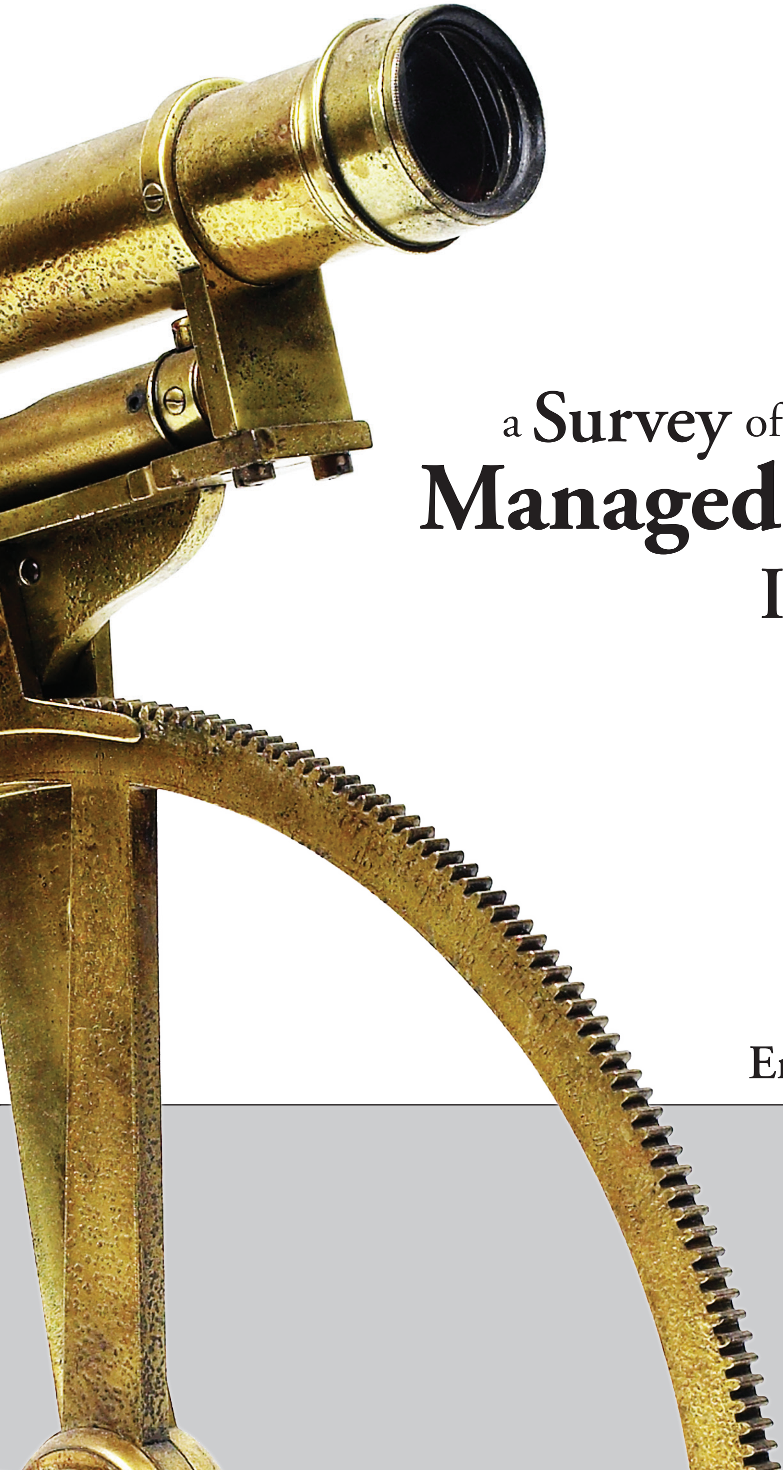


a Survey of the Managed Futures Industry

Ernest L. Jaffarian

second edition

A Survey of the Managed Futures Industry

Ernest Jaffarian
Efficient Capital Management

Forward – Managed futures as an industry has existed since the 1940s with federal oversight since 1974, and is the predecessor to the hedge fund industry. While hedge funds are generally more well-known, managed futures has long been known to the academic world because of the strategic value it can give to a portfolio. Evolving from the world of futures, managed futures has quietly grown to $168 billion in assets, and is being recognized by institutions for its unique characteristics and its potential for providing truly diversifying yield enhancement, often referred to as portable *alpha*. This work is intended to provide a background of the history, characteristics, and current practices of managed futures, along with a glimpse into the future of the industry.

