, x_u and x_h represent respectively the units of unhedged

and hedged stocks, and dp and db are the changes in spot price and basis respectively.

Solving the equations representing the necessary conditions for equilibrium, we obtain the level of hedged stock as

$$x_h = \frac{\sigma_p^2 \, db - cov_{uh} \, dp}{2 \phi \, \sigma_p^2 \, \sigma_b^2 \left(1 - \frac{cov_{uh}^2}{\sigma_p^2 \, \sigma_b^2}\right)} \qquad (4)$$

The relation between x_h (level of hedged stocks) and b (the basis) can be derived by differentiating x_h in (4) with respect to db

$$\frac{\delta \, x_h}{\delta \, (db)} = \frac{\sigma_p^2 - cov_{uh} \, \frac{\delta \, (dp)}{\delta \, (db)}}{2 \phi \, \sigma_p^2 \, \sigma_b^2 \left(1 - \frac{cov_{uh}^2}{\sigma_p^2 \, \sigma_b^2}\right)} \qquad (5)$$

where x_h (short hedging) < 0 , $\frac{\delta \, x_h}{\delta \, (db)} < 0$, when $\delta \, x_h < 0$ and $\delta \, (d_b) > 0$, that is, an increase in basis will lead to an increase in short hedging, provided the numerator in (5) is negative, that is,

$$\frac{\delta \, (db)}{\delta \, (dp)} < \frac{cov_{uh}}{\sigma_p^2} \qquad (6)$$

The covariance between spot price and basis will be negative and the above inequality will hold when a decline in spot price leads to an increase in the basis. Therefore so long as the covariance is negative, an increase in basis will lead to an increase in hedged stocks.

Similar to the short hedger's expected return relation, we can specify the long hedger's expected return relation subject to the variance constraint and deduce that

$$y_f = \frac{df - \rho \frac{\sigma_f}{\sigma_p} dp}{2 \delta \sigma_f^2 (1 - \rho^2)} \qquad (7)$$

Differentiating Y_f with respect to ρ and after simplifying we obtain

$$\frac{\delta y_f}{\delta \rho} > \frac{- 2 \sigma_p Y_p}{\sigma_f (1 - \rho^2)} \qquad (8)$$

We assume that y_f (purchase of futures contract) > 0 and y_p, the amount sold forward (negative inventory) by the trader-manufacturer < 0. It then follows that

$$\frac{\delta y_f}{\delta \rho} > 0$$

which means that larger the value of ρ (effectiveness of hedging), more will be the purchase of futures contract by the long hedger.

We can likewise obtain the relation between long hedging, y_h (purchase of futures contract) and basis, b as follows:

$$\frac{\delta y_h}{\delta (db)} = \frac{\sigma_p^2 - cov_{uh} \dfrac{\delta (dp)}{\delta (db)}}{2 \phi \sigma_p^2 \sigma_b^2 \left(1 - \dfrac{cov_{uh}^2}{\sigma_p^2 \sigma_p^2} \right)} \qquad (9)$$

The numerator of the right hand side expression would be negative when

$$\frac{\delta (db)}{\delta (dp)} < \frac{cov_{uh}}{\sigma_p^2} < 0$$

that is when $cov_{uh} < 0$. Under these circumstances $\frac{\delta y_h}{\delta (db)} < 0$. In other words, purchase of futures contracts by the long hedger will decline with an increase in the basis.

Telser's explanation for long hedging to be risk increasing runs on the following lines. Long hedgers, processing firms or traders, who are buyers of futures contracts cannot be sure that what may be delivered to them in fulfillment of the contract in terms of quality, location, etc. would meet the requirements of the forward sale of the processed goods. If what is delivered is unsuitable, long hedgers may be constrained to sell them and buy in the cash market the stocks bearing the necessary specifications to meet the forward sale commitment. Since the price of the commodity

acquired as stocks at the later date may rise relative to its price in futures, the long hedger increases his risk by buying futures instead of buying the commodity in the cash market at the time the forward delivery commitment is made. The holding of short hedged stocks is therefore a less risky alternative to a trading or processing firm than the alternative of buying futures, that is, long hedging.

The holding of stocks also confers "convenience yield" permitting uninterrupted production by manufacturers, and also the benefit of meeting exigencies of consumer demand at lower cost to both manufacturers and traders. The "convenience yield" obtained from stock-holding and the opportunity of reducing the price risk through short hedging are, according to Telser, the main reasons which help in explaining why there is predominance of short over long hedging.

3. RETURNS TO HEDGERS AND SPECULATORS AND SEASONAL PATTERN OF SPOT AND FUTURES PRICES

We turn now to answering the question posed earlier in this paper: whether long speculation was profitable in Indian futures markets. We also examine the profits earned by owners of unhedged inventories, hedged inventories and the cost of hedging.

Let p_j, p_j1 be spot prices at time j, j^1 and f_j, f_j1 corresponding futures prices at time j, j^1.

The return to a short hedger per unit stock held for time $j^1 - j$ is

$$(p_j1 - p_j) - (f_j1 - f_j) - c$$

where c is the marginal storage cost.

The above relation shows that the return to a short hedger will be positive provided the seasonal increase in spot price is larger than the corresponding seasonal increase in futures price.

$$(p_j1 - p_j) \geq (f_j1 - f_j) + c \qquad (1)$$

The return on hedged stocks in these circumstances will be less than the return on unhedged stocks by the cost of hedging.

Similarly the return per unit of the manufactured commodity to a long hedger processor, who sells the commodity forward at price m_j at time j to be delivered at time j^1 and at the same time buys futures at f_j, and who later buys the raw material needed for manufacture at p_j1 and lifts the long hedge by selling the futures at f_j1 is given by

$$(m_j - f_j) - (p_j1 - f_j1)$$

The above return excludes the cost of manufacturing.

