3. Speculative Trading Strategies

> ...human decisions affecting the future, whether personal or political or economic, cannot depend on strict mathematical expectation, since the basis for making such expectations does not exist.
>
> *John Maynard Keynes*, (The General Theory, chap. 12)

> Throughout its long history, futures trading has been primarily associated with commodities having major seasonal patterns of production and inventory accumulation and liquidation. Prices of seasonally produced commodities are speculative.
>
> *Thomas Hieronymous (1971)*

3.1 Speculative Efficiency?

The Study of Speculation

The study of speculation is ancient. For example, Aristotle in the Politics (Book I, Chapter 11) examines speculation while discussing "the various forms of acquisition". Aristotle maintained that to consider "the various forms of acquisition ... minutely and in detail might be useful for practical purposes; but to dwell upon them long would be in poor taste". At least two cases of speculation are examined. One case involved Thales, the philosopher, and the options he took on olive presses prior to a bumper crop. Another case involved a Sicilian who bought all the available supplies of iron. In both cases, Aristotle attributed the speculative profits to "the creation of a monopoly".

Aristotle's musings reveal two important historical themes in the study of speculation. One theme is the negative connotations attached to speculation, which has often suffered from the direct association with gambling, e.g., Emery (1896). Yet, there are real differences between certain types of speculation, that can require both skill and expertise to be successful, and outright gambling, where outcomes depend purely on randomizers such as dice or playing cards. Yet, these differences are not always appreciated. At various times, speculative gains have been seen as ill gotten, achieved at the expense of some other group. Even Aristotle found more than a passing examination of speculation to be "in poor taste".

Another important theme is the role of market manipulation in obtaining speculative profits. Aristotle determined that the profits of both Thales and the Sicilian iron merchant originated from monopoly power. Writing about trading on the Amsterdam bourse, market manipulation is a central concern for de la Vega in *Confusion de Confusiones* (1688). In the Fourth Dialogue, de la Vega lists twelve different "tricks" that compose "the most speculative part of the business ... the climax of Exchange transactions, the acme of Exchange operations, the craftiest and most complicated machinations that exist in the maze of the Exchange and which require the greatest possible cunning." Mortimer (1761) was also concerned about the market manipulation involving speculating stock jobbers. The stories of speculation in the 19^{th} and early 20^{th} century America has been told previously (see Sec. 1.1).

Modern opinion has been relatively kind to speculators. Vilifications are usually reserved for events such as large, anonymous speculators making an ‘attack’ on a target currency. Various sophisticated types of speculation have become the grist of academic studies. For example, a cash-and-carry arbitrages, even those as readily executed as covered interest arbitrage, are actually speculations, due to deviations from the perfect market assumptions that make these speculations riskless. Sophisticated speculation is inherent in the strategies underlying many hedge funds. Academic studies of speculative trading strategies abound that demonstrate that there are numerous situations where market mis-pricing creates profitable trading opportunities, e.g., Poitras (1997). In particular, many spread trading strategies are designed to mimic the payoffs on hedge positions.

Profitability arises from correct modeling of the basis behavior.

Theories of Pure Speculative Efficiency

The speculative efficiency hypothesis is an extension of the more general notion that expected asset prices accurately reflect currently available information. As a consequence, it is not possible to systematically earn returns that are ‘abnormal’. For a conventional equity investment, abnormal is defined to be more than adequate compensation as measured by the riskless rate plus an adjustment to compensate for the systematic risk of the asset. Because taking a purely speculative position in a derivative security such as a forward contract involves no investment of funds, adequate expected compensation is zero. From the discussion in Sec. 2.1, it can be readily shown that speculative efficiency implies that forward prices will be unbiased predictors of future spot prices. Yet, equilibrium considerations indicate that this requires speculators to be close to risk neutral, in order for speculators to undertake market clearing positions. By construction, speculative efficiency is concerned with random variables defined at different points in time. The resulting speculative trading strategies are risky. Unfortunately, the introduction of risk into the concept of efficiency significantly complicates the problem of determining whether a given market is “efficient”. Unlike the arbitrage profit function which is fully determined on the basis of contemporaneous information, the speculative profit function contains variables that are uncertain when the trading decision is initiated.

As a result of introducing risk, the concept of an efficient market equilibrium is more difficult to define. For example, the proper handling of risk requires some methodology for determining risk-adjusted profits. In addition, both the statistical properties of the random variables and the properties of the trader's objective function with respect to the relevant distributional parameters require specification. It follows that any test of “speculative efficiency” necessarily involves a joint hypothesis because a model of market equilibrium is required to formulate testable hypotheses about market efficiency. More significantly, when applied to a forward market it is difficult to test the hypothesis empirically without using variables observed at different points in time, most importantly $F(0,T) - S(T)$, the forecast error. Statistically, this can raise the problem of moving average error terms if the forecast horizon has a greater length than the sampling frequency. Statistical fundamentals are an important component of one version of the speculative efficiency hypothesis: the unbiased prediction hypothesis.

In addition to being the focus of a large number of studies of forward foreign exchange market efficiency (e.g., Bilson 1981, Boothe and Longworth 1986, Gregory and McCurdy 1984), the unbiased prediction hypothesis has also been applied to test efficiency in a wide range of markets, such as the *wi* market in the US (Ferri, et al. 1985) and the US Tbill futures market (Howard 1982, Hedge and McDonald 1986, Kamara and Lawrence 1986 and MacDonald and Hein 1989). It is possible to theoretically derive the hypothesis using a number of not mutually exclusive theoretical justifications: imposing zero expected value on a specific class of speculative profit functions; in a mean-variance expected utility framework, by assuming that either that speculators are risk neutral or the second moments are unbounded; or, working directly with the properties of the conditional expectation, by assuming that there is no systematic risk in futures price forecasts.

While there are a number of theoretical motivations for speculative efficiency, when the testable requirement for "speculative efficiency" is based on unbiased predictions, it is possible to take advantage of a range of econometric techniques. For example, applied to the *wi* market, speculative efficiency requires:[1]

$$E[TB(N)] = WI(N\text{-}i)$$

where: $E[\cdot]$ is the conditional expectations operator; TB(N) is the issue price of the tbill at the following auction; $WI(N\text{-}i)$ is the price of the to-be-issued tbill observed in the *wi* market i days before the auction settlement date; N is the auction settlement date. Under relatively weak conditions on the allowable functional form for the treasury bill price process, the orthogonal decomposition can be formed:

$$TB(N) = E[TB(N)] + U(i,N)$$

where: *U(i,N)* is the forecast error of the conditional expectation formed at time *N-i*. Combining these two conditions provides for the specification of the *wi* forecast residual *(TB(N) - WI(N-i)*) that is equal to *U(i,N)* under the null hypothesis. Hence, the speculative efficiency hypothesis is intimately connected with the statistical properties of the *U(i,N).*

Although the unbiased prediction hypothesis can be tested statistically in a number ways, implementation of the available methods is complicated by the unobservable expectation. One popular approach is to require *U(i,N)* to be mean zero and serially uncorrelated. The empirical implications are illustrated in Poitras (1991) which plots a representative time series of the forecast errors *U(i,N)* using 2-day wi contracts. The decidedly non-normal behavior of the forecast errors depicted in the data plot is confirmed for all contract maturities. Considerable research effort has been devoted to explaining the behavior of the forecast error in various financial markets. Recognizing the need to incorporate distributional properties, recent research has concentrated on time varying finite volatility models (e.g., McCurdy and Morgan 1988). In practice, this involves making unrealistic stationarity assumptions about the higher moments.

Convenience Yield and the Supply of Storage

The notion of convenience yield, and the closely related concept of the ***supply of storage***, were subjects of central interest in the early research on futures and forward markets.[2] Analytically, these notions have direct implications for explaining the behavior of the key variable is the speculator's profit function: *F(0,T) - E[S(T)]*, where *E[·]* is the conditional mathematical expectation of *S(T)* given the information available at time *t=0*. (For notational simplicity the conditioning information is dropped because, in virtually ever case encountered in the analysis of derivative securities, expectations are conditional.) Because convenience yield and the supply of storage are concerned with properties of the physical commodity, some approaches ignore the role of the futures market and examine *S(0) - E[S(T)]*. Brennan's (1958) two period, two agent equilibrium model of the supply of storage is a case in point. Supply and demand functions are derived for a consumer-merchant market. Brennan describes the market this way:

> During any period there will be firms carrying stocks of a commodity from that period into the next. Producers, wholesalers, etc. carry finished inventories from the periods of seasonally high production to the periods of low production. Processors carry stocks of raw materials. Speculators possess title to stocks held in warehouses. These firms may be considered as supplying inventory stocks or, briefly, supplying storage....On the other hand, there will be groups who want to have stocks carried for them from one period...to another period....These consumers may be regarded as demanding storage.

In this case, the supply and demand functions for storage are behavioral, dependent on both the spread between the expected future spot price and the current spot price as well as on the levels of stocks being held. The upshot is an identified supply of storage function that provides a (potentially nonlinear) montonically increasing relationship between physical inventory levels and *E[S(T)] - S(0).*

The development of the partial equilibrium supply of storage model to include futures markets was provided initially by Weymar (1968) and extended by Turnovsky (1983). In Weymar's model, Three agents are identified: merchants, manufacturers and speculators. Futures markets provide cash market participants with an additional method of carrying inventories. Equilibrium in the futures market is directly specified and a supply of storage function is derived. Much as in Brennan's case, there is a monotonically increasing relationship between physical inventory levels and *E[S(T)] - F(0,T).* Using a more sophisticated, but similar model, Turnovsky is able to show:

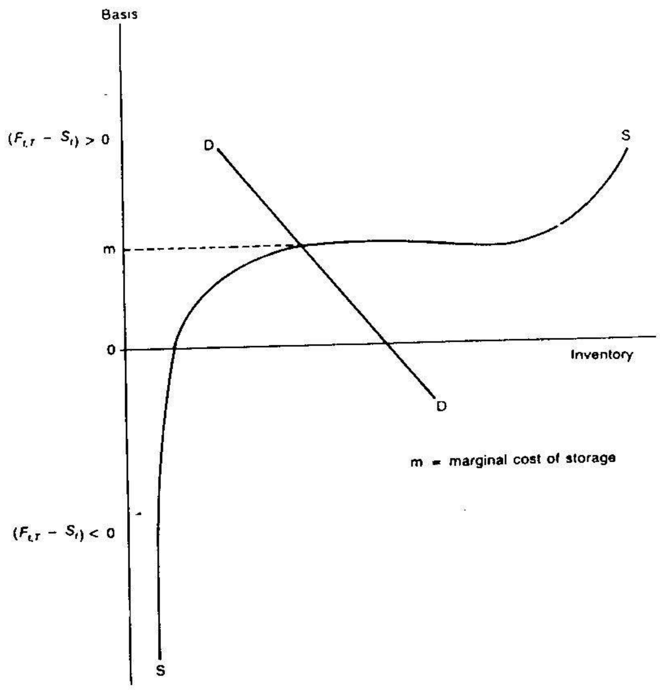
> ...with risk averse behaviour, the current futures price is a weighted average (with weights summing to less than unity) of the current spot price and the expected future spot price. Only if... producers and speculators are risk neutral...does F(0,T)= E[S(T)] and the futures price become an unbiased predictor of the future spot price. Otherwise, the futures price is a biased predictor, with the direction of the bias depending on the magnitude of the (relevant) cost parameters.

A final implication of Turnovsky's model is that 'under normal conditions', hedgers should be net short and speculators net long.

A graphical presentation of the supply of storage function is presented in Figure 5.1. This Figure illustrates the theoretical behavior of the convenience yield as the supply of inventory varies and the physical storage capacity is held fixed. Heuristically, Figure 5.1 indicates that when inventory levels are 'normal', fully hedged holding of stocks will earn storage operators a return to compensate for the costs of maintaining storage capacity. This return will be reflected in a forward price that is higher than the current stock by the relevant cost of providing storage and, possibly, a small convenience yield to holding stocks. The differential between forward and spot prices is relatively constant across a wide range of inventory levels. However, when inventory levels approach the physical limit set by storage capacity, the costs of providing storage increase and, as a consequence, the convenience yield goes to zero or becomes negative. Conversely, at very low inventory levels stocks are in short supply relative to demand and inventories have a high convenience yield.

The upshot of this discussion is that two, potentially conflicting, interpretation of futures price determination have been presented. In discussing the cash basis, it is demonstrated in Sec. 4.1. how cash-and-carry arbitrages bind the futures prices to the current spot price. However, in discussing the supply of storage explanation for the ***future*** basis, $\{F(0,T) - E[S(T)]\}$, it was argued that forecasting accuracy of the futures price is the primary motivation for determining price. The confusion associated with these competing explanations has persisted into the contemporary literature where the behavior of the future basis has attracted considerable attention, albeit in the form of "the speculative efficiency hypothesis". In contrast to the requirement of arbitrage efficiency, speculative efficiency for a given market imposes a zero expected value condition on the speculative profit function. To see this, use the speculative profit function stated in Sec. 2.1 and take expected values to get: $E[\pi] = 0 = E[F(1,T)] - F(0,T) \rightarrow E[F(1,T)] = F(0,T)$.

Figure 3.1 **Supply of Storage**



Source: Leuthold et al. (1989)

Figure 3.2 **CFTC Traders' Committments Data**

TRADERS' COMMITMENTS

This report, from the Commodity Futures Trading Commission, is updated biweekly and released on Friday afternoon. The CFTC requires any person or firm trading a certain number of contracts to report that trading. The number of contracts that triggers the reporting requirement varies by commodity. A commercial hedger is a large trader who also deals in the commodity on a cash basis. A large speculator is a non-commercial trader who has no dealings in the underlying commodity. The number of contracts traded by small traders is derived by subtracting the positions of larger traders and commercial hedgers from the total of all positions.