Acknowledgements – This work is as far from an individual effort as a project can be. The entire team at Efficient Capital Management contributed to the final product, making this truly a joint venture. A few people need to be mentioned specifically for the key roles they played in the creation of this review. Randy York put a dent in the nation's ink supply, compiling the content for this survey and putting it into writing. John Traylor, the lead designer, arranged, illustrated, polished, and segued the content. Joe Mitchell, the project manager, did the statistical analysis and worked as a communication liason. Ryan Bunting provided research assistance and catalogued information sources. Ron Davis provided his expertise with regard to operations and industry history, while Donna Allen did the same with regard to regulation and compliance. Chad Martinson shared his knowledge of structured products, and Grant Jaffarian furnished information on how CTAs work and are evaluated. Marat Molyboga spent hours discussing trading strategy and providing a seasoned mathematician's perspective on risk analysis. Finally, Courtney Ellis brought her editor's eye to refine the work. To them, and to everyone at Efficient Capital, my heartfelt thanks for the dedication, professionalism, and enthusiasm they brought to this undertaking.

Ernest Jaffarian
Naperville, Illinois
June 2007

Contents

Historical Foundations

Derivatives have been around since at least 580 B.C., when the Greek philosopher Thales bought options to rent every olive press in Miletus, believing good weather and a bumper crop were on the way. His purchase gave him the right, but not the obligation, to rent the presses from the owners at the standard price. He was right about the harvest, producer demand soared, and Thales was able to sublet the presses for a very high premium.[1] In other words, he bought calls that he exercised once they were deep in the money.

The earliest organized trading of futures and forward contracts occurred in the seventeenth century at almost the same time in Japan and in London. The Japanese cities of Osaka and Edo (Tokyo) became centers for the storage and sale of rice, and the warehouse receipts for future delivery, known as 'rice tickets,' were openly traded on the Dojima rice market as *cho-ai-mai*, meaning 'rice trade on book.' These constituted the first standardized exchange-traded futures contracts in history.[2] Meanwhile, the Royal Exchange in London authorized trading in forward contracts on tulip bulbs after the collapse of the Dutch tulip market in the famous bubble known as 'Dutch Tulip Bulb Mania.'[3]

The first American futures exchange, and the oldest extant futures exchange in the world, is the Chicago Board of Trade (CBOT), which was founded in 1848 by a group of 83 merchants in an attempt to stabilize the volatile price swings in Chicago spot prices for Midwestern grain. It is natural that modern commodities futures should have their roots in Chicago. The American Midwest has some of the richest soil on earth, leading to high

---

1. Chance, *Essays in Derivatives*, 17; Investopedia Staff, "Pin Down Stock Price"; and Copeland and Antikarov, *Real Options*.
2. McLaren, Everett, and O'Donnell, "Managed Futures," 2-3.
3. Mackay, *Extraordinary Popular Delusions*; Edelman, "Tulip Bulbs and the Stock Market," 17.

yields per acre, and therefore, a great need for price discovery. Initially formed for the use of hedgers, the exchange experienced a much-needed boost in liquidity as speculators (those who work to predict market direction) began to enter the picture in the 1870s. Market makers (those who make a living by meeting bid/ask spreads) then provided bids and offers to hedgers, vastly improving the efficiency of the markets.[4]

However, not all speculators are visible in the markets. Speculating is an activity that undergirds the economy itself, and many people do it without realizing it. In 1880, the H.J. Heinz company began signing purchase agreements with farmers for their cucumbers at pre-arranged prices long before the harvest. These were essentially futures contracts, and any farmer who did not sign one was, by definition, speculating on the future price of cucumbers by holding back the sale of the crop until harvest. Then, as now, speculators could impact the marketplace by their absence, as well as by their presence.

