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Hedge Fund Concepts and a Typical Trade

In the first of three columns focusing on hedge funds, general ideas, types of fund and a successful trade are discussed

Hedge funds are pooled investments that attempt to obtain superior returns for their mostly wealthy investors. The general partner runs the fund and collects fees to compensate for expenses, management fee and superior performance. Typically, the general partner is an investor in the fund. This is called eating your own cooking. Standard fees are 1 to 2 per cent for expenses and a performance fee of 20 per cent of the net new profits (above a high water mark). On occasion, funds return fees not earned after a period of time but this is more rare. The top funds are in a strong bargaining position with investors desperate for good steady returns. Renaissance's $6.7 billion Medallion Fund recently raised performance fees to 44 per cent from 36 per cent. Despite high fees, Medallion has gained 36 per cent net per year since its inception in 1988. The $10 billion Caxton Global has netted investors over 25 per cent per year since 1986. They recently raised the expense fee from 2 to 3 per cent and the incentive from 20 to 25 per cent. Both of these funds are closed to new investors. Medallion recently reduced its size to $5 billion by returning $1.7 billion to investors to help increase its returns which have been dropping because of too much money relative to opportunities. This can be a dangerous practice if leverage is increased as Long Term Capital Management discovered in 1998 (this will be discussed in a later column).

Investment by the general partner in the fund tends to give investors added confidence in that the incentive is to perform well and it dampens the incentive of the manager to take excessive risks which helps the general partner as well as the investors. In addition it is convenient for the general partner to store fees collected month by month or quarter by quarter in the fund. Still a hedge fund can be considered to be a call option on the profits associated with managing other people's money since the fee structure gives the general partner the incentive to take risks that lead to profits that lead to large fees and no negative fees with losses except on their own money invested. In the last two decades, the hedge fund industry has grown explosively. The first official hedge fund was established in 1949. But unofficial hedge funds have existed for much longer. By the late 1980s, the number of funds had increased to about 100. In 1997 there were more than 1200 hedge funds, managing a total of more than $200 billion. Currently, hedge funds have over $500 billion in assets.

Though the number and size of hedge funds are still small compared to mutual fund industry, their growth reflects the importance of alternative investments for institutional investors and wealthy individuals. In addition,

hedge funds frequently exert an influence on financial markets that is much greater than their size. An important example is the collapse of the Long-Term Capital Management hedge fund in 1998, which jeopardized several large financial institutions and was considered a threat to the world economy by the US Federal Reserve. Hence, the study of risk taking in the hedge fund industry is relevant for the financial system as a whole.

The name hedge fund is misleading since a hedge fund is basically a vehicle to trade a pool of money from a number of investors in various financial markets.

Some hedge funds actually use hedging such as those using long/short or convergence trades. Others, called macro funds, use strategies that take directional bets on currencies, stock indices, etc. A list of ten distinct types of hedge funds appears in Table 1

Since 1995, a number of academic studies have tried to estimate the returns and risks of investing in hedge funds (Fung and Hsieh, 1997, Brown, Goetzman and Ibbotson, 1999, Ackerman, McEnally and Ravenscraft, 1999, Liang, 1998 and Agarwal and Naik 1999, Amin and Kat, 2001). Obtaining data for empirical studies has been difficult, as hedge funds are not required to report their returns to the public. As a result, each study typically investigates a subset of the total hedge fund universe, depending on which data happened to be available. Good academic databases are at the University of Massachusetts (contact Tom Schneeweis) and the London Business School (contact Narayan Naik).

In general, the empirical studies seem to agree on one very important point: hedge funds significantly improve the tradeoff between risk and return, when added to a traditional portfolio of bonds, mutual funds and stock indices. This is due to the fact that some hedge funds have relatively little exposure to sources of general market risk. Except for Ackerman, McEnally and Ravenscraft (1999), the studies also find that individual hedge funds provide better risk-adjusted performance (after fees) than a broadly diversified stock index, usually the S&P500.

There is not much persistence in hedge fund performance: winners may easily become losers (Brown, Goetzman and Ibbotson 1999, Liang 1998, Agarwal and Naik 2000, Amin and Kat, 2001). Although the hedge fund industry as a whole provides good opportunities for investors, some successful hedge fund managers tend to lose their magic now and then. A well-known and noteworthy example of a winner that turned into a loser is Long Term Capital Management (Edwards 1999, Jorion 1999, Ross, 1999 and Ziemba, 1999). Julian Robertson's Tiger and George Soros's Quantum funds effectively closed in 2000 after bad returns following many years of high returns. Quantum lost about 5 billion of its $13 billion size shorting the Nasdaq too soon. Had they started shorting about two months later in April 2000, they could possibly have made ten times this amount. Timing and mean returns once again are the key elements of successful investing with good risk control essential for hedge funds. In addition, the real risk in hedge funds that are highly levered through borrowing or derivatives is frequently greatly understated by the monthly or quarterly reporting periods and by using risk measures such as the standard deviation or the Sharpe ratio which are based on normality which readers of *Wilmott* know is inadequate to measure the fat tails of real markets.