Number of Contracts and Change from Previous Week[1]

Contract/Category	Long	Chg.	Short	Chg.
Copper				
Large Speculator ...	17,046	-258	2,920	-36
Commercial Hedger	14,725	1,179	31,588	-10
Small Trader	16,677	-948	13,940	19
Corn				
Large Speculator ...	85,785	2,590	126,120	4,285
Commercial Hedger	551,330	-665	373,290	-5,415
Small Trader	389,685	-3,345	527,390	-290
Crude Oil				
Large Speculator ...	42,597	8,516	7,793	694
Commercial Hedger	248,573	-9,886	299,563	-1,117
Small Trader	95,542	8,196	79,356	7,249
Eurodollars				
Large Speculator ...	53,711	9,550	118,583	-20,691
Commercial Hedger	1960595	3,169	1563970	23,451
Small Trader	555,559	24,598	887,312	34,557
Gold				
Large Speculator ...	33,034	-1,007	37,935	15,285
Commercial Hedger	65,127	2,230	66,527	-26,381
Small Trader	39,936	-4,255	33,635	8,064
Live Cattle				
Large Speculator ...	9,125	2,500	8,397	-899
Commercial Hedger	37,081	-3,520	30,232	-560
Small Trader	23,230	-148	30,807	291
Mark				
Large Speculator ...	11,828	-2,393	8,383	2,056
Commercial Hedger	55,249	7,751	55,887	-441
Small Trader	22,359	-1,718	25,166	2,025
S&P 500				
Large Speculator ...	8,907	2,106	34,840	-3,013
Commercial Hedger	162,865	-9,269	124,242	-3,505
Small Trader	43,094	3,583	55,784	2,938
Silver (Comex)				
Large Speculator ...	53,320	-1,433	8,818	910
Commercial Hedger	22,562	1,485	90,578	-529
Small Trader	38,650	862	15,136	533
Soybeans				
Large Speculator ...	85,065	-8,190	96,205	-345
Commercial Hedger	224,330	-4,500	224,670	-12,225
Small Trader	242,885	-3,825	231,405	-3,945
Sugar (No. 11)				
Large Speculator ...	18,627	-505	8,062	3,455
Commercial Hedger	58,678	1,403	76,435	-3,635
Small Trader	30,241	-524	23,049	554
T-Bonds (Chicago)				
Large Speculator ...	1,980	116	2,674	– 638
Commercial Hedger	1,687	39	3,481	147
Small Trader	10,244	229	7,756	875
Wheat (Chicago)				
Large Speculator ...	95,875	6,125	34,070	– 5,545
Commercial Hedger	66,460	1,665	172,410	14,305
Small Trader	133,380	1,265	89,235	495
Yen				
Large Speculator ...	5,082	-3,886	14,063	1,589
Commercial Hedger	45,612	3,439	27,579	– 3,252
Small Trader	21,333	-2,048	30,385	-832

[1]All data as of latest Tuesday.

Source: <u>Barrons,</u> Monday, August 8, 1994.

The Theory of Normal Backwardation

To better understand the economic theory of forward price determination, it is useful to review the traditional explanation for future basis behavior, associated with Keynes and Hicks, that focused on the motivations of participants in forward (futures) markets. These participants are classified as *hedgers, speculators or arbitragers*.[3] Observing that in the present context it is possible to ignore the role played by arbitragers because these traders are only concerned with the relationship between current prices, this leaves the future basis to be determined by hedgers and speculators.

It is possible to provide precise definitions of hedgers and speculators as has been done in the Commodity Exchange Act or in the trading regulations of the various exchanges. Information from traders subject to filing requirements is published by the CFTC in "Commitments of traders in Commodity Futures". Figure 5.17 provides a summary of this data for Aug. 8, 1994. In this case, a "commercial hedger is a large trader who also deals in the commodity on a cash basis. As a consequence, contracts recorded in the hedger category will often, though not always, be associated with using the futures contract to cover a cash commodity position. Speculators, on the other hand, are traders who take positions to attempt to benefit from *expected* price changes, "a non-commercial trader who has no dealings in the underlying commodity".

By design, hedgers have a position, over time, in both the cash and futures market. From this, it is possible to classify hedgers according to the type of position taken in the futures market. ***Short hedgers*** have a long position in the cash commodity to protect from price fluctuation and, as a result, take a short futures position to offset this risk. While the classic example of short hedger would be a grain farmer hedging the crop price to be received at harvest, there are numerous other examples such as a metals refinery hedging the price of future output or an insurance company hedging the price of its bond portfolio. Long hedgers have a short position in the physical, or possibly a need for the commodity at some future point of time, and take a long position in futures as a hedge. Examples would include a flour mill hedging the cost of future wheat purchases, a fund manager hedging the interest rate on a future investment or an oil refinery hedging the price of future crude oil purchases.

Figure 5.17 reveals that short hedgers dominate the commercial hedger category for a number of commodities, most notably wheat. Copper and silver also have a significantly greater short hedger position. However there are closely related commodities, such as corn and gold, which have a either equal balance or significantly greater long hedger position. Hence, it does not appear that a particular, stylized type of hedger can be assumed. The type of hedging activity and the resulting net hedger position depends on the specifics of the commodity involved.

The traditional hedging situation features a short hedger; the use of this approach was based on the presumption that hedgers were net short in the bulk of futures markets. Based on the evidence in Figure 5.17 this does not seem well founded. However, many of these theories originated prior to the collection of the net hedger data by exchanges and regulatory bodies. Recalling the dictum that "for every short there is a long", it follows that if hedgers are net short then market clearing requires that speculators, *as a group*, have to be net long. Assuming that hedgers have a tangible need for futures markets in order to shift the risk of price fluctuations to speculators, Keynes, Hicks and other writers argued that speculators would have to be paid an 'insurance premium' in order to be induced to hold the net long position. If correct, this insurance premium would be reflected in the future basis. If short (long) hedgers pay 'insurance' to speculators, then the futures price would have to rise (fall) *on average* over the life of the contract. This result is known as the normal backwardation hypothesis.[4]

The gist of the traditional position is well summarized by Hicks:

> In normal conditions, when demand and supply are expected to remain unchanged, and therefore the spot price is expected to be about the same in a month's time as it is today, the futures price for one month's delivery is bound to be below the spot price now ruling. The difference between these two prices (the current spot and the currently fixed futures price) is called ...'normal backwardation'. It measures the amount which hedgers have to hand over to speculators in order to persuade the speculators to take over the risk of the price fluctuations in question.

The immediate implication is that, if hedgers are net short, the current futures price is a downwardly biased predictor of the spot price at delivery time. Houthakker (1968) argues that Hicks maintained this bias would only appear for normal conditions, while Keynes felt it would also hold if there were excessive inventories.[5] Historically, the views of Keynes and Hicks about normal backwardation are not supported by the Amsterdam stock-jobber described by Wilson (1941) who indicates that contango was typical in prices from time bargains.

The normal backwardation hypothesis differs substantively from the speculative efficiency approach based on zero expected value for speculative trades. In effect, if markets are speculative efficient, the futures price will be an unbiased predictor of the future spot price. This approach is also known as the unbiased expectations hypothesis.[6] Just as in the traditional approach, it is possible to specify a number of models that support this view. The presence of risk in the speculator's trading strategies significantly complicates the use of a hedger-speculator approach to explaining the future basis.

Unlike the cash-and-carry arbitrage strategies that only depended on current information, speculative profit functions contain variables that are not known when the trading decision is initiated. Accurate modeling requires the incorporation of risk into the speculator's objective function, as well as including considerations about the distributional properties of the relevant random variables. Given this, it is possible to derive the speculative efficiency hypothesis using a number of not mutually exclusive methods: directly imposing zero expected value on a relevant class of speculative profit functions; by assuming both mean-variance objective functions and risk neutral speculators; or, working directly with the properties of the conditional expectation, by assuming that there is no systematic risk in futures price forecasts.

A priori it is not possible to demonstrate that either the normal backwardation or unbiased prediction hypothesis is correct. Houthakker (1961, p.202) puts the point succinctly:

> ...the theory of normal backwardation does not merely follow from the imbalance of hedging and speculation; it also rests on an assumption concerning speculators, namely that in the long run they will only be net long if by doing so they will earn a profit, usually known as a 'risk premium'.

While it is possible that hedgers pay speculators an insurance premium, it is also possible that speculators may be willing to participate in futures markets without compensation from hedgers. In this case, hedgers would execute trades at prices determined by speculators pursuing zero expected value strategies. At present, while better understood, the issues involved still receive attention.

It is not possible to deal with all the theoretical issues surrounding normal backwardation in a concise fashion. Empirically, in certain markets, cash-and-carry arbitrage conditions provide a "tight" band around the futures price; this is the case for financial commodities. Relatively small deviations from the arbitrage conditions generate cash-and-carry trading activity. In addition, in commodities where the arbitrage is less restrictive, the accessibility of futures trading to small, speculative participants, increases the potential for hedgers to trade at futures prices that reflect an expected value of zero for net (risk neutral) speculative participation. What is perhaps more instructive is to consider the less developed *forward* markets, dealing in the traditional agricultural and industrial commodities, that concerned Hicks and Keynes. Much as with the first futures trade, the lack of speculative liquidity in these markets may have dictated that the marginal hedger would have to pay the counter-party to the trade a premium in the form of a discount to the current spot price. Given the relatively low inflation of that era, "normal conditions" would dictate that the current spot price was an unbiased estimate of the future spot price. In effect, the need to pay a liquidity premium for forward contracting dissipates as the supply of speculative liquidity increases.

3.2 Basic Speculative Trading Strategies

Trading Naked

Examine the profit functions for the short and long futures positions given in Chapter 2. Colloquially, these trades can be referred to as uncovered or ***naked trades***, positions that are not covered or offset with any other position.

Profitability depends on accurately predicting the change in the level of the futures price. This is also the case with naked trading in spot and forward markets. Considerable empirical evidence indicates that changes in prices for almost all commodities, physical and financial, are random. Appropriately adjusted price levels follow random walks, implying that such price changes are serially uncorrelated. This means that it is not possible to use past price behavior to profitably predict future price changes. Loosely put, if the commodity price goes up today, the price is equally likely to go up or down tomorrow. Given this, profitability in naked trading depends on having accurate fundamental information about price changes that is not reflected in current market prices. This type of information would typically be available only to traders intimately involved in cash market trading. Purely speculative traders must rely on a combination of intuition and luck in order to profitably use naked position strategies.

An exception to the empirical evidence about random price changes occurs with intra-day price movements. While the close-to-close price change is serially uncorrelated, numerous empirical studies confirm that within-the-day prices changes can have trends. As much of the volume in cash and futures trading is concentrated around the market opening, this trending behavior in futures markets is the source of profit opportunities for exchange floor traders. A similar result holds for cash and forward markets where purely speculative traders are prevented by market rules from participating. Again, the profit opportunities are available only to those directly involved in the exchange process. Even when intra-day trending behavior is accessible to speculative naked position traders, unfavorable transactions costs puts those not involved in the exchange process at a disadvantage. Even though betting on commodity price changes may provide a better chance at winning than, say, going to the racetrack or buying a lottery ticket, using more sophisticated trading strategies it is possible to place bets that have a higher likelihood of profitability. This leads to the study of speculative spread trading strategies.

Basics of Spread Trading

In the face of the uncertainties associated with naked position trading, the spread trade has decided advantages for the small speculative trader not able to access the cheaper execution costs available to floor traders. In addition, as indicated by L. Melamed, spreading techniques are also of considerable use to floor traders. The importance of spread trading is captured in the futures pits where there is, invariably, a specific pit location for spread traders. The significance of the spread trader in facilitating market liquidity is often misunderstood. Compared to naked positions, intra-commodity spreads offer lower margin requirements and transactions costs. These advantages are combined with numerous potential trading strategies that can be pursued (see Exhibit 3.1). Spread trading techniques provide the ability to tailor speculative trades to make bets that are not accessible using naked position trades. Analytically, the similarity of the hedger and spread trader profit functions permits numerous techniques from risk management to be applied to the design of spread trades. In turn, simplifications provided by futures trading permits spread design to go well beyond the narrow limits of risk management.[7]

The jargon associated with futures trading is often colorful, but not always revealing. This is definitely the case with spread trading. The same concept may be referred to using different terminology, while the same terminology may refer to different concepts. In order to avoid semantic confusion, some attention will be given to defining and explaining important basic notions. Spread trades can be classified into two general types. Intra-commodity spreads, also referred to as ***calendar spreads*** or inter-delivery spreads, involve taking a short position for one delivery date simultaneously with a long position for another delivery date.[8] While there are lesser margin requirements and transactions costs associated with taking an equal number of short and long contracts, there are often analytical and practical advantages to having an unbalanced spread position. The other general type of spread trade is the inter-commodity spread, a category that includes a wide variety of possible trades including tandems, turtles and stereos. In some cases the profit function for an inter-commodity spread can be developed from underlying production relationships. Examples include the soybean crush spread (Johnson, et.al. 1991, Rechner and Poitras 1993) and the crack spread (Schap 1991, 1993).[9] The profit function for other types of inter-commodity spreads can be derived using underlying cash-and-carry arbitrage conditions.