Federal regulation of the futures markets began in 1922 with the creation of the Grain Futures Administration. As the need for daily price limits became apparent, the U.S. government considered setting those limits itself, but by 1925 had given that power to the exchange board of directors.

The first commodity fund, Futures Inc., was established in 1948 by Richard Donchian, who developed the concept of 'trend following' and is considered to be the father of systematic commodities trading. However, his idea of diversification in the commodity futures markets did not gain wide acceptance for another thirty years.[5] In the 1950s, Harry Markowitz devel-

---

4. Chicago Board of Trade, "Our History."

5. Richard Donchian Foundation, "Founder Biography"; and *The New York Times*, "Donchian; Commodities Specialist."

oped the concept of Modern Portfolio Theory (MPT). The roots of MPT go back at least 100 years to the beginnings of the Efficient Market Hypothesis (EMH). The notion of safety in numbers is behind the concept of EMH, which says essentially that the more participants there are in the marketplace, the more reliable the price discovery is. If the prices discovered are reliable, then returns can be analyzed using statistical methods. These ideas were first demonstrated by Louis Bachelier in a paper written in 1900.[6]

Returns, however, are not the only concern an investor should have. Risk, and how to minimize it, cannot be ignored, and it was this need that lay behind Markowitz's work. Diversification was Markowitz's answer to risk. This basic concept for MPT came to him one afternoon while he was reading John Burr Williams' *Theory of Investment Value* in the University of Chicago's library. With the publication of his paper, 'Portfolio Selection,' in the Journal of Finance in 1952, Markowitz first demonstrated portfolio efficiency, realized by diversification among asset classes having low to negative correlation.[7] This kind of diversification can reduce the unsystematic (or specific) risk of a portfolio. Recognizing the time value of money, James Tobin added the risk-free rate to Markowitz's approach in 1958, and William Sharpe (in 1964), John Lintner (in 1965), and Jan Mossin (in 1966) independently modified Markowitz's work to create the Capital Asset Pricing Model (CAPM), which will be discussed later. Harry Markowitz essentially taught the investment world not to keep all its eggs in one basket, especially if they were nest eggs. This did much to lay the groundwork for the eventual acceptance and appreciation of managed futures as a risk reducing compliment to a

6. Peters, *Chaos and Order,* 13-15.

7. Chandler, *Managed Futures,* 23.

traditional portfolio. However, at that time the futures markets themselves were not sufficiently diversified to support the emergence of a managed futures industry. This study now turns to the story of their diversification.

Development of the Managed Futures Industry

Until the 1960s, the futures markets were comprised primarily of agricultural products. This began to change with the introduction of precious metals futures. Silver had been deregulated in the United States in 1893, but the U.S. Mint continued to coin it until 1964. The elimination of silver coinage and silver certificates meant that the marketplace was now free to determine the value of silver, and in 1969, silver futures were introduced on the COMEX. The U.S. government then abolished the gold standard in 1971, allowing its price to fluctuate with the market rather than being set by the government, and in 1974, gold futures began trading. The removal of the gold standard also affected the value of other currencies relative to the U.S. Dollar, so the Chicago Mercantile Exchange (CME) created the International Monetary Market (IMM) in 1972 to trade futures on international currencies. It was then just a matter of time before Interest Rate products were introduced into the futures mix. The Chicago Board of Trade (CBOT) introduced the Ginny Mae contract in 1975, followed by the CME's introduction of a T-Bill contract. In 1977, the CBOT began trading the U.S. 30-Year Treasury Bond contract, which became the highest volume futures contract in the world. The energy complex rounded out this mix with the introduction of Crude Oil futures on the NYMEX in 1983, following President Reagan's decision to lift U.S. oil price and allocation controls.