The existence of long hedging in commodity futures markets implies that to those who engage in it, the expected net return through long hedging is at least as great as the net returns through

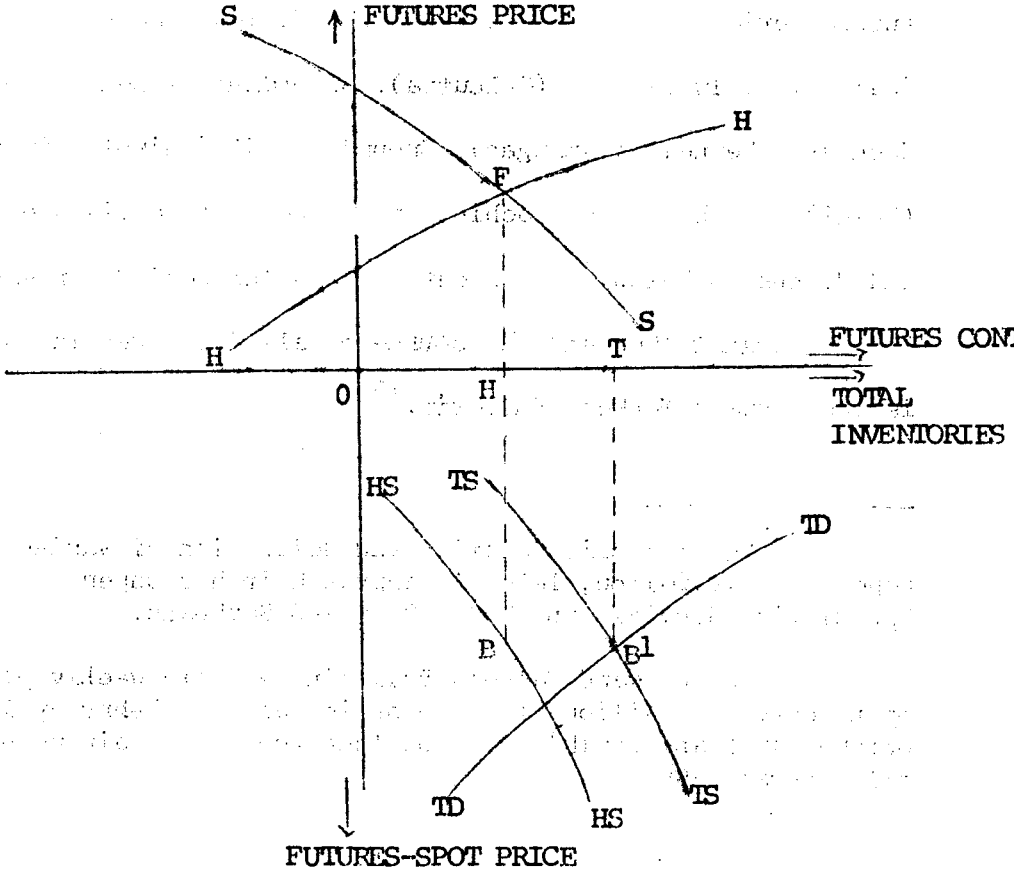
spot purchase of the raw material.

$$(m_j - f_j) - (p_j1 - f_j1) \geq m_j - p_j - c$$

or $$f_j1 - f_j \geq p_j1 - p_j - c \qquad (2)$$

Inequality (1) expresses the necessary condition for regular short hedging and similarly inequality (2) the necessary condition for long hedging.

A typical futures market where there is an excess of long over short speculation and similarly an excess of short over long hedging is shown in the diagram below. The diagram also shows the supply and demand for total inventories for different values of the basis.



When the futures price is HF and the basis is BH, the total inventories that are held equals OT and the amount hedged equals OH.

The volume of short hedging is largest during the period when stocks in the hands of traders and manufacturers are largest and futures price is higher relative to spot price, short hedging tends to decline as the spot price rises relative to the futures price. The volume of long hedging could be expected to be larger when the spot price is higher relative to the futures price. The volumes of the two types of hedging would not be very different when stocks are small.

Empirical results on the seasonal pattern of spot and futures prices for the following commodities: Hessian Cloth (Calcutta), Twill Bags (Calcutta), Groundnut Kernels (Bombay), Groundnut Kernels (Jamnagar), Groundnut Oil (Rajkot), Groundnut Oil (Delhi), Black Pepper (Cochin) and Turmeric (Sangli) are presented and discussed below.[14] The data covers the period January/February 1959 to August 1966 and the source of all data used in this paper is the Forward Markets Bulletin.[15]

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[14] The symbolic notation and definition of variables in this paper closely follow, Telser's approach in his paper "The Supply of Speculative Services in Wheat, Corn and Soybeans."

[15] The Forward Markets Bulletin reported weekly prices and open contract positions for the period January/February 1959 to October 1962 and monthly data on them for the remaining period till August 1966.

Let P_{jt} = spot price in year t and quote j

f_{ijt} = price of futures contract i at quote j in year t

i = 1, ---- I number of futures contracts

t = 1, ---- T number of years in the sample

j = 1, ---- J number of quotations in a futures contract

$$\bar{P}_t = \frac{\Sigma P_{jt}}{J}$$

$$\bar{f}_{it} = \frac{\Sigma f_{ijt}}{J}$$

Since the average spot and futures prices vary from year to year, and they rose during the period 1959 to 1966, it was considered necessary to divide the spot prices within each year by the yearly average spot price[16] and the futures prices for a given contract by the average futures price during the life of that contract[17] to make the deflated prices comparable between different years. This procedure helps in identifying the seasonal nature of the

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[16] The study of seasonality of spot prices is based on monthly observations.