The theoretical literature about hedge funds is relatively small. (Risk control and trading strategy references will be in a later column.) Typically, papers focus on

1. the optimal fee structure for investment funds: Heinkel and Stoughton (1994), Maug and Naik (1995) and Dybvig, Farnsworth and Carpenter (2000);

2. exploiting arbitrage opportunities with restrictions on short selling: Liu and Longstaff (2000) and Loewenstein and Willard (2000); and

3. applying option pricing to calculate the value of the incentive-fees paid to hedge fund managers: Goetzmann, Ingersoll and Ross (1998).

Heinkel and Stoughton (1994), Maug and

TABLE 1: SELECTED TYPES OF PURE HEDGE FUND STRATEGY CATEGORIES, MODIFIED FROM AGARWAL AND NAIK (1999)

1. Market Neutral Strategies

- Fixed Income Arbitrage: long and short bond positions via cash or derivatives markets in government, corporate and/or asset-backed securities. The risk varies depending on duration, credit exposure and the degree of leverage.
- Event Driven: a strategy that attempts to benefit from mispricing arising in different events such as merger arbitrage, restructurings, etc. Positions are taken in undervalued securities anticipated to rise in value due to events such as mergers, reorganizations, or takeovers. The main risk is non-realization of the event.
- Equity Convergence Hedge: investing in equity or equity derivative instruments whose net exposure (gross long minus short) is low. The manager may invest globally, or have a more defined geographic, industry or capitalization focus. The risk primarily pertains to the specific risk of the long and short positions.
- Restructuring: buying and occasionally shorting securities of companies under Chapter 11 and/or ones which are undergoing some form of reorganization. The securities range from senior secured debt to common stock. The liquidation of financially distressed companies is the main source of risk.
- Event Arbitrage: purchasing securities of a company being acquired and shorting that of the acquiring company. This risk relates to the deal risk rather than market risk.
- Capital Structure Arbitrage: buying and selling different securities of the same issuer (e.g. convertibles/common stock) attempting to obtain low volatility returns by exploiting the relative mispricing of these securities.

2. Directional Strategies

- Macro: an attempt to capitalize on country, regional and/or economic change affecting securities, commodities, interest rates and currency rates. Asset allocation can be aggressive, using leverage and derivatives. The method and degree of hedging can vary significantly.
- Long: a growth, value, or other model approach to investing in equities with no shorting or hedging to minimize market risk. These funds mainly invest in emerging markets where there may be restrictions on short sales.
- Long Bias: similar to equity convergence but a net long exposure.
- Short: selling short over-valued securities attempting to repurchasing them in the future at a lower price.

Naik (1995) and Dybvig, Farnsworth and Carpenter (2000) investigate the relationship between fee contracts and fund management. These papers apply the principal-agent framework developed by Ross (1973) in order to derive the optimal management contract from the point of view of the investor.

Liu and Longstaff (2000) and Loewenstein and Willard (2000) investigate the equilibrium impact of investors that exploit arbitrage opportunities (hedge fund managers). In the model of Loewenstein and Willard (2000) hedge fund managers provide liquidity to instutional investors who face uncertain cash withdrawals. Liu and Longstaff (2000) investigate a market with a pure arbitrage opportunity and hedge fund managers that face restrictions on short selling. Similar studies about the risks of arbitrage strategies can be found in Shleifer (2000).

Goetzmann, Ingersoll and Ross (1998) develop a continuous time Black Scholes like environment to model the high water mark incentive system used by many hedge funds. That is, fees are a flat amount per unit of time plus an incentive that is a percentage above a benchmark (which they take to be zero). It is assumed that the hedge fund returns the mean rate of return of the market and goes on forever with continuous redemptions unless it is closed by poor return scenario outcomes. Given these assumptions, the paper estimates the value of the fees paid to the manager as a call option on the investor's wealth.