All of these changes came about in a remarkably short span of time and created cutting-edge opportunities in the world of futures. An industry previously driven by supply, demand, and weather was suddenly subject to a vast new horizon of event-driven market fluctuations in the process of price discovery.

Additional changes in other industries also impacted the world of futures trading. The computing industry experienced developments that formed a revolution in information processing. The availability of dynamic random access memory and the development of the microprocessor in the 1970s made computing faster, less expensive, and more spacious. This allowed traders to make much more extensive use of computer power to analyze market history and develop trading systems. The power of information processing joined with the increasing popularity of business schools, many of which began adding the futures markets to their course offerings, to produce a new generation of MBAs with exposure to and interest in the world of futures trading.

Clearly, such a growing field needed regulation in order to allow for growing possibilities. The creation of the Commodity Futures Trading Commission (CFTC) in 1974 and the subsequent formation of the National Futures Association (NFA) in 1976 introduced the regulatory oversight necessary to provide a more structured environment in which the marketplace could make use of the convergence of all these developments. In short, the futures industry emerged from a 'perfect storm' that blew apart preconceived notions of how futures could be used, and, through its diversification, created an entire world of distinctive opportunities—the world of managed futures.

This was a world that allowed for broad diversification and, therefore, the potential for more consistent returns. Technology was making the world smaller and more accessible than ever before, permitting a growing globalization of the marketplace. The diversification of the futures industry and the responsiveness of the investor community spurred asset growth, and a cycle of ever-increasing liquidity drew additional market participants to deepen the markets.

As speculators increased in number, some began to recognize that their talent could be applied across multiple contracts, and ultimately across multiple market sectors. Their ability to broaden their reach to include various sectors meant that they would no longer have to endure the stresses of standing (and yelling) all day in a trading pit. As these speculators left the trading floors to pursue this cross-market approach to trading, they began to treat the futures universe as an asset class in itself. These talented traders were joined by industry leaders who had discovered that basic systematic trading methodologies yield returns over time. The development and application of these programs provided volume and liquidity that made for more orderly and less volatile markets.

Although contracts and specific trading rules may vary from exchange to exchange, futures markets are the same in concept around the world. There is enough standardization to allow both fundamental and systematic traders to apply their skills across all markets, regardless of the underlying commodity. As the industry continued to develop, traders frequently began applying these ideas as investment traders, standardizing their approach and offering their expertise to the public.

In 1978, the Heinhold Illinois Commodity Fund was introduced,[8] and by 1980 the emerging managed futures industry was large enough to warrant the formation of the National Association of Futures Trading Advisors (NAFTA). Another industry organization, the Managed Futures Trading

---

8. The Heinhold Illinois Commodity Fund was a pioneer in the world of finance. It was the first fund dedicated completely to the trading of managed futures.

Association (MFTA), was formed in 1986, and in 1991 the two combined to create the Managed Futures Association (MFA). In 1997 the MFA changed its name to the Managed Funds Association, in recognition of the broadening scope of the managed futures investment space, and to include alternative trading outside of the exclusive use of futures.

The investment world remained largely skeptical of an industry with its roots in floor-trading (and the reckless cowboy reputation that went with that activity), until Dr. John Lintner of Harvard University presented a watershed study in 1983. In it, he concluded that 'the combined portfolios of stocks (or stocks and bonds) after including judicious investments…in managed futures accounts (or funds) show substantially less risk at every possible level of expected return than portfolios of stocks (or stocks and bonds) alone.'[9] Managed futures was shown to be an asset class that could actually reduce the risk and increase the performance of a traditional portfolio of stocks, or of stocks and bonds.