[17] The study of seasonal pattern of futures prices for every commodity and contract is based on weekly data for the period 1959 to 1962 and monthly data for the remaining period till 1966.

spot and futures price movements.[18]

The spot and futures seasonal price movements in the different commodity futures markets were estimated by using the following non-linear regressions:

$$\frac{P_{jt}}{\bar{P}_t} = a_o + a_1 j + a_2 j^2 + \text{residual} \quad (1)$$

$$\frac{f_{ijt}}{\bar{f}_{it}} = a_{oi} + a_{1i} j + a_{2i} j^2 + \text{residual} \quad (2)$$

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[18] An interesting problem that has been studied by econometricians relating to variability of futures prices is whether the first differences of futures price series have constant variance, display random independence and fulfill the attributes of a random walk model. In a recent study Rutledge states that his analysis of wheat and soybean oil futures prices in the United States lends support to the 'random walk' hypothesis, while his analysis of silver and cocoa futures prices indicates that futures prices are more volatile in the period immediately before the expiry of the contract. Samuelson affirming belief in economic law and commenting on Rutledge's paper states most commodity futures price changes exhibit only vague random independence. In his view, futures prices are likely to be more volatile towards the expiry date of the contract and there is a tendency for near futures contracts to show more variability than distant futures contracts. See D.J.S. Rutledge, "A Note on the Variability of Futures Prices," and P.A. Samuelson, "Is Real World Price a Tale Told by Idiot of Chance?" Review of Economics and Statistics, Vol. LVIII, No. 1, February 1976, pp. 118-122.

The results of the inter-year seasonal regressions of spot and futures prices are presented in Tables 1 and 2.

Table 1 shows that in all the markets except the Turmerik market, the spot prices displayed an upward seasonal consistent with expectations that the rise in spot price over the season must at least equal the marginal cost of storage to make the carrying of stocks forward worthwhile.

Table 3 shows the returns to owners of unhedged inventory (excluding the marginal cost of storage) and the cost of short hedging. The gross returns on unhedged stocks per annum as percentage of average spot price were 4.7 percent in Hessian Cloth, 6.1 per cent in Twill Bags, 8.1 percent in Groundnut Kernels (Bombay), 9.6 percent in Groundnut Kernels (Jamnagar), 3.6 percent in Groundnut Oil (Rajkot), 2.3 percent in Groundnut Oil (Delhi) and 5.5 percent in Black Pepper. There would have been a loss of 2 percent per annum in holding unhedged stocks of Turmeric, over and above the marginal cost of storage.

The results of inter-year seasonal regressions of futures prices presented in Table 2 indicate that all four futures contracts in Hessian Cloth, Sacking Twill Bags and Groundnut Kernels (Bombay) show upward trends. Two out of four Groundnut Kernels (Jamnagar) futures contracts, viz., January and April-May show downward trend, there is absence of any trend in the July contract and an upward

TABLE 1 - INTER-YEAR SEASONAL REGRESSIONS OF DEFLATED SPOT PRICES, JANUARY/FEBRUARY, 1959 TO AUGUST, 1966

$$\frac{P_{jt}}{\bar{P}_t} = a_0 + a_1 j + a_2 j^2$$

Commodity	Location	a_0	$a_1 \times 10^3$	t-ratio	$a_2 \times 10^3$	t-ratio	R
Hessian Cloth	Calcutta	0.933	5.33	4.24	-0.083	-3.24	0.3
Twill Bags	Calcutta	0.905	6.80	4.55	-0.094	-3.05	0.3
Groundnut Kernels	Bombay	0.849	7.98	5.95	0.047	-1.69	0.6
Groundnut Kernels	Jamnagar	0.872	11.09	9.77	-0.179	-7.56	0.6
Groundnut Oil	Rajkot	0.915	2.95	2.10	0.022	0.76	0.5
Groundnut Oil	Delhi	0.906	0.66	0.45	0.110	3.64	0.6
Pepper	Cochin	0.915	5.97	4.32	-0.075	-2.65	0.3
Turmeric	Sangli	0.997	-3.12	-1.95	0.104	3.18	0.2

TABLE 2 - INTER-YEAR SEASONAL REGRESSIONS OF DEFLATED FUTURES PRICES, BY FUTURES, 1959-1966

$$\frac{f_{ijt}}{\bar{f}_{it}} = a_{0i} + a_{1i}j + a_{2i}j^2$$

Commodity and Futures	a_{0i}	$a_{1i} \times 10^3$	t-ratio	$a_{2i} \times 10^3$	t-ratio	Sample Size	R
Hessian Cloth (Calcutta)							
February	0.979	3.10	1.10	-0.063	0.382	75	0.335
May	0.984	-2.08	-0.563	0.370	1.75	87	0.484
August	0.967	6.80	2.70	-0.253	-1.95	87	0.382
November	0.966	0.40	0.232	0.195	2.64	100	0.695
Sacking Twill Bags (Calcutta)							
February	0.996	-3.09	-1.38	0.288	2.51	81	0.455
May	0.945	12.05	3.82	-0.482	-2.83	82	0.496
August	0.986	-0.74	-0.236	0.198	1.20	83	0.412
November	0.973	-3.24	-1.19	0.421	3.59	101	0.668
Groundnut Kernels (Bombay)							
Jan.-Feb.-Mar.	0.968	2.37	0.620	0.098	0.56	89	0.452
April-May	0.970	7.38	2.98	-0.287	-2.42	76	0.373
July-August	0.975	9.55	2.37	-0.694	-2.34	44	0.345
September	0.944	6.22	0.894	0.226	0.51	19	0.823
Groundnut Kernels (Jamnagar)							
January	1.022	-9.17	-2.44	0.501	2.98	63	0.406
Mar.-Apr.-May	0.998	8.39	1.93	-0.780	-2.89	45	0.558
July	1.008	-4.00	-1.05	0.299	1.18	48	0.180
September	0.991	1.04	0.129	0.209	0.32	32	0.305
Groundnut Oil (Rajkot)							
January	1.000	-5.05	-1.761	0.403	2.96	83	0.499
Mar.-Apr.-May	0.990	4.13	1.104	-0.223	-0.98	66	0.144
July	1.009	-3.53	-0.901	0.231	0.82	50	0.132
September	0.986	1.08	0.209	0.156	0.45	33	0.399
Groundnut Oil (Delhi)							
January	1.009	-6.64	-2.216	0.415	3.25	90	0.461
Feb.-Mar.-Apr.	1.007	-2.91	-0.707	0.372	1.03	22	0.316
May	0.983	3.71	0.630	-0.033	-0.06	20	0.510