Gamblers as hedge fund managers

I have been fortunate to work and consult with four individuals who used investment market anomalies and imperfections and hedge funds ideas to turn a humble beginning with essentially zero wealth into hundreds of millions. Each had several common characteristics: a gambling background obtained by playing blackjack professionally and a very focused, fully researched and computerized system for asset position selection and careful attention to the possibility of loss. Each of these individuals focused more on not losing rather than winning. Two were relative value long/short managers consistently eaking out small edges who extensively used derivatives. One was a futures trader taking bets on a large number of liquid financial assets based on favorable trends (interest rates, bonds and currencies were the best). The fourth was a Hong Kong horse race bettor; see Benter's paper in Hausch, Lo and Ziemba (1994). Their gambling backgrounds led them to conservative investment behavior and excellent results both absolute and risk adjusted. They have their losses but rarely do they overbet or non-diversify enough to have a major blow out like the hedge fund occurrences. Good systems for diversification and determination of bet size such as that discussed in later columns in *Wilmott*. All of them used versions of the Kelly criterion in some way. I designed such a system that was implemented by the futures trader to optimize bets over the ninety most liquid futures markets that he traded.

Dr Edward O. Thorp, a mathematician with a PhD from UCLA and a fellow contributor to *Wilmott*, became famous in 1960 for devising a simple to use card counting system for beating the card game blackjack, see Thorp (1962). In 1966 Thorp wrote a follow-up to *Beat the Dealer* called *Beat the Market* which outlined a system for obtaining edges in warrant markets, and some of these ideas were obviously used in his hedge fund, Princeton Newport Partners (PNP) trading. Thorp wrote the foreword to my book with Donald Hausch, *Beat the Racetrack* published in 1984 which provided a simple to use winning system for racetrack betting based on weak market inefficiencies in the more complex place and show markets using probabilities estimated from the simpler win market. The PNP hedge fund, with offices in Newport Beach, California and Princeton, New Jersey, was run from 1969 to 1988 using a variety of strategies, many of which can be classified as convergence or long-short. See Figure 1 for the annual record of the PNP. As discussed in previous issues of *Wilmott*, there is more, including Thorp's recent record, but this figure illustrates my points. Actual trades and positions used by Dr Thorp and his colleagues are not public information, but a trade that Thorp and I jointly executed based on my ideas folllows which gleans some idea of the approach used.

PNP gained 15.1 per cent net of fees (which were about 4 per cent given the 20 per cent of profits fee structure) versus 10.2 per cent for the S&P500 and 8.1 per cent for T-bills. An initial index of 100 as of November 1, 1969 became, at the end of December 1988, 148,200 in PNP versus 64,500 for the S&P500 and 44,500 for T-bills. But what is impressive and what is a central lesson of these columns, is that the risk control using various stochastic optimization procedures led to no years with losses. Of course, in comparison to Keynes, Figure 2 in my last column, PNP had a much easier market to deal with. For example only in 1973, 1974 and 1976 did the S&P500 have negative returns.

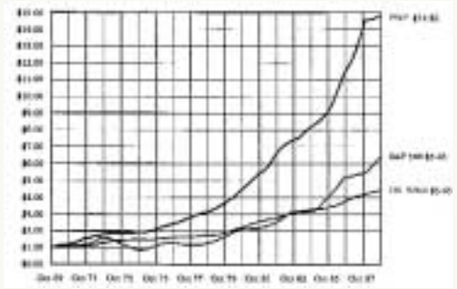

Figure 1. Princeton Newport Partners, L.P., Cumulative Results, November 1968–December 1988}

A typical convergence trade: the Nikkei put warrant market of 1989-90

Dr Thorp and I, with assistance from Julian Shaw (then of Gordon Capital, Toronto, now the risk control manager for Barclays trading in London), did a convergence trade based on differing put warrant prices on the Toronto and American stock exchanges. The trade was successful and Thorp won the over $1 million risk adjusted hedge fund contest run by Barron's in 1990. There were risks involved and hedge fund risk management care was needed. What follows is a brief description of the main points. Additional discussion and technical details appears in Shaw, Thorp and Ziemba (1995).

Japanese stock and land prices were astronomical and very intertwined, see Stone and Ziemba (1993) for more on this.