As discussed in Chapter 2, a basic building block for developing the analytics of spreading strategies is the profit function for the one-to-one intra-commodity spread, a calendar spread involving equal position sizes on the two legs of the spread. Without loss of generality assume that this trade is initiated at $t=0$ and closed out at $t=1$ and that the trader goes ***short-the-nearby (N)*** contract and ***long-the-deferred (T)*** contract. Taking $F(t,N)$ and $F(t,T)$ to be the futures prices observed at time t, the associated trading profile is given in the text-box. Spread profitability depends on the change in the *futures* basis (not to be confused with the future basis of Sec. 2.4). More precisely, the one-to-one intra-commodity spread that is short-the-nearby and long-the-deferred will be profitable if the difference between the deferred and nearby prices widens. The opposite would be true for the alternative spread, long-the-nearby and short-the-deferred.[10]

Figure 3.3 **Profit Function for an One-to-One Intra-commodity Futures Spread Position**

DATE	***Nearby Position***	***Deferred Position***
$t=0$	Short Q units at $F(0,N)$	Long Q units at $F(0,T)$
$t=1$	Close out position with Long Q units at $F(1,N)$	Close out position with Short Q units at $F(1,T)$

Taking Q to be always positive, the profit function (π) can be specified by observing that the profit for each leg of the spread is equal to the contract selling (short) price minus the purchase (long) price:

$$\begin{aligned}\pi/Q &= \{F(0,N) - F(1,N)\} + \{F(1,T) - F(0,T)\} \\ &= \{F(1,T) - F(1,N)\} - \{F(0,T) - F(0,N)\} \qquad (3.1)\end{aligned}$$

Analysis of (3.1) proceeds by introducing the general cash-and-carry arbitrage condition for futures contracts, e.g., Dubofsky (1992), Poitras (1991), Siegel and Siegel (1990), Allen and Thurston (1988), Hegde and Branch (1985), Kawaller and Koch (1984):

$$F(t,T) \equiv F(t,N)\,\{1 + ic(t,N,T)\} \qquad (3.2)$$

In (3.2), the ***implied carry***, $ic(t,N,T)$, is defined as the ***net*** cost of carrying the commodity from $t=N$ to $t=T$ observed at time t implied in the futures prices $F(t,N)$ and $F(t,T)$. The cash-and-carry arbitrage interpretation of $ic(t,N,T)$ can be motivated by taking $F(t,N)$ to be $S(t)$, the price of the spot commodity, and examining the mechanics of the arbitrage connecting spot and futures prices. While somewhat more abstract, the futures-futures cash-and-carry arbitrage has the same logical mechanics as the spot-futures arbitrage. The functional determinants of the $ic(t,N,T)$ term will depend on the cash-and-carry arbitrage for a specific commodity. For example, gold will have an *ic* that depends primarily on interest charges of carrying gold through time while Treasury bonds will have *ic* dependent on the both interest charges of carrying Tbonds as well as a carry return arising from interest earned on the underlying security.

Exhibit 3.1 **A Taxomony of Spread Trades**

Spread trades are sometimes referred to as ***straddle*** trades but this terminology is also used to describe a specific option trading strategy and can create semantic confusion. Schwager (1984, Part 5) provides a useful and practical introduction to spread trading.

Calendar Spread, also referred to as an inter-delivery spread, is a trade composed of a short and a long position in the same commodity involving different delivery dates. The number of contracts used for the short and long positions can be equal, a one-to-one spread, or unequal.

Tailed Spread is a calendar spread where an unequal number of contracts is used for the short and long positions. The number of short and long contracts is chosen to achieve a specific type of trade payoff. It is possible to set the tail to have a spread trade payoff that depends on changes in the implied repo rate, an important feature for stereo and turtle trades.

Tandem Spread is a trade combining calendar spreads in two different commodities, e.g., Kilcollin (1982), Poitras (1987). The component spreads can be either one-to-one or tailed. The trade involves a hedge ratio to be calculated, usually to equalize the starting values of the positions in the two commodities. There are a wide range of possible rationales for doing tandem trades.

A ***Stereo*** trade is a specific type of tandem trade designed to speculate on changes in the implied repo rates for different commodities, e.g., Yano (1989). Hence, a stereo is a specific type of tailed tandem where the tails are determined to have the calendar spread payoffs depend on changes in implied repo rates. The trade is usually triggered when the implied repo rates for different commodities are observed to deviate from typical historical relationships.

A ***Turtle*** trade combines a tailed spread in one commodity with a short or long position in an interest rate future. The tail is determined to have the calendar spread payoff depend on changes in implied repo rates. The rationale for a turtle varies depending on the specific commodity. For Tbonds and Tnotes, the turtle is triggered when the implied repo rate is observed to deviate significantly from the cash repo rate, e.g., Jones (1981), Rentzler (1986).

Making appropriate substitutions of the arbitrage condition (3.2) into the profit function (3.1) and dropping the N,T notation for ic gives the result:

$$\pi/Q = F(1,N)\ ic(1) - F(0,N)\ ic(0)$$

Observing that $\Delta\ ic = ic(1) - ic(0)$ and $\Delta\ F = F(1,N) - F(0,N)$, basic algebra provides the fundamental result for the one-to-one spread profit function:

$$\pi/Q = ic(0)\ \Delta\ F(N) + F(1,N)\ \Delta\ ic \tag{3.3}$$

This demonstrates that π for the one-to-one spread depends on the change in two variables, ΔF and Δic. Except in special cases, the need to predict the behavior of two random variables in order to ascertain profitability can be problematic. Significantly, the technique of ***tailing*** the spread, e.g., Jones (1981), involves altering the relative sizes of the nearby and deferred positions in such a way that the $\Delta\ F$ term disappears. In this fashion, tailed intra-commodity spreads can be used to speculate on changes in the implied ***net*** cost of carry without needing to adjust for changes in price levels. In addition, tailed spreads can be combined with other positions to create trading strategies such as the turtle.

As an example of how price level changes can affect spread profitability, consider the case of gold for the period Nov. 9, 1979 to Feb. 15, 1980. Over this period, interest rates were relatively unchanged, the benchmark three month Tbill rising only 11 basis points from 12.25 to 12.36. During this period the Handy and Harmon spot price rose from \$389.75 to \$667. Examining the June 80-June 81 COMEX gold futures spread for this period, the June 80 contract rose from \$420. 80 to \$703.50 while the June 81 contract rose from \$471.20 to \$843. This resulted in a change in the futures spread from \$50.40 to \$139.50. Remembering that the futures spread ic for gold is primarily determined by interest rates, the impact of interest rate changes on the gold spread was reflected over the period Mar. 3, 1980 to Aug. 25, 1980. Over this period the Handy and Harmon spot price was relatively unchanged, going from \$633.75 to \$634.75. During this period, interest rates, as reflected in the three month Tbill rate, fell from 13.38 to 9.41. Examining the Oct 80-Oct 81 COMEX gold futures spread over this period, the Oct 80 contract fell from \$709.50 to \$629.70 while Oct 81 fell from \$849.50 to \$719.40. This reflects a decline in the gold futures spread from \$140 to \$89.70.

Tailing the Spread

Figure 3.4 **Profit Function for a General Intra-commodity Futures Spread Position**

DATE	***Nearby Position***	***Deferred Position***
$t=0$	Short Q_N units at $F(0,N)$	Long Q_T units at $F(0,T)$
$t=1$	Close out position with Long Q_N units at $F(1,N)$	Close out position with Short Q_T units at $F(1,T)$

In this case, the profit function can be specified:

$$\pi(1,T) = \{F(0,N) - F(1,N)\}\, Q_N + \{F(1,T) - F(0,T)\}\, Q_T \qquad (3.4)$$

To motivate the profit function for a tailed spread, consider the trading profile for an intra-commodity spread with potentially unequal position sizes. Letting the contract amounts be Q_N and Q_T, the short-the-nearby, long-the-deferred trade is depicted in Figure 3.4. The tail for an intra-commodity spread can be set by holding either spread leg constant and varying the other leg. To see this, set $Q_T = 1$. It can now be verified that $Q_N = F(0,T)/F(0,N)$ will give a trade profit function that depends only on $\Delta\, ic$. Observing that $F(0,T)/F(0,N) = \{1 + ic(0)\}$ and substituting this result and $Q_T = 1$ into (3.4) gives:

$$\pi(1) = F(1,N)\, \Delta\, ic \qquad (3.5)$$

The case where $Q_N = 1$ *and* $Q_T = F(0,N)/F(0,T)$, gives virtually the same result:

$$\pi(1) = \{F(1,N)/(1 + ic(0))\}\, \Delta\, ic$$

Because the two approaches do not give the same exact answer, the trades can involve taking a slightly different number of contracts for the spread legs. However, because the change in *ic* is the only random variable in either profit function, the difference is not of practical importance.

To illustrate the use of a tail, consider the following gold prices that were available in February 1989:

June 1989	$379	Aug 1989	$382.90
June 1990	$404.80	Aug 1990	$409.20

For the June contracts, the one year spread gives 1 + *ic*(0) = 1.068 and for the August contracts 1 + *ic*(0) = 1.069. Using the tailing method that sets the number of deferred contract equal to one involves taking 1.068 June 89 nearby contracts for every one June 90 deferred contract. By tailing, the dollar value of the gold underlying the nearby and deferred positions is equalized. In the futures market terminology, this method of spread tailing is a ***dollar equivalency*** technique. Because futures contracts are only traded in whole numbers, it is necessary to gross the number of contracts up until an acceptable ratio is found. In this case, 14(1.068) = 14.952. Hence, a ratio of 15 nearby for every 14 deferred contracts would appear to be acceptable; though as the size of the spread trade positions grows, the more accurate the tail can be.

Because gold is typically at or near full carry, the size of the tail will depend on the prevailing level of interest rates. To see this, consider the following prices for gold futures prices for June 16, 1992:

June 1992	\$343.10	Aug 1992	\$344.90
June 1993	\$355.80	Aug 1993	\$358.40

Observing that for the June contracts $1 + ic(0) = 1.037$ and for the August contracts $1 + ic(0) = 1.039$, using the method that sets the deferred contract equal to one involves taking 1.039 Aug 92 nearby contracts for every one Aug 93 deferred contract. Again observing that futures contracts are only traded in whole numbers, it is necessary to gross the number of contracts up until an acceptable ratio is found. In this case, 24(1.039) = 24.936. Hence, a ratio of 25 nearby for every 24 deferred contracts would appear to be an acceptable hedge ratio; subject to the caveat that as the size of the spread trade position grows, the more accurate the tail can be. The large number of contracts required to tail the spread in 6/92 was unusual, driven by the historically low interest rates of this period.

The need to tail a spread depends on both the shape of the term structure of futures prices and the length of time between N and T. When prices across delivery months are relatively the same level or if there is no distant deferred deliveries available for trading, it is not necessary to tail. This is the case in a number of commodities. For example, in currencies there is often no trade in futures contracts over one year to delivery. Taking, say, a six month (Sept. 92/Mar. 93) spread in Japanese yen, using the price quotes for 8/31/92 gives a tail of (.8016/.8013) = 1.0004. For the Canadian dollar on that date the same maturity for the contracts gives a tail of 1.0067. Neither of these numbers indicates that a tail is required unless the trade sizes go well beyond the allowable position limits. The story is different again for Tbond futures that admit both distant delivery dates and typically sloped futures term structure. Using 7/16/92 quotes gives a Sept 92/Sept 93 tail of 1.046. As will be seen when the specifics of inter-commodity trades such as the turtle are considered, dollar equivalency is not the only possible tailing method. The process of setting the tail can also be done to attain profit functions that are dependent on components of *ic*, and not just *ic* itself.

Table 3.1 **Interest Rate Futures Prices**

INTEREST RATE

TREASURY BONDS (CBT)–$100,000; pts. 32nds of 100%

	Open	High	Low	Settle	Change	Lifetime High	Lifetime Low	Open Interest
Sept	103-00	103-16	102-30	103-09	+ 6	118-26	90—12	390,284
Dec	102-10	102-24	102-08	102-17	+ 5	118-08	91-19	73,842
Mr95	101-22	101-30	101-22	101-25	+ 5	116-20	98-20	4,218
June	101-05	101-08	101-04	101-04	+ 5	113-15	98-12	1,638
Sept	....	....	....	100-17	+ 5	112-15	97-28	673

Est vol 200,000; vol Fri 509,266; op int 470,763, +7,397.

TREASURY BONDS (MCE)–$50,000; pts. 32nds of 100%

	Open	High	Low	Settle	Change	Lifetime High	Lifetime Low	Open Interest
Sept	103-02	103-16	103-02	103-09	+ 8	115-20	100-02	14,067
Dec	102-14	102-24	102-14	102-17	+ 7	114-00	99-10	359

Est vol 3,500; vol Fri 5,328; open int 14,430, +51.

TREASURY NOTES (CBT)–$100,000; pts. 32nds of 100%

	Open	High	Low	Settle	Change	Lifetime High	Lifetime Low	Open Interest
Sept	104-01	104-09	103-31	104-05	+ 2	115-01	101-18	241,497
Dec	103-03	103-10	103-01	103-06	+ 1	114-21	100-25	24,587

Est vol 40,000; vol Fri 152,073; open int 266,143, +9,983.

5 YR TREAS NOTES (CBT)–$100,000; pts. 32nds of 100%

	Open	High	Low	Settle	Change	Lifetime High	Lifetime Low	Open Interest
Sept	03-295	04-025	03-295	104-00	....	10-195	102-12	180,491
Dec	03-075	103-10	03-055	03-075	....	104-18	101-26	10,898

Est vol 20,000; vol Fri 61,379; open int 191,389, +4,901.

2 YR TREAS NOTES (CBT)–$200,000, pts. 32nds of 100%

	Open	High	Low	Settle	Change	Lifetime High	Lifetime Low	Open Interest
Sept	02-232	102-25	02-232	02-235	– ¾	104-31	102-04	31,300
Dec	102-05	02-055	02-045	02-045	– ¾	02-187	02-045	610

Est vol 2,000; vol Fri 2,112; open int 31,910, +145.

30-DAY FEDERAL FUNDS (CBT)-$5 million; pts. of 100%

	Open	High	Low	Settle	Change	Lifetime High	Lifetime Low	Open Interest
Aug	95.56	95.57	95.56	95.57	+ .01	96.58	95.05	4,662
Sept	95.32	95.33	95.31	95.33	+ .02	96.44	94.81	3,083
Oct	95.08	95.10	95.08	95.09	+ .01	95.63	94.63	807
Nov	94.88	94.91	94.88	94.89	+ .01	95.52	94.50	311
Dec	94.62	94.62	94.62	94.62	....	96.00	94.46	102

Est vol 2,222; vol Fri 2,743; open int 9,053, +1,000.