$$\frac{f_{ijt}}{\bar{f}_{it}} = a_{0i} + a_{1i}j + a_{2i}j^2$$

Commodity and Futures	a_{0i}	$a_{1i} \times 10^3$	t-ratio	$a_{2i} \times 10^3$	t-ratio	Sample Size	
Black Pepper (Cochin)							
January	1.088	-26.41	-2.977	1.478	1.86	44	0.
February	0.945	48.26	2.213	-5.814	-2.31	39	0.
March	0.886	78.11	3.140	-8.725	-3.00	35	0.
May	1.011	-1.93	-0.327	0.015	0.03	59	0
July	1.007	-1.32	-1.000	0.022	0.71	83	0
August	0.983	18.23	2.704	-2.026	-3.68	58	0
October	1.043	-17.07	-1.855	1.380	1.73	57	0
December	1.037	-8.01	-1.391	0.357	0.99	71	0
Turmeric (Sangli)							
May	0.982	3.70	2.16	-0.139	-2.54	140	0
October	0.961	6.04	3.49	-0.145	-2.12	87	0
December	1.005	7.96	1.14	-0.850	-2.04	46	0

TABLE 3 - RETURNS ON UNHEDGED STOCKS, COST OF HEDGING AND RETURNS ON HEDGED STOCKS

Commodity, Market and Future	Return on Unhedged Stocks - Percent Per Annum of Average Spot Price $\frac{P_{t+n} - P_t}{\bar{P}}$	Cost of Heding By Future and Average Cost Per Annum $\frac{f_{i,t+n} - f_i}{\bar{f}_{i,t}}$		Average Return On Hedged Stocks $\left(\frac{P_{t+n} - P_t}{\bar{P}}\right) - \frac{\sum\left(\frac{f_{i,t+n} - f_i}{\bar{f}_{i,t}}\right)}{\Sigma i}$
Hessian Cloth (Calcutta)				
February			2.509	
May			3.003	
August	4.676		3.862	1.525
November			3.228	
		Average	3.151	
Sacking Twill Bags (Calcutta)				
February			0.719	
May			6.362	
August	6.135		2.017	3.246
November			2.456	
		Average	2.889	
Groundnut Kernels (Bombay)				
Jan.-Feb.-Mar.			4.008	
April-May			4.014	
July-August	8.106		0.580	3.437
September			10.073	
		Average	4.669	

TABLE 3 - Continued

Commodity, Market and Future	Return on Unhedged Stocks - Percent Per Annum of Average Spot Price $\frac{P_{t+n} - P_t}{\bar{P}}$	Cost of Hedging By Future and Average Cost Per Annum $\frac{f_{i,t+n} - f_i}{\bar{f}_{i,t}}$		Average Retur Hedged Stocks $\left(\frac{P_{t+n} - P_t}{\bar{P}}\right.$ $\sum\left(\frac{f_{i,t+n}}{\bar{f}_{i,t}}\right.$ Σi
Groundnut Kernels (Jamnagar)				
January			-2.923	
Mar.-Apr.-May			-1.925	
July	9.639		-0.124	9.849
September			4.133	
		Average	-0.210	
Groundnut Oil (Rajkot)				
January			0.208	
Mar.-Apr.-May			1.354	
July	3.560		-0.580	2.460
September			3.418	
		Average	1.100	
Groundnut Oil (Delhi)				
January			-1.369	
Feb.-Mar.-Apr.	2.299		2.119	0.846
May			3.609	
		Average	1.453	

TABLE 3 - Continued

Commodity, Market and Future	Return on Unhedged Stocks - Percent Per Annum of Average Spot Price $\frac{P_{t+n} - P_t}{\bar{P}}$	Cost of Hedging By Future and Average Cost Per Annum $\frac{f_{i,t+n} - f_i}{\bar{f}_{i,t}}$		Average Return On Hedged Stocks $\left(\frac{P_{t+n} - P_t}{\bar{P}}\right) - \frac{\sum\left(\frac{f_{i,t+n} - f_i}{\bar{f}_{i,t}}\right)}{\sum i}$
Black Pepper (Cochin)				
January		-8.749		
February		1.048		
March		4.985		
May		-1.085		
July	5.481	-0.686		6.729
August		1.214		
October		-3.618		
December		-3.093		
		Average	-1.248	
Turmeric (Sangli)				
May		2.006		
October	-1.944	5.362		-1.155
December		-9.735		
		Average	-0.789	

trend in the September contract. Two out of the four Groundnut Oil (Rajkot) futures contracts viz., April-May and September contracts show upward trend, there is absence of any trend in the January and July contracts of Groundnut Oil (Rajkot). Two of three Groundnut Oil (Delhi) futures contracts show upward trend, viz., the March-April and May contracts. Two of the three Turmeric (Sangli) futures contracts, viz., the May and October contracts show an upward trend, the December Turmeric futures contract displays a significant downward trend. Five out of eight Black Pepper futures contracts, viz., the January, May, July, October, December contracts display a downward trend (the downward trend in the July contract is insignificant).

Keynes and Hicks regarded the excess demand of futures contracts by speculators as less than perfectly elastic; the lower the futures price the larger the excess demand for futures contracts. The underlying assumption is that futures price is a downward biased forecast of spot price at delivery time and it is this which makes it possible for speculators to receive the risk

premium from short hedgers.[19]

Our results indicate (see Table 3) that long speculators would have received an average return of about 3 percent per annum in the Hessian Cloth and Sacking Twill Bags futures markets, 4.7 percent per annum in the Groundnut Kernels (Bombay) futures market, 1.1 percent per annum in the Groundnut Oil (Rajkot) futures market, 1.5 percent per annum in the Groundnut Oil (Delhi) futures market. The long speculators would have lost on the average 0.2 percent

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[19] In contrast to the Keynesian - individual asset - analysis in which we identify the risk of a futures contract solely with its price variability, Dusak discusses another capital assets model in which the returns on any risky capital asset, including futures, are governed by that assets contribution to the risk of a large and well diversified portfolio of assets $\left[\frac{\delta \sigma (\bar{R}_w)}{\delta x_i}\right]$