The historical development leading up to the NSA put warrants

● Tsukamoto Sozan Building in Ginza 2-Chome in central Tokyo is the most expensive land in the country with one square meter priced at Y37.7 million or about $279,000 U.S. at the (December 1990) exchange rate of about Y135 per U.S. dollar.
● Downtown Tokyo land values highest in the world, about $800 million an acre
● Office rents in Tokyo are twice those in London yet land costs 40 times as much
● Japanese stock market up 221 times in yen and 553 in dollars as measured by the Nikkei stock average from 1949 to end of 1989.
● Despite this huge rise, there had been twenty declines from 1949 to 1989 of 10 per cent or more. Plus two more in 1990 and two more in 1991. So the market was volatile. Stocks, bonds and land were highly levered with debt.
● There was a tremendous feeling in the West that the Japanese stock market was overpriced as was the land market. The Emperor's palace was reputed to be worth all of California or Canada. Japanese land was about 23 per cent of world's non-human capital. Japanese PE ratios were 60+.
● Various studies were made by academics and brokerage researchers to argue that the high prices of stocks and land were justified by higher long run growth rates and lower interest rates in Japan versus the US. See for example, Ziemba and Schwartz (1991) and French and Poterba (1991). However, similar models predicted a large fall in prices once interest rates rose from late 1998 to August 1990.
● Hence both must crash!
● There was a tremendous feeling in Japan that their economy and products were the best in the world.
● There was a natural trade in 1989, early 1990
— Westerners bet Japanese market will fall
— Japanese bet Japanese market will not fall

Various Nikkei put warrants which were three year American options were offered to the market to fill the demand by speculators who wanted to bet that the NSA would fall.

NSA puts and calls on the Toronto and American stock exchanges, 1989-1992

The various NSA puts and calls were of three basic types, see Table 2

The various puts are of three basic types. Let NSA_0 be the strike price and NSA_e the expiry price of the Nikkei stock average. Let E_0 be today's exchange rate and E_e be the exchange rate on expiry for Canadian or U.S. dollars into yen. The symbol $(X)^+$ means the greater of X or zero. Then we have

	US/Cdn Dollars	Puts	Calls	Terminology
I.	$a\left(\frac{NSA_0-NSA_e}{E_e}\right)^+$	BT-I, SEK, BTB, London OTC	PW	Ordinary
II.	$b\left(\frac{NSA_0-NSA_e}{E_0}\right)^+$	BT-III, BT-IV, TFC, DXA, EXW, SXA, SXO, PXB	Sal	Product
III.	$c\left(\frac{NSA_0 \cdot NSA_e}{E_0 \cdot E_e}\right)^+$	BT-II		Option to Exchange

	Puts
Canadian $, Toronto	BT-I, NK; BT-II, NKA; BT-III, NKB; BT-IV, NKC; TFC, SEK
US $, New!York	BTB, DXA, SXA, SXO, EXW

	In Yen	US/Cdn Person
I.	$a(NSA_0-NSA_e)^+$	Takes currency risk
II.	$b(NSA_0-NSA_e)^+ E_e/E_0$	No currency risk
III.	$c\left(\frac{NSA_0 \cdot NSA_e}{E_0 \cdot E_e}\right)^+ E_e$	Currency risk in!final!conversion in!strike!price

Table 2 NSA Puts on the Toronto and American Stock Exchanges, 1989-1992

Our convergence trades in late 1989 to early 1990 involved:

1. selling expensive Canadian currency Bankers Trust I's and II's and buying cheaper US currency BT's on the American Stock Exchange; and

2. selling expensive Kingdom of Denmark and Salomon I puts on the ASE and buying the same BT I's also on the ASE both in US dollars. This convergence trade was especially interesting because the price discrepancy was based mainly on the unit size and used instruments on the same exchange.

We performed a complex pricing of all the warrants which is useful in the optimization of the positions size, see Shaw, Thorp and Ziemba (1995).

Some of the reasons for the different prices were: Large price discrepancy across Canadian/U.S. border; Canadians trade in Canada, US's trade in U.S.; Different credit risk; Different currency risk; Difficulties with borrowing for short sales; Blind emotions vs reality; An inability of speculators to properly price the warrants

I's were ordinary puts traded in yen. II's were currency protected puts (often called quantos). III's were the Nikkei in Canadian or US dollars. The latter were marketed with comments like: you can win if the Nikkei falls, the yen falls or both. The payoffs in yen and in US/Cdn are shown in Table 2. A simulation in Shaw, Thorp and Ziemba (1995) showed that for similar parameter values, I's were worth more than II's, which were worth more than III's. But investors preferred the currency protected aspect of the II's and overpaid (relative to hedging that risk separately in the currency futures markets) for them relative to the I's. Figures 2 and 3 show the two convergence trades.

$$\text{RelativeCost} = \frac{\text{ActualCost} - \text{TheoreticalCost}}{\text{TheoreticalCost}}$$

when $\sigma = 20\%$ is plotted rather than implied volatility since the latter did not exist when there were deep in the money options trading for less than intrinsic as in this market. Fair value at 20 per cent NSA volatility and 10 per cent exchange rate volatility is zero on the graph. At one, the puts are trading for double their fair price. At the peak, the puts were selling for more than three times their fair price.