TREASURY BILLS (CME)–$1 mil.; pts. of 100%

	Open	High	Low	Settle	Chg	Discount Settle	Discount Chg	Open Interest
Sept	95.24	95.26	95.22	95.24	....	4.76	....	18,533
Dec	94.68	94.70	94.65	94.66	– .02	5.34	+ .02	9,198
Mr95	94.38	94.40	94.37	94.39	....	5.61	....	3,245

Est vol 1,559; vol Fri 3,962; open int 30,994, –905.

LIBOR-1 MO. (CME)–$3,000,000; points of 100%

	Open	High	Low	Settle	Chg	Discount Settle	Discount Chg	Open Interest
Aug	95.27	95.30	95.27	95.29	+ .02	4.71	– .02	22,148
Sept	95.06	95.08	95.06	95.06	+ .01	4.94	– .01	9,640
Oct	94.86	94.87	94.86	94.86	+ .01	5.14	– .01	2,602
Nov	94.70	94.70	94.70	94.69	+ .01	5.31	– .01	2,376
Dec	93.97	93.97	93.97	93.97	....	6.03	....	1,594
Ja95	....	....	....	94.31	– .01	5.69	+ .01	384
Feb	....	....	....	94.19	– .01	5.81	+ .01	112
Mar	....	....	....	94.06	....	5.94	....	109
May	....	....	....	93.81	....	6.19	....	205

Est vol 5,304; vol Fri 12,937; open int 39,263, +2,351.

Source: *Wall Street Journal*, Monday, August 8, 1994.

Table 3.2 **Eurodollar Futures Prices**

EURODOLLAR (CME)–$1 million; pts of 100%

	Open	High	Low	Settle	Chg	Yield Settle	Yield Chg	Open Interest
Sept	94.82	94.83	94.80	94.81	+ .01	5.19	– .01	427,280
Dec	94.09	94.12	94.08	94.09	....	5.91	....	496,265
Mr95	93.85	93.87	93.84	93.85	....	6.15	....	333,927
June	93.55	93.55	93.52	93.53	....	6.47	....	249,693
Sept	93.26	93.27	93.25	93.26	....	6.74	....	215,033
Dec	93.00	93.00	92.97	92.99	....	7.01	....	150,225
Mr96	92.93	92.93	92.90	92.92	....	7.08	....	130,650
June	92.82	92.82	92.80	92.81	....	7.19	....	106,418
Sept	92.72	92.73	92.71	92.72	+ .01	7.28	– .01	97,391
Dec	92.56	92.58	92.55	92.56	+ .01	7.44	– .01	76,780
Mr97	92.55	92.57	92.54	92.56	+ .02	7.44	– .02	68,643
June	92.47	92.49	92.46	92.48	+ .02	7.52	– .02	57,107
Sept	92.40	92.42	92.39	92.41	+ .02	7.59	– .02	52,734
Dec	92.26	92.28	92.25	92.27	+ .02	7.73	– .02	50,066
Mr98	92.27	92.29	92.26	92.28	+ .02	7.72	– .02	36,539
June	92.19	92.21	92.18	92.20	+ .02	7.80	– .02	31,795
Sept	92.11	92.14	92.11	92.13	+ .02	7.87	– .02	23,814
Dec	92.00	92.02	91.99	92.01	+ .02	7.99	– .02	19,722
Mr99	92.02	92.04	92.02	92.03	+ .02	7.96	– .02	15,964
June	91.95	91.98	91.95	91.96	+ .02	8.04	– .02	8,867
Sept	91.89	91.91	91.89	91.90	+ .02	8.10	– .02	8,182
Dec	91.78	91.79	91.78	91.78	+ .02	8.22	– .02	6,986
Mr00	....	....	....	91.81	+ .01	8.19	– .01	7,109
June	....	....	....	91.76	+ .01	8.24	– .01	5,273
Sept	....	....	....	91.71	+ .01	8.29	– .01	7,028
Dec	....	....	....	91.61	+ .01	8.39	– .01	5,862
Mr01	....	....	....	91.67	+ .01	8.33	– .01	6,923
June	....	....	....	91.64	+ .01	8.36	– .01	4,428
Sept	....	....	....	91.62	+ .01	8.38	– .01	2,373
Dec	....	....	....	91.54	+ .01	8.46	– .01	2,429
Mr02	91.59	91.59	91.59	91.60	+ .01	8.40	– .01	2,009
June	91.60	91.60	91.60	91.61	+ .01	8.39	– .01	2,141
Sept	....	....	....	91.60	+ .01	8.40	– .01	1,785
Dec	....	....	....	91.52	+ .01	8.48	– .01	1,354
Mr03	....	....	....	91.57	+ .01	8.43	– .01	1,516
June	....	....	....	91.55	+ .01	8.45	– .01	1,158
Sept	....	....	....	91.56	+ .01	8.44	– .01	1,071
Dec	....	....	....	91.50	+ .01	8.50	– .01	1,385
Mr04	....	....	....	91.56	+ .01	8.44	– .01	1,124

Est vol 193,687; vol Fri 775,986; open int 2,692,116, +42,309.

Figure 3.3 **Profit Function for a Tailed Tbond Spread**

DATE	***Nearby (N) Position***	***Deferred Position** (T)*
$t=0$	Short $[F(0,T)/F(0,N)]\ Q$ Tbonds at F(0,N)	Long Q Tbonds at $F(0,T)$
$t=1$	Long $[F(0,T)/F(0,N)]\ Q$ at $F(1,N)$	Short Q at $F(1,T)$

From (3.5), the profit function for the short-the-nearby, long-the-deferred tailed Tbond spread takes the form:

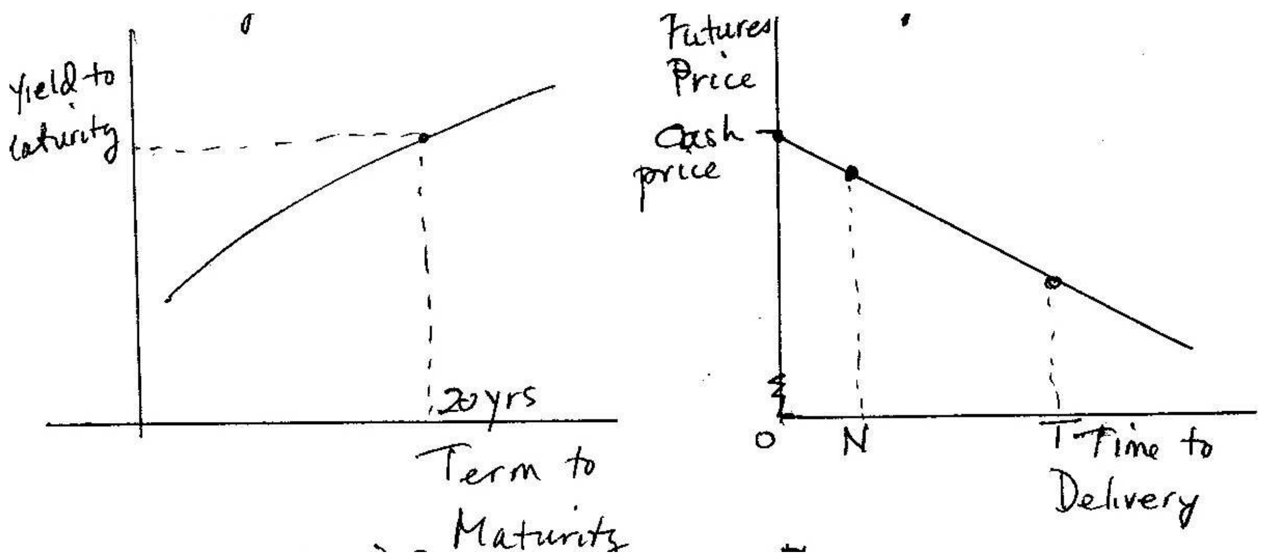
$$\pi(1) = F(1,N)\ \Delta\ ic = F(1,N)\ \{\Delta\ irr(N,T) - \Delta\ R(N,T)\}$$

where *irr* is the implied repo rate *(irr)*, the repurchase agreement financing rate implied in Tbond futures prices, and R is the return earned on the cash Tbond position during the period between the two delivery dates, *N* and *T*. With suitable modification, this type of profit function also applies to all other debt futures contracts.

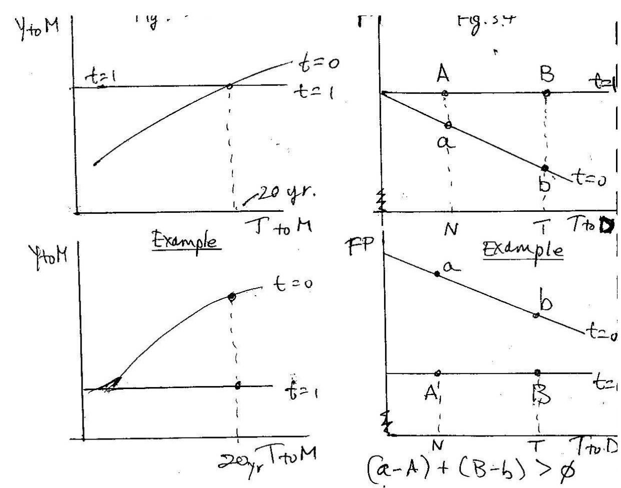
One interesting application of the concept of tailing occurs with the intra-commodity Tbond spread. In this case, the tailed spread can be used for speculating on changes in the shape of the yield curve (see Figure 3.3). From Figure 3.3, the connection between the payoff on a tailed Tbond spread and shifts in the term structure of interest rates should be apparent. While more precise examination of the determination of *irr* can be found in a number of sources, e.g., Siegel and Siegel (1990, Chap. 6), Rentzler (1986), for purposes of analyzing the tailed Tbond spread *irr* can be taken to be a short term interest rate while the cash Tbond rate, being for > 15 year maturities, is a long-term rate.[11] From $F(0,T) = F(0,N)\{1 + irr(0,N,T) - R(0,N,T)\}$, it follows that $F(0,T) < F(0,N)$ and the futures price term structure is downward sloping when the yield curve is upward sloping. By considering a variety of yield curve changes, allowing for changes in the spot Tbond rate, it can be verified that π on the tailed Tbond spread depends only on changes in yield curve shape; the level of the spot interest rate does not affect the profitability of the trade undertaken. This is not surprising, given that the spread is tailed. However, the positions involved in the tailed spread must be reversed when the yield curve is inverted. While a short-the-nearby, long-the-deferred spread is profitable when an upward sloping yield curve flattens, a long-the-nearby, short-the-deferred spread is profitable when an inverted yield curve flattens. Similarly, the positions will be reversed when a flat yield curve either inverts or becomes upward sloping.

Tables 3.1 and 3.2 provide various interest rate futures prices from Aug. 8, 1994. Examining the Tbond futures prices in Table 3.1 reveals a downward sloping futures price term structure. The more deferred the delivery date, the lower the price. Figure 3.3 demonstrates theoretically that this futures price structure is a result of the downward sloping yield curve in the Treasury bond market, a result that is supported empirically by the upward sloping cash Tbond yield curve on Aug. 8, 1994. A similar result applies for the Eurodollar futures prices which also reflects the presence of a downward sloping cash market yield curve. However, it is not possible to use Figure 3.3, which applies to Tbond futures, as a theoretical motivation for the connection between the cash market yield curve and the term structure of futures prices. As demonstrated in Sec.6.3, the term structure of Eurodollar futures prices reflect the implied forward interest rates embedded in the Eurodollar cash market yield curve.

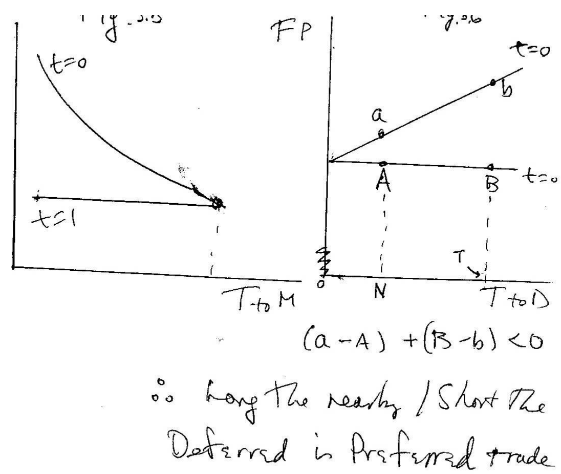
Graphs 3.1 and 3.2 **The Relationship between the Cash Yield Curve and the Futures Term Structure**



Graphs 3.3 and 3.4 (with examples)



Graphs 3.5 and 3.6



The analysis of the tailed Tbond spread can be illustrated diagrammatically. The discussion extends naturally to other types of interest rate futures contracts, such as Eurodollars. The two basic graphs required are provided in Graph 3.1, which captures the shape of the term structure of interest rates in the cash market, and Graph 3.2, which takes the information from the assumed term structure shape and translates this into a term structure of Tbond futures prices using the fundamental arbitrage for futures. The specific shapes that appear in the Figures apply to an upward sloping (normal backwardation) yield curve. From $F(0,T) = F(0,N)\{1 + irr(0,N,T) - R(0,N,T)\}$, it follows that $F(0,T) < F(0,N)$ and the futures price term structure is downward sloping when the yield curve is upward sloping. Analysis of the trading implications of specific changes in yield curve shape now follows by superimposing the "new" yield curve and futures price structure over the initial values.

The method required for determining the position type and trade profitability of the tailed Tbond spread is illustrated in Graphs 3.3 and 3.4 where the "new" yield curve is flat $(irr=R)$. The yield curve pivots in such a way that the 15-20+ year yield remains unchanged. In this way, the cash price that anchors the futures price structure is unchanged. Taking points on the initial price schedule to be lower case, and the "new" schedule to be upper case, then the profitability of the short nearby, long deferred spread follows: $(a - A) + (B - b) > 0$. It follows from switching the time dates that a long nearby, short deferred spread will be profitable when the yield curve steepens and the cash Tbond yield is unchanged. By redrawing the "new" yield curve to allow for changes in the spot Tbond rate, it can be verified that the level of the spot rate does not affect the type of trade undertaken. This is not surprising, given that the spread is tailed. However, as illustrated in Graphs 3.5 and 3.6, the trades are reversed when the yield curve is inverted. In other words, the long nearby, short deferred spread is profitable when an inverted yield curve flattens. Similarly, the short nearby, long deferred spread is profitable when the yield curve inverts.