The Dusak model is represented by

$$E(\tilde{R}_i) = R_f + \left[\frac{E(\bar{R}_w) - R_f}{\sigma(\bar{R}_w)}\right] \frac{\delta \sigma (\bar{R}_w)}{\delta x_i}$$

which after simplication yields $E(\tilde{R}_i) = R_f + \left[E(\bar{R}_w) - R_f\right] \beta_i$ where $E(\tilde{R}_i)$ and $E(\bar{R}_w)$ are expected rates of return on asset i and total wealth respectively, R_f is the riskless rate of interest and β_i (relative risk of asset i) $= \frac{\text{cov.}(\tilde{R}_i, \bar{R}_w)}{\sigma^2(\bar{R}_w)}$. By regressing $\tilde{R}_i$ (rate of return for holding unhedged stocks in wheat, corn and soybean markets in U.S.) on $\bar{R}_w$ (rate of return to total wealth) she obtains values of β_i, which are close to zero. From this result she deduces that no risk premium was earned by speculators in these futures markets. See K. Dusak, "Futures Trading and Investor Returns: An Investigation of Commodity Market Risk Premiums," Journal of Political Economy, Vol. 81, No. 6, 1973, pp. 1387-1406.

per annum in the Groundnut Kernels (Jamnagar) futures market, 1.3 percent per annum in the Black Pepper futures market and 0.8 percent per annum in the Turmeric futures market. This reckoning of average profit or loss, of course, ignores variation in short hedging commitment and therefore variation in purchase of futures contracts by long speculators from future to future. With this qualification, the evidence, however, does indicate that the average return to long speculators was less than 5 percent in all markets and that in three markets, viz., Groundnut Kernels (Jamnagar), Black Pepper (Cochin) and Turmeric (Sangli), the long speculators did not receive any positive return and that they infact incurred small losses in the Black Pepper and Turmeric futures markets.

The normal backwardation returns to long speculators in markets with an upward trend in futures prices is from the "naive" strategy of being constantly long. Long speculators could receive a larger return if they in addition had special forecasting skill to forecast shorter price trends.[20] The major source of income to speculators, according to Holbrook Working, is not as sellers of insurance to hedgers but as scalper speculators, who derive their income by

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[20] Charles Rockwell. "Normal Backwardation, Forecasting and the Returns to Commodity Futures Traders," Food Research Institute Studies, Supplement to Vol. VII, 1967, pp. 107-130.

recognizing the price dips and bulges occasioned by hedging orders.[21]

The comparison of spot and futures seasonal price movements (Tables 1 and 2) and the computation therefrom of annual percentage gross return on unhedged stocks, cost of hedging and percentage gross return on hedged stocks (Table 3) shows that the gross returns per annum on unhedged stocks are greater than on hedged stocks in the Hessian Cloth, Sacking Twill Bags, Groundnut Kernels (Bombay), Groundnut Oil (Rajkot) and Groundnut Oil (Delhi) futures markets. The returns on hedged stocks are greater than on unhedged stocks in the Groundnut Kernels (Jamnagar) and Black Pepper futures markets. Table 3 also indicates that trading losses would have been reduced through hedging in the Turmeric futures market from approximately 2 percent to 1 percent per annum. The Turmeric traders are likely to have hedged more in the December futures contract and less in the May and October contracts and would have sought to cover their loss in the spot market by gains in the December futures contract.

The results indicate that gross annual returns on unhedged stocks are less than 10 percent in all markets, indeed less than 5 percent except in Groundnut Kernels (Bombay), Groundnut Kernels

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[21] Holbrook Working. "Tests of a Theory Concerning Floor Trading on Commodity Exchanges," Food Research Institute Studies Supplement to Vol. VII, 1967, pp. 5-48.

(Jamnagar) and Black Pepper. The return on hedged stocks was less than 5 percent in all futures markets except Groundnut Kernels (Jamnagar) and Black Pepper.

We follow this analysis of spot and futures seasonal price movements with an empirical test in the next section on Houthakker's and Telser's hedging asymmetry theory.

4. THE RELATION OF SHORT AND LONG HEDGING TO RELATIVE BASIS

We have argued that positive stock holders face price risk in the owning of stocks and seek to reduce the risk by hedging their stocks in the futures market since the basis risk in holding hedged stocks is less than the price risk in holding unhedged stocks. The amount of hedging by positive inventory owners will depend on the extent to which they can curtail their risk through hedging. The amount of short hedging will be more, the more favourable the basis or the future-spot price spread.[22]

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[22] Under large holdings of inventory situation, the amount of short hedging will be large when the basis (contango) is large and will be small when the basis (contango) is small. Under a 'normal' inventory situation, the amount of short hedging will be large when the backwardation is small, and will be small when the backwardation is large.

Since long hedgers have the option of buying futures contracts or acquiring stocks of the commodity at the time they have made the forward sales, their decision to buy futures or buy spot will depend on the futures - spot price relationship. The lower the futures price relative to the spot price, the larger will be the amount of long hedging because larger will be the expected return from long hedging. This will be the case provided the higher risk per unit through increased long hedging does not offset the benefit of larger expected return. This implies that for risk averse long hedgers, the extent of their long hedging should be inversely related to the basis. Unlike short hedging, long hedging would be less at the time stocks are large with traders and would rise toward the end of the crop year.

What we have said in the preceding paragraphs is in line with Houthakker's determinants of short and long hedging, according to which the basis effect is favourable to short hedging and unfavourable to long hedging. Yamey makes the perceptive observation that Houthakker's argument of hedging asymmetry, limited risk of short hedgers and unlimited risk of long hedgers, as it stands, is too comprehensive and needs to be qualified in special cases. Long hedgers are exposed to unlimited risk in those futures markets where futures do not mature every month. Long hedgers who buy, for example, Groundnut Kernels futures in October with no contract maturing that month face such risk. A plausible implication that follows Yamey's observation is that the unlimited risk fear of long hedgers should

decline with increase in the number of futures contracts traded in that commodity. Thus for example, long hedgers in the Black Pepper futures market should have comparatively less 'increasing risk' than long hedgers in the Turmeric futures market since many more futures contracts are traded in Black Pepper. The results show that long hedging is inversely related to the basis in the Black Pepper futures market in the same way as it is in all other futures markets. The increasing risk of long hedging thus does not disappear with increase in the number of futures contracts though its absolute magnitude may decline. The real reason for the hedging asymmetry as observed by Yamey is not merely the existence of the risk asymmetry between short and long hedging but also the important benefit of 'convenience yield' derived by short hedgers by owning stocks.