The BT-I's did not trade until January 1990 and in about a month the Canadian BT-I's and BT-II's collapsed to fair value and then the trade was unwound. The Toronto newspapers inadvertently helped us by pointing out that the Canadian puts were overpriced relative to the US puts so eventually there was selling of the Canadians, which led to the convergence to efficiency. To hedge before January 1990 one needed to buy an over the counter put from a brokerage firm such as Salomon who made a market in these puts. The NSA decline in 1990 is also shown in Figure 2. Additional risks of such trades are being bought in and shorting the puts too soon and having the market price of them go higher. We had only minor problems with these risks.

Fair value at 20 per cent NSA volatility and 10 per cent exchange rate volatility is zero on the graph. At one the puts are trading for double their fair price. At the peak, the puts were selling for more than three times their fair price.

For the second trade, the price discrepancy lasted about a month. The market prices were about $18 and $9 where they theoretically should have had a 5 to 2 ratio since one put was worth 20 per cent and the other 50 per cent and trade at $20 and $8. These puts were not identical so this

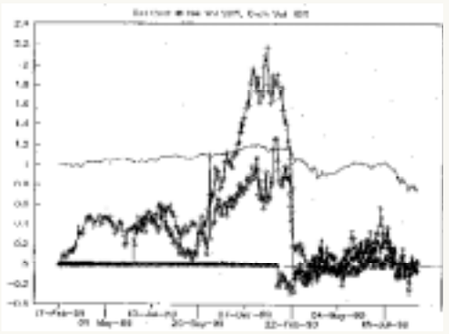

Figure 2: Relative costs of BT-I, BT-II and BTB NSA put warrants with NSA volatility of 20% and exchange rate volatility of 10%, 17 February 1989 to 21 September 1990. Key: (+) BT=I, type I, Canadian, (◇) BT-II, type III, Canadian and (△) BTB type I, US and (-) normalized Nikkei

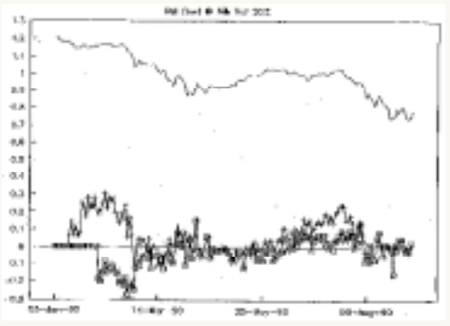

Figure 3: Relative costs of US type I (BTB) versus US type II (DXA, SXA, SXO) NSA put warrants with NSA volatility of 20%, January to September 1990. Key: ([]) BTB, type I, 0.5 NSA, (+) avg DXA, SXA, SXO, type II, 0.2 NSA, and, (-) normalized Nikkei.

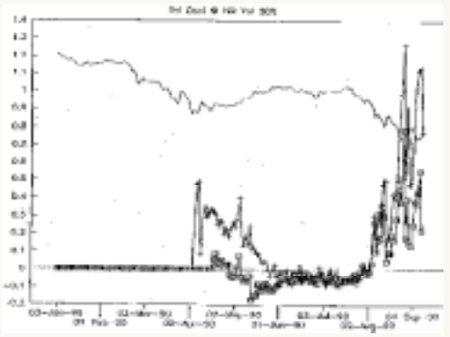

Figure 4: Relative costs of Paine Webber and Salomon NSA call warrants with NSA historical volatility of 20%, April to October 1990. Relative deviation frommodel price = (actual cost - theoretical value)/(theoretical value). Key: (+) PXA, (+) SXZ and (—) normalized Nikkei.

is risk arbitrage not arbitrage. The discrepancy here is similar to the small firm, low price effect (see Keim and Ziemba, 2000). Both puts were trading on the American stock exchange.

There was a similar inefficiency in the call market where the currency protected options traded for higher than fair prices; see Figure 4. There was a successful trade here but this was a low volume market. This market never took off as investors lost interest when the NSA did not rally. US traders prefered Type II (Salomon's SXZ) denominated in dollars rather than the Paine Webber (PXA) which were in yen.

The Canadian speculators who overpaid for these put warrants that led to our risk arbitrage made $500 million Canadian since the NSA's fall was so great. A great example of the mean dominating! The issuers of the puts also did well and hedged their positions with futures in Osaka and Singapore. The losers were the holders of Japanese stocks. We did a similar trade with Canadian dollar puts traded in Canada and hedged in the US. The difference in price (measured by implied volatility) between the Canadian and US puts stayed relatively constant over an entire year (a gross violation of efficient markets). The trade was also successful but again like the Nikkei calls, the volume was low.

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