In addition to intra-commodity spread trades such as tailed Tbond or Tnote spreads, inter-commodity spreads with naked positions in futures for different securities also provide an array of spreading opportunities. For purposes of speculating on changes in yield curve shape, examples would include Tnotes and Tbonds (the NOB spread), GNMA's and Tnotes (the GUN spread), Tnotes and Tbills and Tbonds and Tbills (the BOB spread).[12] The profit functions for these types of spreads are of the form:

$$\pi = \{Q_1 [F(1,T)] - Q_2 [G(1,T)]\} - \{Q_1 [F(0,T)] - Q_2 [G(0,T)]\}$$

These types of inter-commodity usually leave a hedge ratio to be calculated. To illustrate the method involved, recall that "equalization of basis points" is a convenient method for calculating dollar value hedge ratios. For a Tbill/Tbond spread, the Tbill has a *bp* value of $25. The Tbond *bp* value depends on the level and direction of change in rates. Suppose, for example, that rates are expected to change from 8% to 7% (100 bp). Observing that the Tbond at 8% has $F(0,N)$ = $100,000, the price of the Tbond at 7% is calculated as $110,590, a $10,590 change in value for a 100 *bp* change results in $105.90 per *bp*. This gives a hedge ratio of slightly more than 4/1. Similar calculations for going from 8-9% gives a $9130 change or $91.30 per *bp*. A hedge ratio of approximately 42 to 10 is indicated. This illustrates the heuristic result that the BOB hedge ratio is 4/1 when the Tbond is around par.

Another type of spreading strategy involves trading spread positions against spread positions. This can be done both intra and inter-commodity. When the spreads are all intra-commodity, the resulting trades are known as butterflies and condors. When the spreads are in different commodities, the trades are generically referred to as tandems or stereos. Analytically, some of the most interesting trades, such as the stereo NOB (Yano 1989) and the TED tandem (Poitras 1989, 1998), are of this variety. A final type of spreading strategy arise from production relationships. Examples of these iinter-commodity trades are the soy crush (Rechner and Poitras 1993) and the crack spread (Poitras 2001). The soy crush is based on the crushing of soybeans into soybean mean and soybean oil. The crack spread is based on the distillation of crude oil into heating oil and gasoline. The hedge ratios for the various positions is based on the underlying production relationships. While these relationships are relatively exact in the soy crush and crack spreads, other types of less deterministic production spreads are also possible, such as live hogs, pork bellies and corn.

3.3 Basis Relationships

Types of Basis

In market terminology, a ***basis*** refers to the difference between two prices. The study of basis relationships is fundamental to understanding cash markets as well as futures and forward markets.[13] Various types of basis relationships are of interest. One basis relationship that is of theoretical interest is the ***maturity basis***, the difference between the delivery date price of a futures contract and the corresponding spot price. It is often theoretically convenient to assume that the maturity basis is zero, implying that $F(T,T)=S(T)$. Though the maturity basis is often zero for forward contracts, which are often written with delivery in mind, for futures the maturity basis will only be zero where the spot and futures prices both refer to the deliverable commodity. When the maturity basis for a deliverable spot commodity deviates from zero, a profit opportunity is provided for delivery arbitragers operating on the futures exchange. Evaluation of the maturity basis is often complicated by the grade and location characteristics of the spot commodity. Even for futures contracts, the deliverable standard grade specified in the futures contract often permits multiple delivery grades or locations. For example, CBT Treasury bond futures contracts permit delivery of any Treasury bond with maturity greater than 15 years and non-ferrous London Metals Exchange contracts can allow for delivery in ports such as Bristol or Hamburg.[14] In addition to the complications this presents to delivery arbitragers, the presence of ***multiple delivery specifications*** requires the ***cheapest deliverable*** commodity to be identified in order to determine the precise commodity grade and location that is being traded with a futures or forward contract.[15]

Figure 3.6 **Cash Prices for Selected Commodities**

CASH PRICES

Monday, August 8, 1994.
(Closing Market Quotations)

	Mon	Fri	Yr.Ago
GRAINS AND FEEDS			
Barley, top-quality Mpls., bu	2.30-.50	2.50	2.35
Bran, wheat middlings, KC ton	63.-65.0	63.-65.0	53.00
Corn, No. 2 yel. Cent. Ill. bu	bp2.11	2.09½	2.23½
Corn Gluten Feed, Midwest, ton	88.-95.0	88.-95.0	78.00
Cottonseed Meal, Clksdle, Miss. ton	140-142½	140.00	172.50
Hominy Feed, Cent. Ill. ton	60.00	60.00	58.00
Meat-Bonemeal, 50% pro. Ill. ton.	192.50	192.50	n.a.
Oats, No. 2 milling, Mpls., bu	1.39¼-44¼	1.38½-43½	1.61¾
Sorghum, (Milo) No. 2 Gulf cwt	4.30	4.26	4.36
Soybean Meal, Cent. Ill., 44% protein-ton	164-168	163½-67½	206.00
Soybean Meal, Cent. Ill., 48% protein-ton	177-181	176½-80½	218.00
Soybeans, No. 1 yel Cent.-Ill. bu	bp5.60	5.58	6.57½
Wheat, Spring 14%-pro Mpls. bu	3.77¼-82¾	3.77¾-82¾	4.91¼
Wheat, No. 2 sft red, St.Lou. bu	bp3.17½	3.17½	3.02½
Wheat, No. 2 hard KC, bu	3.54¼	3.54¼	3.24¼
Wheat, No. 1 sft wht, del Port Ore	3.51	3.52	3.41
FOODS			
Beef, Carcass, Equiv.Index Value, choice 1-3,550-700lbs.	103.60	103.75	111.60
Beef, Carcass, Equiv.Index Value, select 1-3,550-700lbs.	95.85	96.40	108.05
Broilers, Dressed "A" NY lb	x.5330	.5373	.5690
Broilers, 12-Cty Comp Wtd Av	.5385	.5379	.5985
Butter, AA, Chgo., lb.	.75½	.75½	.78
Cocoa, Ivory Coast, $metric ton	g1,627	1,667	1,176
Coffee, Brazilian, NY lb.	n1.74	1.97	.64½
Coffee, Colombian, NY lb.	n1.84	c2.05	.80½
Eggs, Lge white, Chgo doz.	.60-.65	.60-.65	.69½
Flour, hard winter KC cwt	9.40	9.40	9.95
Hams, 17-20 lbs, Mid-US lb fob	.53	.53	.63½
Hogs, Iowa-S.Minn. avg. cwt	43.25	43.25	48.00
Hogs, Omaha avg cwt	44.00	43.50	47.50
Pork Bellies, 12-14 lbs Mid-US lb	.42-.44	.39-.42	.47½
Pork Loins, 14-18 lbs. Mid-US lb	1.16-.17	1.16-.17	1.11
Steers, Tex.-Okla. ch avg cwt	70.50	z	76.75
Steers, Feeder, Okl Cty, av cwt	89.50	88.50	97.50
Sugar, cane, raw, world, lb. fob	.1187	.1196	.0949
FATS AND OILS			
Coconut Oil, crd, N. Orleans lb.	xxn.29¾	.29½	.22½
Corn Oil, crd wet mill, Chgo. lb.	n.25	.25	.21
Corn Oil, crd dry mill, Chgo. lb.	n.28¼	.28¼	.21½
Grease, choice white, Chgo lb.	n.16¾	.16¾	.14
Lard, Chgo lb.	n.18¼	.18¼	.15½
Palm Oil, ref. bl. deod. N.Orl. lb.	n.30	.28	.20
Soybean Oil, crd, Decatur, lb.	.2454	.2468	.2354
Tallow, bleachable, Chgo lb.	n.18¼	.18¼	.15¼
Tallow, edible, Chgo lb.	n.19	.19	.16
FIBERS AND TEXTILES			
Burlap, 10 oz 40-in NY yd	n.2750	.2750	.2400
Cotton 1 1/16 str lw-md Mphs lb	.6985	.7087	.5423
Wool, 64s, Staple, Terr. del. lb.	2.30	2.30	1.37
METALS			
Aluminum ingot lb. del. Midwest	q.69-.71	.69-.71	.56½
Copper cathodes lb.	p1.11	1.11	.90
Copper Scrap, No 2 wire NY lb	h.87½	.87½	.65½
Lead, lb.	q.36988	.38150	.33½
Mercury 76 lb. flask NY	q200.00	200.00	185.00
Steel Scrap 1 hvy mlt Chgo ton	135.-138.	135.-138.	112.50
Tin composite lb.	q3.4652	3.4752	3.3252
Zinc Special High grade lb	p.46500	.46500	.44750
MISCELLANEOUS			
Rubber, smoked sheets, NY lb.	n.66¾	.65	.43¼
Hides, hvy native steers lb., fob	.89	.89	.79
PRECIOUS METALS			
Gold, troy oz			
Engelhard indust bullion	378.89	379.59	383.00
Engelhard fabric prods	397.83	398.57	402.15
Handy & Harman base price	377.60	378.30	381.70
Handy & Harman fabric price	379.10	379.80	z
London fixing AM 377.70 PM	377.60	378.30	381.70
Krugerrand, whol	a384.00	384.50	385.50
Maple Leaf, troy oz.	a390.00	390.50	397.00
American Eagle, troy oz.	a390.00	390.50	397.00
Platinum, (Free Mkt.)	406.00	410.50	394.50
Platinum, indust (Engelhard)	408.00	411.00	396.00
Platinum, fabric prd (Engelhard)	508.00	511.00	496.00
Palladium, indust (Engelhard)	152.00	152.00	141.00
Palladium, fabrc prd (Englhard)	167.00	167.00	156.00
Silver, troy ounce			
Engelhard indust bullion	5.140	5.175	4.730
Engelhard fabric prods	5.551	5.589	5.108
Handy & Harman base price	5.130	5.160	4.720
Handy & Harman fabric price	5.156	5.186	z
London Fixing (in pounds)			
Spot (U.S. equiv. $5.1130)	3.3165	3.3670	3.1260
3 months	3.3590	3.4100	3.1705
6 months	3.4085	3.4605	3.2140
1 year	3.5225	3.5835	3.2920
Coins, whol $1,000 face val	a3,643	3,673	3,397

a-Asked. b-Bid. bp-Country elevator bids to producers. c-Corrected. d-Dealer market. e-Estimated. f-Dow Jones International Petroleum Report. g-Main crop, ex-dock, warehouses, Eastern Seaboard, north of Hatteras. h.-Reuters. i.-f.o.b. warehouse. k-Dealer selling prices in lots of 40,000 pounds or more, f.o.b. buyer's works. n-Nominal. p-Producer price. q-Metals Week. r-Rail bids. s-Thread count 78x54. x-Less than truckloads. z-Not quoted. xx-f.o.b. tankcars.

Source: Wall Street Journal, Monday, August 8, 1994.

Figure 3.7 **Cash Prices for Canadian Grain**

GRAIN

BY PARRISH and HEIMBECKER

(Prices quoted in tonnes)

Domestic 1 CW 13.5 wheat, Thunder Bay, 187.24, Export 1 CW 13.5 wheat, St. Lawrence, 235.86, Export 1 CW durum, St. Lawrence, 289.28.

Domestic milling wheat — CIF Bayports: 1 CW durum wheat 270.21, 1 CW 14.5 wheat 236.23, 1 CW 13.5 wheat 208.24, 2 CW 13.5 wheat 200.93, 1 CW 12.5 wheat 206.93; 2 CW 12.5 wheat 198.38.

FEEDING GRADES

Sample wheat DGC 119.20; 3 CW oats 140.50; 1 CW barley 112.00, 1 feed screening 108.00.

ONTARIO GRAIN

Approximate bid price track shipping point.

2 white oats 115.00; Ontario feed oats 90.00; Ontario barley 95.00; 2 winter wheat milling 169.58, 2 soybeans 273.10, 2 rye 100.00; 2 yellow corn 129.82; 3 yellow corn 128.63.

WINNIPEG CASH PRICES

Feed oats: 1 cw 106.40; 2 cw 106.40; 3 cw 104.40; mixed grain oats; 94.40.

Feed barley (Thunder Bay): 1 cw 94.90; 2 cw 92.90; mixed grain barley 84.90.

Rye: 1 cw 112.60; 2 cw; 110.60; 3 cw 82.60.

Flax: 1 cw 271.60; 2 cw 269.60; 3 cw 236.60.

Canola: In store Thunder Bay No. 1 Canada 473.60; In store Vancouver No. 1 Canada 481.30.

Feed Wheat: 3 red spring: 109.70; Can Feed: 103.70.

WHEAT BOARD

Export wheat, St. Lawrence: 1 cw 13.5 pct; 235.86; 1 cw 11.5 pct; 225.26; 2 cw 13.5 pct; 230.26; 2 cw 11.5 pct; 220.26; 3 cw 220.26; 1 durum 294.37; 2 durum 289.53; 3 durum 284.53.

Malting barley (domestic), Thunder Bay: Special Select 6-row; 169.00; Select 6-row 166.50; Special Select 2-row; 176.00; Select 2-row 173.50.

Source: Globe and Mail, Monday, August 8, 1994.

Figure 3.6 **Cash Prices for Oil**

OIL PRICES

Monday August 8, 1994.