Telser's theoretical argument relating to the determinants of short and long hedging run parallel to Houthakker's theory except that his theoretical discussion on the relation between relative basis and long hedging is more comprehensive and complicated. According to Telser the belief of greater risk in long hedging will make long hedgers reduce their long hedging commitments and to increase their purchase of stocks to fulfill the forward sale contract. This action of theirs, he states, will make the spot price to rise and the futures price to fall so that the decline in long hedging commitments will be related positively to decline in basis (futures-spot price ratio). This increasing risk fear, Telser goes on to argue, could lead them to reduce their forward sales

transaction sufficiently and consequently their long hedging commitments and/or purchase of stocks. Under these conditions he says the spot and futures prices may remain unaffected and the relation between basis and long hedging could become weak and insignificant. Telser's position is not clear on why he believes long hedgers both influence the relative basis and adjust their long hedging commitments while short hedgers merely adjust the level of short hedging commitments to the level of relative basis.[23]

We now examine the evidence on the relation between relative basis (futures-spot price ratio) and the amount of short and long commitments of small and large traders in several Indian futures markets. See Tables 4 and 5. We have already mentioned that the open position data on long and short commitments of small and large traders reported in the Forward Markets Bulletin do not classify the positions as hedging and speculative. In the circumstances, it was not possible to relate the relative basis to actual short and long hedging commitments of the small and large traders. On the belief that short speculation in all these markets would have been very

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[23]See Telser, "The Supply of Speculative Services in Wheat, Corn and Soybeans," page 165.

small,[24] we consider that the short position would prove to be a good proxy for the short hedging commitments of both classes of traders.[25] Unfortunately, we can make no such assumption relating to long hedging commitments. However, we believe that a systematic showing of negative coefficients should indicate the presence and response of long hedgers to movements in the relative basis. The absence of negative coefficients ought to indicate either there are an overwhelming proportion of long speculators, or to say the same thing differently, the volume of long hedging is low and not very sensitive to variations in the basis.

Table 4 contains results of the regression of basis on long and short commitments of small traders. The R values are low. Let us first consider the relation between short commitments and

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[24] The loss to short speculators is equivalent to the cost of hedging to short hedgers. Table 3 shows (see second column) that short speculators would have lost money in five of the eight futures markets; they would have practically received no return in the Groundnut Kernels (Jamnagar) market and received no more than 1 percent per annum in the Black Pepper and Turmeric markets. It is unlikely in the face of consistent losses in five markets and practically no gain in the remaining three markets that short speculation could have been anything other than small.

[25] The necessary equality between total long and total short contracts in futures market is given by:

$$S_L + H_L = S_s + H_s$$

where subscripts S, L refer to the short and long position in the market and S, H refer to speculative and hedging commitments.

Now when $S_s \rightarrow 0$, $S_L + H_L \rightarrow H_s$

and when $H_s > H_L$, $S_L \rightarrow H_s - H_L$

the basis. All 4 Hessian Cloth short commitment coefficients are positive, 3 out of 4 Sacking Bags short coefficients are positive, 2 out of 4 Groundnut Kernels (Bombay) short coefficients are positive, 3 out of 4 Groundnut Kernels (Jamnagar) short coefficients are positive, 1 out of 4 Groundnut Oil (Rajkot) short coefficient is positive, 1 out of 3 Groundnut Oil (Delhi) short coefficient is positive, 4 out of 8 Black Pepper short coefficients are positive and 2 out of 3 Turmeric short coefficients are positive. The pattern of results just described with 20 out of 34 short coefficients positive, and with most of the negative coefficients not significant, suggests that the short commitment of small traders was largely short hedging commitment and the relation between it and the basis is as predicted in the Houthakker - Telser theory.

There are 21 long commitment coefficients out of a total of 34 that are negative. This indicates that the larger proportion of the long position of small traders consisted of long hedging.[26]

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[26] In contrast 24 out of 34 long commitment coefficients of large traders are positive. See Table 5. On the long side, it appears that small traders were predominantly long hedgers and large traders were predominantly long speculators. The notable exception appears to be the Groundnut Oil (Delhi) market, where there was probably little long hedging.

TABLE 4 - INTER-YEAR SEASONAL REGRESSIONS OF FUTURES-SPOT PRICE RATIO ON SHORT AND LONG COMMITMENTS OF SMALL TRADERS BY FUTURES, 1959-1966

$$\frac{f_{ijt}}{P_{jt}} = C_{0i} + C_{1i} \log X_{sjt} + C_{2i} \log Y_{sjt}$$

Commodity and Futures	C_{0i}	Long Commitment $C_{1i} \times 10^3$	t-ratio	Short Commitment $C_{2i} \times 10^3$	t-ratio	Sample Size	R
Hessian Cloth (Calcutta)							
February	0.977	-74.79	-2.219	74.32	2.336	75	0.269
May	0.925	-36.86	-1.288	47.06	1.580	87	0.223
August	0.991	- 6.51	-0.286	4.63	0.207	87	0.059
November	0.932	-32.64	-1.745	39.64	2.104	100	0.248
Sacking Twill Bags (Calcutta)							
February	0.938	1.20	0.080	8.36	0.581	81	0.297
May	0.947	-2.91	-0.157	12.68	0.699	82	0.363
August	0.957	-6.68	-0.695	15.25	1.572	83	0.513
November	0.951	29.64	2.676	-27.02	-2.480	101	0.274
Groundnut Kernels (Bombay)							
Jan.-Feb.-Mar.	0.941	-40.02	-2.076	38.97	2.037	89	0.231
April-May	0.971	4.62	0.161	-1.63	-0.050	76	0.286
July-August	1.100	2.01	0.093	-16.78	-0.756	44	0.323
September	0.964	-71.66	-3.249	71.92	2.701	19	0.633
Groundnut Kernels (Jamnagar)							
January	0.941	30.31	1.337	-32.77	-1.443	63	0.361
Mar.-Apr.-May	0.951	30.98	1.036	9.07	0.309	45	0.479
July	0.992	-2.86	-1.738	12.11	2.451	48	0.342
September	0.986	-2.11	-0.188	1.23	0.109	32	0.060