This major academic endorsement was the breakthrough for which the managed futures industry had been waiting. Lintner's original samples were expanded and tested by other researchers, who showed his theories to be sound.[10] While Lintner's work provided an academic base for investing in managed futures, it was the creation of retail-based products that spurred the early growth of the industry. With the academic underpinnings in place, brokerage houses were free to develop products and then sell them. This they did, and they did it aggressively, taking in significant commissions and clearing fees. As major investment firms such as Merrill Lynch, Dean Witter,

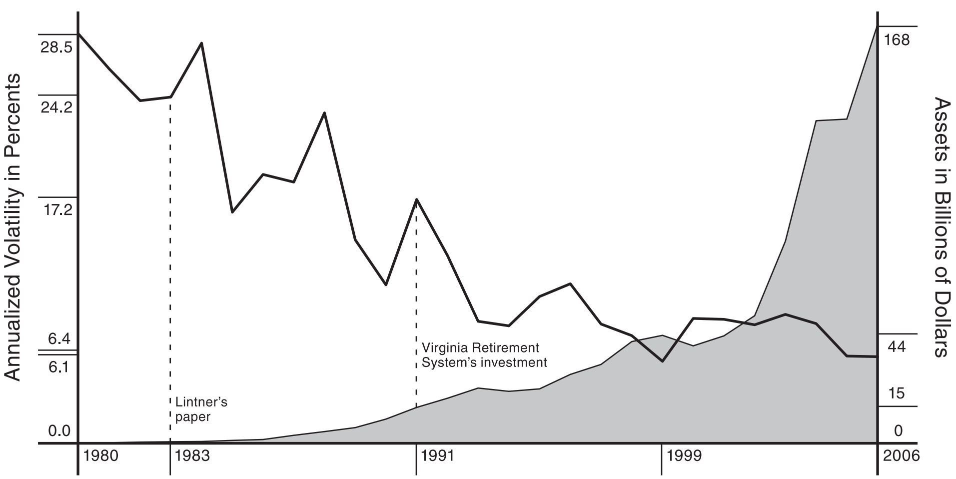
9. Lintner, "The Potential Role of Managed Commodity-Financial Futures Accounts," 67.

10. Chandler, *Managed Futures*, 25.

and Prudential added managed futures to their retail offerings, both the number of funds and the number of managed accounts increased dramatically, and the amount of money under management rose five-fold in just five years, from $2 billion in 1983 to more than $10 billion in 1988. In 1991 the Virginia Retirement System became the first public pension fund to allocate to a managed futures program, with an initial commitment of $100 million.[11] As more and more investors and traders chose to enter the world of futures, the industry continued to grow. By the end of 2006, the total assets under management for the industry had grown to $168 billion.[12]

Figure 1

Managed Futures Industry's Volatility and Assets



11. Chance, *Managed Futures and Their Role,* 5.

12. Data provided by CISDM.

Industry Regulation

Asset growth in the managed futures industry was paralleled by the growth of regulatory oversight. While the Federal government has regulated some futures trading since the 1920s, Congress acted in 1974 to create the Commodity Futures Trading Commission (CFTC) as a federal regulatory agency for all futures and derivatives trading.

In their mission to provide regulatory oversight for the futures industry, the CFTC is joined by the National Futures Association (NFA), a self-regulatory organization founded in 1982, and the U.S. exchanges. Each futures exchange oversees the member firms, brokers, and traders who conduct business through it, while the NFA regulates anyone trading futures or futures options for U.S. investors.[13]

Figure 2

Regulatory Bodies' Missions *as defined by the CFTC*

CFTC	Commodity Futures Trading Commision	'…to protect market users and the public from fraud, manipulation, and abusive practices related to the sale of commodity and financial futures and options, and to foster open, competitive, and financially sound futures and option markets.'
NFA	National Futures Association	'..to develop rules, programs and services that safeguard market integrity, protect investors, and help [their] Members meet their regulatory responsibilities.'

The NFA, in regulatory partnership with the CFTC, provides the primary oversight in the auditing of member firms. The NFA, as a self-regulatory

13. Data provided by the National Futures Association.

organization, acts as the primary contact for FCMs, IBs, CPOs, and CTAs.[14] The NFA carries the primary responsibility to conduct audits, but the CFTC conducts audits as well. The NFA also provides an arbitration program for resolving disputes in the futures industry.