CRUDE GRADES	Mon	Fri	Yr. Ago
OFFSHORE-d			
European "spot" or free market prices			
Arab lt.	h16.25	16.55	13.95
Arab hvy.	h15.05	15.35	11.55
Iran, lt.	h17.30	17.60	14.90
Forties	h17.95	18.15	16.60
Brent	h17.85	18.15	16.50
Bonny lt.	h18.05	18.35	16.95
Urals-Medit.	h17.05	18.55	14.85
DOMESTIC-f			
Spot market			
W. Tex. Int Cush (1775-1875) (Sep)	h19.40	19.30	17.55
W.Tx.sour, Midl (1550-1740)	h18.50	18.40	15.65
La. sw. St.Ja (1750-1870)	h19.50	19.35	17.80
No. Slope del USGULF	hn17.75	17.65	15.80

Open-market crude oil values in Northwest Europe around 17:50 GMT in dlrs per barrel, for main loading ports in country of origin for prompt loading, except as indicated.

REFINED PRODUCTS	Mon	Fri	Yr. Ago
Fuel Oil, No. 2 NY gal.	g.4975	.4905	.4790
Diesel Fuel, 0.05 S. NY harbor low sulfur	g.5100	.5010	n.a.
Gasoline, unlded, premium NY gal.	g.7110	.7145	.6145
Gasoline, unlded, reg. NY gal.	g.5915	.5880	.5345
Propane, Mont Belvieu, Texas, gal.	g na	.3040	.3065
Butane, normal, Mont Belvieu, Texas, gal.	g na	.3540	.3615
RAW PRODUCTS			
Natural Gas Henry Hub, $ per mmbtu	g1.57½	1.65	n.a.

a-Asked. b-Bid. c-Corrected. d-as of 11 a.m. EST in Northwest Europe. f-As of 4 p.m. EST. Refiners' posted buying prices are in parentheses. g-Provided by Telerate Systems. h-Dow Jones International Petroleum Report. n.a.-Not available. z-Not quoted. n-Nominal. r-Revised.

Source: *Wall Street Journal*, Monday, August 8, 1994.

The ***quality basis*** is a development on the maturity basis. The quality basis relates to the difference between prices for different grades of a commodity. Consumers encounter various types of quality basis decisions on a daily basis. For example, automobile drivers have to decide whether to buy regular or premium gas when tanking up. The difference between these two prices is a quality basis. When the maturity basis is not zero, the difference between spot and futures prices will be a quality basis. Numerous examples of the quality basis are provided in Figures 3.6-3.8. In Figure 3.6, for New York delivery, Brazilian coffee is selling for $1.74/lb. while Columbian coffee is selling for $1.84/lb. Engelhard refined industrial and fabrication quality platinum are selling for $408 and $508 per troy ounce. Copper cathodes and copper scrap are selling for $1.11 and $.87 per pound. In Figure 3.8, Arabian heavy and light oil in Rotterdam are selling for $15.05 and $16.25 per barrel.

Price differences due to variations in quality are determined by market considerations and are not typically constant. This variation will be of concern to hedgers, both for determining the hedge position for the spot commodity and identifying the appropriate deliverable commodity to use for the cash-futures basis. Because of possible variation in the quality basis, futures contracts with multiple delivery specifications must provide an acceptable method to account for changes in the quality basis of deliverable commodities. The quality basis is also of relevance for some financial commodities. For example, because the contract permits a range of bonds to be deliverable, delivery arbitragers in Tbonds require quality basis information for determining the cheapest Tbond to deliver.

Another related type of basis relationship is the ***location basis*** which refers to the difference between the price of the same commodity at two different locations, e.g., live hogs in Des Moines and Chicago, winter wheat in Topeka and Kansas City. An example of a location basis is provided in Figure 3.7 for No. 1 Canola in Vancouver ($481.30/tonne) and in Thunder Bay ($473.60/tonne). For many of the non-financial commodities, including canola, transportation costs have an important impact on the location basis. In addition to transport costs, a number of other factors can impact the location basis, such as local supply and demand considerations. Information on the behavior of the location basis is important for hedgers to determine hedging strategies. For hedgers, the relevant location basis is the difference between the local price of the relevant spot commodity being hedged and the price of the commodity deliverable against the futures contract. Where multiple delivery locations are permitted, the location basis can also be important for determining which location is the cheapest for purposes of making delivery. For many commodities, grade and location basis are combined, such as W. Texas Intermediate crude oil in Cushing, Okla. at $19.75 per barrel and Brent Sea crude at $17.85 per barrel in Rotterdam (see Figure 3.8).

When referring to ***the basis***, without further adjectives, reference is usually being made to the difference between an appropriate forward or futures price and the cash price: $F(0,T) - S(0)$. This form of basis is also referred to as the cash basis or the cash-futures/cash-forward basis. Certain markets have specialized terminology for the basis, e.g., in FX markets the basis is referred to as the swap rate or swap points. Comparing the cash prices in Figures 3.6-3.8 with the futures prices for grain and oil in Figures 3.9-3.10 reveals that, when the price of the deliverable spot commodity is correctly identified, the nearby futures contract price is often almost identical with the spot price of the appropriate deliverable commodity. To make the relevant comparisons needed to evaluate the basis, it is necessary to identify the deliverable commodity associated with the futures contract of interest by referencing the contract specifications from the relevant exchange website. This exercise will reveal that, even though it is not always possible to precisely reconcile cash market quotes with futures markets quotes, various commodities such as gold, silver, crude oil, and soybean meal do exhibit a near zero maturity basis.

Figure 3.9 **Futures Prices for Grains and Oilseeds**

Monday, August 8, 1994

Open Interest Reflects Previous Trading Day

GRAINS AND OILSEEDS

CORN (CBT) 5,000 bu.; cents per bu.

	Open	High	Low	Settle	Change	Lifetime High	Lifetime Low	Open Interest
Sept	216¼	222½	215½	219¾	+ 2½	292¼	214¾	39,811
Dec	218½	225¼	217¾	222¾	+ 3	277	217	123,332
Mr95	226½	233¾	226½	231½	+ 3	282½	226	24,926
May	233¼	240¼	233	238¼	+ 3¼	285	232½	10,169
July	237½	244¾	237	242½	+ 3¼	285½	236½	9,160
Sept	245	245	244	244	+ 3	270½	239	610
Dec	241¾	247	241¾	245¼	+ 2½	263	235½	4,920
Dc96	....	....	....	243	+ 2	257	239	129

Est vol 50,000; vol Fri 22,558; open int 213,057, −906.

OATS (CBT) 5,000 bu.; cents per bu.

	Open	High	Low	Settle	Change	Lifetime High	Lifetime Low	Open Interest
Sept	118¼	121	118¼	120¼	+ ¾	154½	111½	5,327
Dec	119¾	122	119¾	121	+ ¼	157¼	116	6,882
Mr95	126¾	127½	126¼	126¼	+ ½	152¾	121½	483
May	....	....	....	129¾	+ ¼	151	125	1,025

Est vol 2,000; vol Fri 1,606; open int 13,657, −81.

WHEAT (CBT) 5,000 bu.; cents per bu.

	Open	High	Low	Settle	Change	Lifetime High	Lifetime Low	Open Interest
Sept	333½	336½	333	334½	....	357¼	302	14,594
Dec	347	350½	346½	348¼	− ½	365	309	35,556
Mr95	354	357	353½	354½	− ¾	364½	327	9,145
May	349	349¾	347	348¾	− 2	356½	325	557
July	331½	332½	331¼	332	− ½	342¾	311½	1,135

Est vol 11,000; vol Fri 9,206; open int 60,989, −275.

WHEAT (KC) 5,000 bu.; cents per bu.

	Open	High	Low	Settle	Change	Lifetime High	Lifetime Low	Open Interest
Sept	344½	347	343¾	344¾	− ¼	355	302½	15,052
Dec	352¾	354½	351	351¾	− 1	360	312½	16,992
Mr95	353	354½	352¾	352½	....	359½	326½	5,189
May	346	346	345	345	+ 2½	346½	321½	418
July	332½	332½	332	332	+ ¾	343	316½	389

Est vol 4,431; vol Fri 6,054; open int 38,042, −252.

WHEAT (MPLS) 5,000 bu.; cents per bu.

	Open	High	Low	Settle	Change	Lifetime High	Lifetime Low	Open Interest
Sept	342	344	341	342¾	....	358	300	6,124
Dec	345	347½	344¾	346¼	+ ¾	360	304	5,359
Mr95	351	352	350	351½	+ 1½	363	325¼	683

Est vol 2,649; vol Fri 2,564; open int 12,264, −356.

RICE-ROUGH (MCE) 2000 cwt; $ per cwt

	Open	High	Low	Settle	Change	Lifetime High	Lifetime Low	Open Interest
Sept	6.580	6.580	6.550	6.580	− .010	10.100	5.990	1,008
Nov	6.730	6.800	6.730	6.780	+ .055	9.650	5.950	930
Ja95		....	....	6.990	+ .040	9.700	6.230	122
Mar		....	....	7.180	+ .040	9.630	6.340	480

Est vol 100; vol Fri 187; open int 2,624, −89.

CANOLA (WPG) 20 metric tons; Can. $ per ton

	Open	High	Low	Settle	Change	Lifetime High	Lifetime Low	Open Interest
Aug	394.00	404.00	394.00	404.00	+ 15.00	514.50	321.50	623
Sept	366.00	382.40	366.00	381.40	+ 13.20	412.00	315.00	7,047
Nov	361.50	377.50	361.50	375.70	+ 12.40	401.00	316.00	26,829
Ja95	364.00	379.00	364.00	376.00	+ 11.40	401.50	317.50	9,829
Mar	367.00	380.00	367.00	378.10	+ 11.10	403.90	331.00	11,444
June	380.50	383.70	376.00	381.00	+ 11.30	409.50	346.50	1,887

Est vol 5,625; vol Fri 3,700; open int 57,659, +714.

SOYBEANS (CBT) 5,000 bu.; cents per bu.

	Open	High	Low	Settle	Change	Lifetime High	Lifetime Low	Open Interest
Aug	574½	588½	574	584	+ 7½	735	571¼	7,519
Sept	562½	577	562½	570¾	+ 4¼	708½	560½	14,448
Nov	557	569	556	563¼	+ 3	699	551	71,774
Ja95	565½	576½	564	571¼	+ 2¾	704	560	11,040
Mar	573	585	573	580½	+ 3	705	569	4,068
May	580	591½	580	587¼	+ 3¼	705½	575½	3,094
July	585	596	585	590¾	+ 3	706½	578½	5,571
Aug	588	591	588	590½	+ 2½	594½	579	128
Nov	589½	595½	589	592	+ 2½	645	578½	2,610

Est vol 50,000; vol Fri 27,974; open int 120,274, + +171.

SOYBEAN MEAL (CBT) 100 tons; $ per ton.

	Open	High	Low	Settle	Change	Lifetime High	Lifetime Low	Open Interest
Aug	174.00	175.90	173.30	174.90	+ .20	225.00	173.30	8,491
Sept	171.70	174.90	171.60	173.30	+ .60	210.00	171.60	19,098
Oct	171.00	173.90	170.80	172.00	+ .40	207.50	170.80	10,081
Dec	170.70	174.00	170.70	172.20	+ .80	209.00	170.60	31,963
Ja95	171.50	174.40	171.50	173.00	+ .60	207.50	171.50	4,527
Mar	173.50	176.00	173.30	174.90	+ .60	207.50	173.00	4,971
May	174.80	176.80	174.50	175.20	+ .20	207.00	174.00	3,178
July	175.90	179.00	175.90	177.20	+ 1.20	206.00	175.80	1,595
Aug	179.50	179.50	179.50	178.50	+ 1.70	181.30	178.00	108

Est vol 20,000; vol Fri 15,593; open int 84,036, +593.

SOYBEAN OIL (CBT) 60,000 lbs.; cents per lb.

	Open	High	Low	Settle	Change	Lifetime High	Lifetime Low	Open Interest
Aug	24.60	24.84	24.49	24.54	− .12	30.65	21.65	4,739
Sept	24.55	24.82	24.45	24.49	− .11	30.34	22.40	22,168
Oct	24.30	24.60	24.21	24.30	− .10	29.54	22.10	15,528
Dec	23.95	24.39	23.90	24.07	+ .04	28.87	22.00	36,035
Ja95	23.95	24.25	23.90	24.05	+ .05	28.55	22.65	4,344
Mar	23.97	24.24	23.92	24.03	+ .01	28.30	22.95	4,808
May	23.90	24.04	23.90	23.99	− .01	28.05	22.93	3,510
July	23.85	24.05	23.85	23.96	+ .04	27.85	23.00	1,583
Aug	23.75	24.10	23.75	23.90	+ .10	27.20	22.95	154

Est vol 22,000; vol Fri 20,625; open int 92,922, −2,168.

Source: *Wall Street Journal*, Monday, August 8, 1994.

Figure 3.8 **Oil Complex Futures Prices**

CRUDE OIL, Light Sweet (NYM) 1,000 bbls.; $ per bbl.

Sept	19.35	19.70	19.35	19.42	+ .11	20.78	14.50	86,504
Oct	na	19.35	19.06	19.10	+ .13	20.73	14.65	62,136
Nov	na	19.05	18.84	18.87	+ .15	20.69	14.82	33,481
Dec	na	18.85	18.64	18.68	+ .16	21.25	14.93	47,835
Ja93	na	18.66	18.49	18.53	+ .17	20.12	15.15	22,220
Feb	na	18.53	18.38	18.44	+ .18	19.60	15.28	14,297
Mar	na	18.45	18.30	18.37	+ .19	20.66	15.42	14,039
Apr	na	18.37	18.25	18.31	+ .20	19.68	15.55	6,516
May	na	18.30	18.24	18.27	+ .20	19.23	15.69	9,622
June	18.30	18.32	18.27	18.26	+ .20	21.21	15.73	19,267
July	na	18.32	18.25	18.27	+ .20	18.85	16.28	6,554
Aug		....	....	18.28	+ .20	18.85	16.90	4,600
Sept	18.35	18.35	18.35	18.29	+ .20	19.84	16.28	7,002
Oct		....	....	18.30	+ .20	20.08	16.42	2,192
Nov		....	....	18.32	+ .20	18.87	17.15	3,507
Dec	18.40	18.45	18.40	18.34	+ .20	20.80	16.50	17,754
Ja96		....	....	18.37	+ .21	18.89	18.35	749
Feb		....	....	18.40	+ .22	18.84	18.84	376
Mar		....	....	18.43	+ .22	18.80	17.15	5,132
June		....	....	18.49	+ .22	20.40	17.22	12,218
Dec		....	....	18.73	+ .24	20.40	17.65	21,007
Ju97	na	19.00	19.00	19.00	+ .29	19.60	18.50	6,200

Est vol 90,686; vol Fri 152,056; open int 403,208, −3,516.