TABLE 4 - Continued

$$\frac{f_{ijt}}{P_{jt}} = C_{0i} + C_{1i} \log X_{sjt} + C_{2i} \log Y_{sjt}$$

Commodity and Futures	Long Commitment C_{0i}	Long Commitment $C_{1i} \times 10^3$	Long Commitment t-ratio	Short Commitment $C_{2i} \times 10^3$	Short Commitment t-ratio	Sample Size	R
Groundnut Oil (Rajkot)							
January	0.973	-2.74	-2.068	-6.44	-0.478	83	0.180
Mar.-Apr.-May	1.016	-23.25	-1.607	16.16	1.286	66	0.197
July	1.033	55.81	0.515	-12.82	-1.086	50	0.259
September	1.012	16.45	1.981	-17.32	-2.101	33	0.355
Groundnut Oil (Delhi)							
January	0.908	-7.92	-0.786	11.15	1.088	90	0.176
Feb.-Mar.-Apr.	0.879	70.38	3.066	-39.87	-1.811	22	0.595
May	1.000	38.48	2.901	-37.05	-2.898	20	0.578
Black Pepper (Cochin)							
January	1.008	-25.02	-1.455	25.41	1.478	44	0.226
February	1.035	-1.54	-0.196	1.05	0.133	39	0.109
March	1.038	5.01	1.250	-5.37	-1.354	35	0.236
May	1.061	-2.41	-0.404	-1.34	-0.221	59	0.101
July	1.098	-6.45	-1.676	-3.34	-0.819	83	0.377
August	1.075	-9.04	-2.528	1.76	0.454	58	0.383
October	1.064	0.67	0.107	-7.60	-1.153	57	0.292
December	0.984	-5.92	-1.077	6.57	1.187	71	0.146
Turmeric (Sangli)							
May	0.984	-1.23	-0.379	3.56	1.106	140	0.309
October	1.025	15.38	1.208	-15.20	-1.199	87	0.131
December	1.010	-15.40	-1.453	15.97	1.530	46	0.244

The relation between basis and long hedging is as predicted by Houthakker, viz., that long hedging would be less when the basis is large and would be more when the basis is small. All 4 Hessian Cloth long commitment coefficients are negative, 2 out of 4 Sacking Bags long coefficients are negative, 2 out of 4 Groundnut Kernels (Bombay) long coefficients are negative, 2 out of 4 Groundnut Kernels (Jamnagar) coefficients are negative, 2 out of 4 Groundnut Oil (Rajkot) long coefficients are negative, only 1 out of 3 Groundnut Oil (Delhi) long commitment coefficient is negative, 6 out of 8 Black Pepper long commitment coefficients are negative and 2 out of 3 Turmeric long commitment coefficients are negative.

The pattern of relation between basis, long and short commitments of large traders in these markets was different from those of small traders. See Table 5. The R values are again low. Only 15 out of 34 short coefficients are positive. Out of the remaining 19 short coefficients that are negative only 4 are significant. The aggregate short commitment of large traders averaged over the four contracts was only one-half the total short commitments of small traders in the Hessian cloth and Groundnut Kernels (Bombay) futures markets. The large traders short commitments on the average was less than one-fourth of small traders in the Sacking Bags Twill and Groundnut Oil (Delhi) markets. The aggregate short commitments of large and small traders were approximately of the same size in the Groundnut Kernels

TABLE 5 - INTER-YEAR SEASONAL REGRESSIONS OF FUTURES-SPOT PRICE RATIO ON SHORT AND LONG COMMITMENTS OF LARGE TRADERS BY FUTURES, 1959-1966

$$\frac{f_{ijt}}{P_{jt}} = b_{0i} + b_{1i} \log X_{1jt} + b_{2i} \log Y_{1jt}$$

Commodity and Future	Long Commitment b_{0i}	Long Commitment $b_{1i} \times 10^3$	Long Commitment t-ratio	Short Commitment $b_{2i} \times 10^3$	Short Commitment t-ratio	Sample Size	R
Hessian Cloth (Calcutta)							
February	0.961	1.60	2.044	-3.046	-3.94	75	0.469
May	0.975	0.02	0.032	-0.613	-0.79	87	0.157
August	0.976	-0.92	-1.194	0.386	0.50	87	0.174
November	0.954	-0.70	-1.823	-0.572	-1.51	100	0.377
Sacking Twill Bags (Calcutta)							
February	0.968	0.25	0.416	-0.869	-1.44	81	0.232
May	0.979	9.54	0.911	-0.927	-1.59	82	0.202
August	0.985	0.06	0.166	-0.393	-1.08	83	0.194
November	0.950	-1.35	-2.315	0.221	0.38	101	0.275
Groundnut Kernels (Bombay)							
Jan.-Feb.-Mar.	0.946	0.31	0.290	-0.289	-0.27	89	0.032
April-May	0.999	0.70	1.428	1.215	2.41	76	0.479
July-August	0.970	0.76	1.058	-0.516	-0.76	44	0.171
September	0.974	2.28	2.088	-1.683	-3.05	19	0.603
Groundnut Kernels (Jamnagar)							
January	0.933	0.64	0.594	-2.544	-2.29	63	0.412
Mar.-Apr.-May	1.012	1.32	1.030	2.739	2.12	45	0.612
July	1.000	0.04	0.034	0.339	0.31	48	0.124
September	0.996	-0.49	-1.034	1.166	2.41	32	0.531