HEATING OIL NO. 2 (NYM) 42,000 gal.; $ per gal.

Sept	na	.5060	.4950	.4985	+ .0067	.5717	.4380	32,980
Oct	na	.5130	.5075	.5085	+ .0073	.5730	.4490	19,861
Nov	na	.5230	.5190	.5190	+ .0068	.5630	.4600	14,438
Dec	na	.5380	.5290	.5290	+ .0039	.5900	.4680	26,556
Ja95	na	.5390	.5345	.5345	+ .0039	.5850	.4745	15,521
Feb	na	.5410	.5375	.5355	+ .0039	.5875	.4795	5,500
Mar	na	.5335	.5270	.5260	+ .0034	.5750	.4700	6,049
Apr	.5225	.5235	.5200	.5165	+ .0029	.5500	.4525	1,775
May	.5200	.5200	.5110	.5095	+ .0029	.5350	.4700	2,094
June	na	.5120	.5090	.5060	+ .0029	.5300	.4679	4,458
July	.5115	.5130	.5110	.5080	+ .0029	.5290	.4785	4,635
Aug	.5200	.5200	.5165	.5150	+ .0029	.5390	.4740	809
Sept	.5295	.5295	.5265	.5240	+ .0029	.5060	.4845	669
Dec		....	....	.5495	+ .0029	.5265	.5370	1,096

Est vol 32,038; vol Fri 67,508; open int 136,525, +816.

GASOLINE-NY Unleaded (NYM) 42,000 gal.; $ per gal.

Sept	.5810	.5920	.5805	.5844	+ .0023	.6105	.4390	42,076
Oct	na	.5560	.5475	.5493	+ .0016	.5750	.4310	17,173
Nov	na	.5300	.5240	.5265	+ .0044	5480	.4275	11,869
Dec	na	.5790	.5720	.5770	+ .0049	.6000	.5080	6,817
Ja95	na	.5660	.5600	.5635	+ .0034	.5860	.5080	2,622
Feb	na	.5580	.5550	.5585	+ .0029	.5825	.5110	1,750

Est vol 20,713; vol Fri 39,678; open int 82,307, −598.

Having established the correspondence between the prices of the cash and nearby futures contract, examine Figures 3.9-3.10 to determine the behavior of prices for futures contracts as delivery dates get progressively more deferred. Significant deviations between spot and futures prices can be observed. For example, in Figure 3.9 soybean futures prices exhibit a pattern related to the soybean harvest cycle. In Figure 3.10, heating oil exhibits futures prices that are seasonal. The precise pattern of the futures price deviations for different delivery dates varies considerably across commodities, e.g., the financial commodities, including the precious metals, exhibit futures prices that increase or decrease monotonically. The basis relationship between the prices of futures contracts for different delivery dates is the ***futures basis***. An essential objective of Chapter 4 is to demonstrate how the basis and the futures basis are determined by arbitrage considerations. More precisely, differences in the basis and the futures basis will be determined by the specific arbitrage trades applicable to the commodity involved.

3.4 Speculation and Hedge Funds

What is a Hedge Fund?

An excerpt from the testimony given by George Soros to the US House Committee on Banking, Finance and Urban Affairs, 13 April 1994.

I must state at the outset that I am in fundamental disagreement with the prevailing wisdom. The generally accepted theory is that financial markets tend toward equilibrium and, on the whole, discount the future correctly. I operate using a different theory, according to which financial markets cannot possibly discount the future correctly because they do not merely discount the future; they help to shape it. In certain circumstances, financial markets can affect the so-called fundamentals which they are supposed to reflect. When that happens, markets enter into a state of dynamic disequilibrium and behave quite differently from what would be considered normal by the theory of efficient markets. Such boom/bust sequences do not arise very often, but when they do they can be very disruptive, exactly because they affect the fundamentals of the economy …

Generally, *hedge funds* do not act as issuers or writers of derivative instruments. They are most likely to be customers. Therefore, they constitute less of a risk to the system than the dynamic hedgers at the derivatives desks of financial intermediaries. Please do not confuse dynamic hedging with hedge funds. They have nothing in common except the word “hedge”.

I am not here to offer a blanket defence for hedge funds. Nowadays the term is applied so indiscriminately that it covers a wide range of activities. The only thing they have in common is that the managers are compensated on the basis of performance and not as a fixed percentage of assets under management.

Our type of hedge fund invests in a wide range of securities and diversifies its risks by hedging, leveraging and operating in many different markets. It acts more like a sophisticated private investor than an institution handling other people’s money. Since it is rewarded on absolute performance, it provides a healthy antidote to the trend-following behavior of institutional investors …

But the fee structure of hedge funds is not perfect. Usually there is an asymmetry between the upside and the downside. The managers take a share of the profits, but not of the losses; the losses are usually carried forward. As a manger slips into minus territory, he has a financial inducement to increase the risk to get back into the positive fee territory, rather than to retrench as he ought to. This feature was the undoing of the hedge fund industry in the late 1960’s, just as I entered the business.

The term "hedge fund" is generic, being used to describe a variety of different fund strategies that loosely share some similar characteristics. The PWGFM (p.40) defines the term "to refer to a variety of pooled investment vehicles that are not registered under the federal securities laws as investment companies, broker-dealers, or public corporations". Both of these features, pooled investment vehicle and absence of registration, is important to identifying whether a given fund qualifies as a hedge fund. More precisely, in order to avoid the registration requirements specified under US federal securities laws for securities companies, hedge funds have to be privately structured and closely held. As such, the primary investors in hedge funds are high net worth individuals and institutional investors.

The President's Working Group (1999) on Hedge Funds

Hedge funds are not a recent invention, as the founding the first hedge fund is conventionally dated to 1949. A 1968 survey by the Securities and Exchange Commission identified 140 hedge funds operating at that time. During the last two decades, however, the hedge fund industry has grown substantially. Although it is difficult to estimate precisely the size of the industry, a number of estimates indicate that as of mid-1998 there were between 2,500 and 3,500 hedge funds managing between $200 billion and $300 billion in capital with approximately $800 billion to $1 trillion in total assets. Collectively, hedge funds remain relatively small when compared to other sectors of the US financial markets. At the end of 1998, for instance, commercial banks had $4.1 trillion in total assets; mutual funds had assets of approximately $5 trillion; private pension funds had $4.3 trillion; state and local retirement funds had $2.3 trillion; and insurance companies had assets of $3.7 trillion.

Hedge funds are not the only securities that seek such specific exemptions from US securities laws. For example, venture capital pools, asset securitization vehicles, family estate planning vehicles and investment clubs can receive such treatment. Another defining feature of hedge funds is the types of strategies that the funds pursue. Yet, in this area, hedge funds exhibit considerable variation. "The is no single market strategy or approach pursued by hedge funds as a group. Rather, hedge funds exhibit a wide variety of investment types, some of which use highly quantitative techniques while others employ more subjective factors" (PWGFM 1999).

The diversity of hedge fund strategies extends to the types of securities traded (PWGFM, p.9):

> Many hedge funds trade equity or fixed income securities, taking either long or short positions, or sometimes both simultaneously. A large number of funds also use exchange-traded futures contracts or over-the-counter derivatives, to hedge their portfolios, to exploit market inefficiencies, or to take outright positions. Still others are active participants in foreign exchange markets. In general, hedge funds are more active users of derivatives and of short positions than are mutual funds and many other classes of asset managers.

However, behind all the confusion about hedge fund typology, the basic intuition is relatively clear: hedge funds combine long positions is certain securities with short positions in other securities. Inherently, hedge fund strategies will, directly or indirectly, involve leveraging.

Hedge funds are not conventional investment vehicles. Investor liquidity is often compromised with "lock-up periods of one year for initial investors and subsequent restrictions on withdrawals to quarterly intervals" (Ackermann et al. 1999, p.834). The regulatory exemptions that hedge funds work under severely restricts the ability of hedge funds to advertise. Another untypical feature of hedge funds concern the management (Ackermann et al.1999):

> Hedge funds are ... characterized by strong performance incentives. On average, hedge fund managers receive a 1 percent annual management fee and 14 percent of the annual profits. For most funds this bonus incentive fee is paid only if the returns surpass some hurdle rate or "high-water mark" -- meaning there is no incentive fee until the fund has recovered from past losses. Although incentive fees and high-water marks could lead to excess risk taking under some conditions, there are countervailing forces that my dampen risk. Hedge fund managers often invest a substantial amount of their own money in the fund. Furthermore, the managers of US hedge funds are general partners, so they may incur substantial liability if the fund goes bankrupt.

In contrast to mutual funds which have been intensively studied, hedge funds have only started to receive attention, though work on managed futures funds and commodity pools, which started somewhat earlier, is also applicable,e.g., Irwin and Brorsen (1985), Elton, Gruber and Rentzler (1987), Edwards and Ma (1988), Irwin et

The MARhedge hedge fund categories

MARhedge is an important source of information and news about the hedge fund industry. Data available through MARhedge has been thoroughly examined in Ackermann et al. (1999). In order to provide some degree of organization to this mis-mash of hedge fund strategies, MARhedge (www. MARhedge.com), classifies hedge funds into eight broad categories:

Global Macro funds: take positions on changes in global economic conditions in equity, FX and debt markets. Use derivatives, including index derivatives, and leverage.

Global funds: similar to macro funds but targeted at specific regions, often involving stock picking.

Long-only (US Opportunistic) funds: are like traditional equity funds but with the hedge fund characteristics of leveraging and incentive fees for managers. Strategies for these funds include Value, Growth and Short-term trading.

Market-neutral funds: the basic objective of these funds is to be long in one group of securities and short in another group, such that market risk is controlled or neutralized. This can be done in a number of ways: by going long one group of stocks and short another group, seeking to benefit from superior stock picking skills; conversion arbitrages, which are long in underpriced convertibles and short in the underlying stocks; stock index arbitrages; and, fixed income arbitrages, which are long, say, off-the-run Treasuries, and short on-the-run Treasuries.

Sectoral hedge funds: have an industry focus; short-sale funds, which short sale over-valued securities, investing the balance in indexes or fixed income securities

Event-driven funds: target special situations, specifically distressed securities of firms in reorganization or bankruptcy as well risk trading in takeovers, e.g., buying the target and selling the acquirer.

Short Sales funds: the fund is positioned to benefit from market declines. These funds can be index driven or can be based on stock picking.

Funds of hedge funds: funds of hedge funds, sometimes leveraged.

Within each of these general group, a variety of different strategies could be pursued. Similarly, some funds may be involved in activities covering more than one fund category.

al. (1993), Edwards and Park (1996), Cornew (1988). Some useful recent studies directly on hedge funds include Klein and Lederman (1995), Fung and Hseih (1997, 2000), Brown et al. (1999), Schneweiss and Spurgin (1998), Ackermann et al. (1999), and Liang (2000). As useful overview of studies of hedge fund performance is given by Caldwell (1995, p.13):

> Considerable caution must be used when reviewing performance statistics for the hedge fund industry and its various segments. Even the best statistics are skewed by asset weighting (or lack thereof), voluntary selection and a strong survivorship bias. It's highly unlikely that hedge fund performance statistics accurately reflect the true, weighted average return to investors for any segment of this industry.

Though more recent studies have come some of the way to correcting these difficulties, there is still considerable uncertainly about how to measure and assess hedge fund performance.

History of Hedge Funds

In a sense, the essence of a hedge fund is inherent in the process of financial intermediation. Similarly, prior to the availability of derivatives for financial commodities, hedging of market risks for, say, a stock portfolio involved going short a similar bundle of stocks. Such practices date back to early trading in financial securities. Yet, the modern hedge fund has evolved considerably from these beginnings. Caldwell (1995) dates the beginning of the modern hedge fund to 1949, when Alfred Jones (1901-1989) set up a general partnership operating a fund with the requisite elements.[16] Prior to establishing this fund, Jones held led a full life. In addition to earning a Ph.D. in sociology from Columbia in 1941, Jones as an associate editor for Fortune and was a business writer for Time and other publications. Prior to this, Jones had travelled the world, including a stint as vice consul at the US embassy in Berlin during the early days of Hitler's reign.

Apparently, it was the research that Jones did for an article published by Fortune in March 1949 that provided the foundation for the establishment of his hedge fund. The research involved Jones interviewing many of the important players on Wall Street. The basic strategy guiding the fund was to combine short selling and leverage to create a relatively conservative investment portfolio aimed at capturing stock picking opportunities. At the time, this was a novel approach, given that both leverage and short sales were generally used to increase return variability, not reduce variability. Jones went beyond this to develop a measure of market exposure for his fund. The result was the first of the *market neutral* hedge funds.

Caldwell (1995, p.7) describes the Jones approach to fund management:

> Jones regularly calculated the exposure of his capital to market risk ... His method of quantifying market exposure is highly valued by traditional hedge fund managers for its intuitive relevance, yet it is largely ignored or misunderstood by academics and the financial media.
>
> Market exposure = (Long Exposure - Short Exposure)/ Capital
>
> A typical asset allocation for Jones would look like this: Given $1000 in capital, he would employ leverage to purchase shares valued at $1100 and sell shares short valued at $400. His gross investment of $1500 (150 percent of capital) would have a net market exposure of only $700 ($1100 - $400), making this portfolio "70 percent net long". Although Jones valued stock picking over market timing, he increased or decreased the net market exposure of his portfolio based on his estimation of the strength of the market. Since the market generally rose, Jones was generally "net long".