TABLE 5 - Continued

$$\frac{f_{ijt}}{P_{jt}} = b_{0i} + b_{1i} \log X_{1jt} + b_{2i} \log Y_{1jt}$$

Commodity and Future	b_{0i}	Long Commitment $b_{1i} \times 10^3$	t-ratio	Short Commitment $b_{2i} \times 10^3$	t-ratio	Sample Size
Groundnut Oil (Rajkot)						
January	0.929	0.24	0.074	1.235	0.53	83
Mar.-Apr.-May	0.997	3.70	4.388	0.193	0.22	66
July	1.003	0.63	0.700	0.467	0.54	50
September	1.010	-1.97	-2.726	1.969	2.86	33
Groundnut Oil (Delhi)						
January	0.919	2.59	3.273	-0.720	-0.97	90
Feb.-Mar.-Apr.	1.006	3.26	1.947	1.064	0.65	22
May	1.032	-0.50	0.539	2.048	2.41	20
Black Pepper (Cochin)						
January	1.003	-0.27	-0.216	-0.282	-0.23	44
February	1.027	-0.20	-0.388	-0.427	-0.85	39
March	1.033	-0.71	-1.142	0.051	0.08	35
May	1.042	0.08	0.142	-0.389	-0.66	59
July	1.051	0.23	0.585	-0.826	-2.20	83
August	1.041	-0.45	-1.163	-0.037	-0.10	58
October	1.033	0.71	1.681	-0.635	-1.43	57
December	0.980	0.05	0.086	-0.935	-1.77	71
Turmeric (Sangli)						
May	0.977	0.99	0.557	3.684	2.53	140
October	1.032	-2.49	-1.596	6.074	3.79	87
December	1.013	1.05	0.793	-0.113	-0.09	46

(Jamnagar) and Groundnut Oil (Rajkot) markets. The aggregate large traders' short commitments were approximately four times the small traders short commitments in the Black Pepper and Turmeric markets.

Presumably the larger proportion of short commitments of large traders was also hedging. However, they do not appear to have been as responsive as small traders - short hedgers to movements in the basis. The large traders probably hedged a smaller proportion of their inventories compared to small traders.

We find that 24 out of 34 long commitments of large traders are positive. Most of the long commitment coefficients, whether positive or negative, are not significant. These results suggest that very possibly a large proportion of the large traders on the long side were speculators, who bought futures when futures prices were relatively low and who anticipating rise in futures prices maintained their long position till the maturity of the contract. These long speculators were not expected to be responsive to basis movements like long hedgers.

5. SUMMARY AND CONCLUSIONS

In this paper we briefly refer to the Keynes-Hicks theory of normal backwardation and review the theoretical explanations offered by Houthakker and Telser on the hedging asymmetry. There is much in common between the Houthakker and Telser explanations on hedging

Our empirical results relating to five futures markets, viz., Hessian Cloth, Sacking Bags, Groundnut Kernels (Bombay), Groundnut Oil (Rajkot) and Groundnut Oil (Delhi) support the theory of "normal backwardation". The results for Black Pepper, Turmeric and Groundnut Kernels (Jamnagar) indicate absence of "normal backwardation". The "normal backwardation" in the five markets above mentioned was much less than the 10 percent indicated by Keynes and also less than 6 percent mentioned by Houthakker. They ranged from 1 to 5 percent.

Our data had limitations, as we did not have the classification of hedging and speculative positions for the futures markets we studied. On the strength of the belief that the short positions of traders represented very largely short hedging positions, we investigated the relation between basis, short and long commitments of small and large traders in eight futures markets. The results obtained by us relating to small traders show that the basis was positively related to short commitments (short hedging) and negatively related to long commitments (presumably largely long hedging). This is strictly in accordance with the asymmetric nature of short and long hedging in relation to basis as described by Houthakker. The pattern of relation between short commitment (presumably also short hedging) and basis for large traders was also the same as for small traders, viz., positive relation. The relation between long commitment of large traders and basis is weak and not clearcut. It

It is possible that this was because most of the long commitment position of large traders was long speculative commitment, which was not expected to be responsive to basis movements.

When a theory is emperically verifiable, its soundness rests on empirical support. The empirical verification of the normal backwardation theory has not lead to universal acceptance of that theory. Much of the reservation has come from some leading American economists. A notable exception to this reservation is Houthakker's support based on empirical verification. Could it be that large stocks - contango situation, with possibility of short-hedger arbitrage and small trend in futures prices are characteristics of only U.S. Grain Futures Markets? Another related reason for the special characteristic of U.S. futures markets in these commodities could be that these commodities had effective price supports. The empirical evidence, which we present for commodity markets with normal stocks, while it does not give unqualified support to the theory of normal backwardation suggests that in most markets speculators did receive a positive return in the range of 1 to 5 percent.

Houthakker explains that the mainspring of futures trading is the need to finance inventories in the face of fluctuating prices. The volume of inventories and the variance of prices

therefore determine the size of futures trading.[27] Futures trading, Houthakker mentions could be less for a processed or manufactured commodity if the level of inventories and variation in prices there are less than for an agricultural commodity.[28] Our data indicates that the volume of trading and variation in prices were not always less for a processed commodity. The variance in prices of Groundnut Kernels was certainly more than in Groundnut Oil but the variance in prices of Hessian Cloth and Sacking Bags were as great as the variance in price of Black Pepper and much more than the variance in price of Turmeric. The volume of trading in Hessian Cloth, Sacking Twill Bags and Groundnut Kernels was much larger than in Groundnut Oil and the trading in Groundnut Oil was much greater than in Black Pepper and Turmeric. The comparatively smaller volume of futures trading in Black Pepper and Turmeric probably explains why there was no 'normal backwardation' in Black Pepper and Turmeric.

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[27] H.S. Houthakker, "Scope and Limits of Futures Trading," in The Allocation of Economic Resources. Essays in Honour of B.F. Haley by Moses Abramovitz et al. Stanford University Press, 1959 page 158.

[28] Ibid.