As with other modern hedge funds, there was an uncommonly high management fee. Though there was no high water marks or loss pay-backs, the 20% of realized profits to the general partner is in the realm of more recent arrangements. Similar with recent hedge funds, Jones also kept his entire investment capital in the fund, providing a strong managerial incentive for positive performance.

Jones introduced another innovation in 1954, reducing fund risk by bringing in other fund managers to run part of the portfolio, effectively starting the fund-of-funds approach to hedge fund management. Though there was oversight to ensure that duplication and cancellation was not happening, managers were given wide latitude to make investment decisions. Over the years, Jones would have as many as eight managers working the fund portfolio. With this move, the Jones fund became an incubator for new hedge fund creation. Two of his early selections, Dick Ratcliffe and Carl Jones, eventually moved on to start their own hedge funds, Ratcliffe establishing Fairfield Partners in 1965 and C. Jones establishing City Associates in 1964. Certain elements of hedge funds structure were adapted by other funds. For example, the notion of hedge fund management fees, i.e., incentive-based partnership agreements, was adopted by, among others, Warren Buffett with Buffett Partners and Walter Schloss with WJS Partners. Though possessing some elements of hedge funds, these funds did not regularly use short sales to create market neutral positions.

Caldwell (1995, p.9) identifies another turning point in hedge fund history as the publication of an article by C. Loomis in Fortune magazine in April 1966. This article detailed the performance of the Jones fund, demonstrating that this fund was easily the best performing fund over the previous five years, even when account was taken of the 20% management fees. Loomis also provided a reasonably accurate description of how the Jones fund was run. Fuelled on the demand side by sudden investor for such investment vehicles and on the supply side by fund managers attracted by the high management fees, the result was a wave of new hedge funds being created (Caldwell p.10):

> Although we don't know how many hedge funds were established in the three-year flurry following Loomis's article, estimates range from 140 to several hundred. Michael Steinhardt and George Soros were among those setting up funds at this time. The SEC found 215 investment partnerships in a survey for the year ending 1968 and concluded that 140 of

these were hedge funds, with the majority formed that year.

The market contraction that started at the end of 1968 and continued until the end of 1974 demonstrated that there was considerably more to running a hedge fund than desire and marketing. Considering just the 28 largest US hedge funds at year end 1968, within two years there had been five funds shut down, with fund asset values down 70% due to losses and withdrawals.

Some hedge funds survived the tough years between 1968 and 1974 while others foundered. Why? There are no detailed empirical studies of hedge fund strategies during this period. Hedge funds are closely held and such information was and is difficult to obtain. Anecdotal evidence is strongly in favour of the hypothesis that most fund managers did not adequately establish sufficient short positions. Many so-called hedge funds were decidedly long, not market neutral. In effect, these 'hedge funds' were more like traditional mutual funds, only with the high performance fees. Not surprisingly, the Renaissance in derivative securities has seen a remarkable resurgence of hedge funds. Armed with the new risk management technologies, e.g., VaR, a number of new style hedge funds actively use derivatives to leverage underlying capital. Yet, there is a vast number of hedge fund strategies in place, some of which are similar to the Jones model. Others, such as LTCM, are creatures of the Renaissance in derivative securities.

Regulation of Hedge Funds

The recent collapse of LTCM raised numerous quandries for regulators. For example, a formal legal definition of a hedge fund is lacking: "The term 'hedge fund' is not defined or used in the federal securities laws" (PWGFM, p.40). One of the attractive features of hedge funds is the avoidance of certain legalities associated with registration, information filing, taxes and so on. More precisely, a hedge fund can be characterized as a pooled investment vehicle, that is privately organized, closely held among a small number of partners and run by professional investment managers, typically on an incentive fee basis. Such funds are often domiciled outside the US, often being incorporated in havens such as the British Virgin Islands or Bermuda.

The various features of a hedge fund all interact to create a security that falls through many of the cracks in the US securities laws. In addition to the SEC Act, if properly created hedge funds also do not fall under the Investment Company Act:

> To maximize flexibility, hedge funds operating in the US are structured so as to be exempt from regulation under the Investment Company Act of 1940. Most hedge funds rely on the "private" investment company exclusions in Sections 3(c)(1) and 3(c)(7) of the Investment Company Act. These exclusion exempt certain pooled investment vehicles from the definition of "investment company" and from substantive regulation under the Investment Company Act.

The 3(c)(1) exemption used by many hedge funds require two qualifying factors: the number of investors may not exceed 100 and the fund cannot make a public offering of its securities. A 3(c)(7) exemption requires investors to have not less than $5 million in investments. Using this exemption would also further limit the number of investors to less than 500 to avoid an SEC filing rule.

Even though hedge funds do not fall within the scope of the SEC Act or the Investment Company Act, they still could be subject to a number of other US statutes. Indirectly, hedge funds are regulated through the regulations that are imposed on the array of financial institutions with which hedge funds need to conduct business. For example, the SEC imposes capital, margin and reporting requirements on broker-dealers, which are essential counter-parties or clearing members for hedge funds. Included among these requirements are risk assessment rules specified in the SEC Act to "establish record-keeping and reporting requirements for subject broker-dealers and their affiliates whose business activities are reasonably likely to have a material impact on the financial and operational conditions of the broker-dealer" (PWGFM, p.42).

One potential regulatory body for hedge funds is the CFTC. Yet, the scope of CFTC regulation is quite narrow. "The term hedge fund is not defined under the Commodity Exchange Act. Thus no rule of the CFTC applies specifically to hedge funds as a separate category of regulated entity. However, to the extent that hedge funds trade commodity futures or options interests and have US investors, their operators or advisors become subject to CFTC registration and reporting requirements" (PWGFM, p.49). These reporting requirements apply only to large positions held on markets regulated by the CFTC, and the associated speculative limits. There is no requirement that hedge funds report activities in other markets.

In addition to filing requirements, another aspect of CFTC regulation covers the operators of the hedge fund. Again the scope of regulation is somewhat narrow: "If hedge funds have US investors and trade commodity futures or commodity options, these funds would be commodity pools under the CEA. The CEA subjects the operators of commodity pools and their advisors -- but not the pools themselves -- to regulation" (PWGFM, p.49). The objective of the regulating commodity pool advisors is to protect investors against fraud and overreaching by fund managers. These regulations require registration, disclosure, reporting and record-keeping requirements, but does not include rules for capital adequacy or other financial standards.

Hedge Funds and Speculation

Due to the collapse of LTCM, hedge funds have attracted considerable recent attention from the popular press and policy makers. Yet, aside from some recent articles on hedge fund performance, little attention has been given to hedge funds in academic studies. The comparison with mutual funds, for which there are literally thousands of studies, is striking. This asymmetric treatment reflects an underlying asymmetry in what passes for the received theory of finance. Modern finance theory, starting with Markowitz and continuing with Sharpe and Fama, up to the present, depends fundamentally on the assumption of efficient markets. In this framework, investment vehicles that depend on speculative outcomes, such as hedge funds, are treated as anomalies. However, unlike other anomalies such as the January effect and the small firm effect, there is no cohesive economic rationale for hedge funds.

Financial theory is often motivated by the assumption of perfect markets. Numerous results, from the Modigliani-Miller theorems to the Black-Scholes option pricing model use this assumption. It is clean and efficient when seeking out theoretical results. Under perfect markets, there is no rationale for hedge funds. More precisely, a fund that is simultaneously long and short positions in a homogeneous commodity and its related derivatives can only earn the riskless rate of interest on the capital that is invested in the position. Such is the logic of the riskless hedge portfolio in Black-Scholes. Hedge funds arise in inefficient markets, driven by mis-pricing in different markets. There are numerous sources of the mis-pricing, from informational advantages to market liquidity to price noise to regulatory arbitrage. For example, the sheer size and volume of LTCM trades reflects the number of potential strategies.

All this is not meant to impugn the pure theory of finance. Rather, the objective is to recognize that the theory of speculation, in general, and hedge funds, in particular, lie outside the scope of conventional finance theory in the Markowitz tradition. The efficient markets hypothesis requires that appropriately discounted prices follow a random walk. Yet, speculators aim to profit from superior price forecasts. Current prices are not accurate forecasts of future prices, there is mis-pricing. Hedge funds are involved in shorting one portfolio and buying another portfolio, with the objective of achieving abnormal returns from the inherent leveraging. This process involves predicting the behavior of random variables: stock prices, exchange rates, interest rates and so on. The gambles involved are often sophisticated, involving combinations of prices for different commodities. Because random variables are involved, optimal speculation will implicitly be improved by incorporating some type of risk management, a point that was, apparently, overlooked by the Hunt Brothers, among others.

Questions

1. Discuss the distinction between investment, speculation and gambling. What are key elements that distinguish a speculative decision from the other two types of financial decisions?

2. Comment the contemporary implications of the following statement from Ben Graham in *The Intelligent*

Investor: "The distinction between investment and speculation in common stocks has always been a useful one and its disappearance is a cause for con
cern. We have often said that Wall Street as an institution would be well advised to reinstate this distinction and to emphasize it in all dealings with the public. Otherwise, the stock exchanges may some day be blamed for heavy speculative losses, which those who suffered them had not been properly warned against". To what extent does this comment also applying to trading in derivative securities?

3. As discussed in Sec. 6.1, a butterfly is a trade involving a spread of two calendar spreads, whereby the nearby spread is, say, short and the deferred spread is long. This would result in a trade that is long one nearby contract, short two intermediate contracts and long one deferred contract. Using current market prices, explain how a butterfly trade can be used to speculate on the seasonal basis in oil complex contracts.

NOTES

1. However, despite the considerable theoretical motivation, to date little attention has been given the trading mechanics that support the unbiased prediction hypothesis. From a trading perspective, the underlying strategies are naive. Violation of (4) induces a long *wi* trade when *wi* prices are greater (*wi* rates lower) than expected tbill auction prices. A short *wi* trade is initiated when *wi* prices are lower (*wi* rates higher) than expected auction prices. Given the risks of these "naked position" strategies relative to other available strategies (e.g., Yano 1989), there would have to significant information-induced discrepancies to generate sizable trading activity. At best, such events would be discrete.

2. Relevant works include Working (1949), Brennan (1958), Muth (1961), Weymar (1968), Danthine (1978), Pickett (1979) and Turnovsky (1983).

3. These participant categories are not mutually exclusive. For example, it is possible for the same trader to engage in arbitrage and hedging activities, just as it is possible for hedgers to also be speculators.

4. In practice, the terms normal backwardation and contango are used to describe a number of different notions. In addition to the Keynes/Hicks usage that refers to futures prices being downward biased predictors (normal backwardation) or upwardly biased predictors (contango), these terms are also used to refer to the relationship between current spot and futures prices. In cases where futures prices for succeedingly more distant deliveries get high, the futures market is said to be in *contango*. When the futures prices fall as more distant deliveries are considered, the market is said to be in *backwardation*. Following a discussion provided by Hicks, the notion of normal backwardation is also applied to the term structure of interest rates where normal backwardation refers to higher yields for longer maturity bonds, i.e., the term structure is upward sloping when the level of interest rates is expected to be unchanged. The 'insurance premium' in this case is typically attributed to a liquidity premium embedded in shorter maturity securities.

5. The early, empirically motivated debate on the normal backwardation hypothesis included Telser (1958), Rockwell (1967), Cootner (1960,1967) and Houthakker (1968).

6. Included in this literature are Bilson (1981), Hansen and Hodrick (1980), Geweke and Feige (1979), Hakkio (1981), Baille, et.al. (1981), Gregory and McCurdy (1984) and Boothe and Longworth (1986).

7. A Futures and Options Trading Game is available at www.sfu.ca/~poitras which is designed to familiarize students with some of the more well known spreading strategies.

8. Calendar spreads are also sometimes referred to as futures straddles, e.g., Peterson (1977). However, both these terms also refer to option trading strategies. Schwager (1984, Chap. 30-4) and Poitras (1994, Chap. 3) provide a general overview of spread trading techniques.

9. The soy crush spread involves trading the value of soybean contracts against the value of soybean meal and soybean oil contracts. The production relationship is defined by the number of pounds of meal and oil that is obtained when one bushel of soybeans is crushed. The crack spread connects the value of a crude oil contract with the gasoline and heating oil contracts. This spread refers to the process of "cracking" or distilling a barrel of oil into various components, the most important of which are heating oil and gasoline. Other types of possible production relationship spreads are discussed in Tzang and Leuthold (1990) and Schap (1992).

10. There are a number of pitfalls in the interpreting the spread trade profit function. For example, if the t=0 difference between the deferred and the nearby prices were negative, then profitability for the short nearby/long deferred spread would require that the absolute difference between the prices narrow.

11 It is not possible to deal adequately with the various issues that are raised here. For example, direct comparison of the *irr* and the actual repo rate is distorted because the various seller's options to select the cheapest deliverable Tbond. In addition to illustrating how to derive the *irr* from Tbond futures, Siegel and Siegel (1990) also provide a more complete development the *irr* - R relationship.

12. Yano (1989) provides an excellent discussion of these and various other strategies.

13. Even though the following discussion is presented in terms of futures contracts, the relevant concepts also apply directly for forward contracts. However, the diversity of forward trading requires numerous secondary qualifications and asides to be introduced that obscure the presentation of the essential points. For this reason, futures contracts are used.

14. The specifications for the Tbond deliverable often are stated as 20 years to call. However, due to the introduction of strip issues in the mid-80's, the US Treasury dropped the use of the 5 year call provision on long term bonds. Presently, there are no callable Tbonds eligible for delivery. Hence, the 15 year maturity is applicable.

15 A number of useful studies, both theoretical and empirical are available on multiple delivery specifications and the cheapest deliverable application, e.g., Hemler (1990), Chance and Hemler (1993), Cita and Lien (1992), Kamara and Siegel (1987), Lien (1989a,b), Cornell (1997).

16 The fund was converted to a limited partnership in 1952.