Trading on behalf of U.S. investors in any futures contract listed on an exchange outside the United States must be approved by the CFTC. This approval is not required for trading outside the United States on behalf of non-U.S. investors. However, traders who trade on exchanges outside the United States may be subject to regulatory agencies that oversee those exchanges. For example, the Financial Services Authority (FSA) in London regulates all investment products traded in the UK, including derivatives such as futures and options.[15]

However, Foreign Exchange (FX or Forex) is one aspect of the Managed Futures industry that remains largely unregulated. Futures trading in international currencies came under the purview of the CFTC in 1972 when the IMM was founded, but the great majority of currency trading remains over-the-counter in the form of inter-bank spot and forward markets, and is presently subject only to limited regulation.[16]

Security Futures, which can be either Single Stock Futures (SSF) or Narrow-Based Security Index Futures, began trading in 2002. This space has grown to include hundreds of different single stock futures contracts and

---

14. Additional information about and definitions for these terms can be found in figures 2 and 3.

15. Current listings of international trading authorities, along with complete contact information, can be found on the Internet. One particularly helpful listing is the Future Source's reference, found at http://futuresource.com/reference/agencies.jsp. Also, Beverly Chandler has devoted an entire section of her book, *Managed Futures,* to the regulation of managed futures funds in the United States, Japan, Europe, and European offshore centers.

16. National Futures Association, *Trading in the Retail,* 12-13.

other products. These products are regulated jointly by the Securities and Exchange Commission (SEC) and the CFTC.

Industry Organizations

In order to make the following section on industry stabilization clear, a table of organizations will first be helpful.[17]

Figure 3

Industry Organizations *as defined by the CFTC*

CTA	Commodity Trading Advisor	A person who, for pay, regularly engages in the business of advising others as to the value of commodity futures or options or the advisability of trading in commodity futures or options, or issues analyses or reports concerning commodity futures or options.
CPO	Commodity Pool Operator	A person engaged in a business similar to an investment trust or a syndicate and who solicits or accepts funds, securities, or property for the purpose of trading commodity futures contracts or commodity options. The CPO either itself makes trading decisions on behalf of the pool or engages a commodity trading advisor to do so.
FCM	Futures Commission Merchant	Individuals, associations, partnerships, corporations, and trusts that solicit or accept orders for the purchase or sale of any commodity for future delivery on or subject to the rules of any exchange and that accept payment from or extend credit to those whose orders are accepted.
IB	Introducing Broker	A person *(other than a person registered as an Associated Person of a FCM)* who is engaged in soliciting or in accepting orders for the purchase or sale of any commodity for future delivery on an exchange who does not accept any money, securities, or property to margin, guarantee, or secure any trades or contracts that result therefrom.

17. The following definitions are from the CFTC's website at http://www.cftc.gov

If a CTA or a CPO has U.S. investors, it is subject to CFTC regulations and must register with the NFA. If a CTA or a CPO does not have any U.S. investors, it is not regulated by the CFTC and does not need to register, even if the investments are being traded on U.S. exchanges. There are other exemptions to CTA and CPO registration that may change from time to time. The CFTC maintains a current listing of exemptions on its website and offers assistance in due diligence.

Figure 4

CTA Responsibilities	CPO Responsibilities
Developing trading strategies.	Selecting CTAs and determining allocations to them.
Monitoring performance and reporting to investors.	Monitoring the performance of individual CTAs.
	Monitoring pool performance and reporting to investors.
Ensuring the completion of audited financial statements for submission to the NFA.	Ensuring the completion of audits for submission to the NFA.
Ensuring that funds and managed accounts meet the requirements of the CFTC and NFA.	Ensuring that the pool meets the requirements of the CFTC and NFA.
Ensuring that the investors meet all necessary requirements.	Ensuring that the investors meet all necessary requirements.
Complying with all rules and regulations of the CFTC and NFA.	Complying with all rules and regulations of the CFTC and NFA.

A CTA can operate one or more CPOs, likewise a CPO can own one or more CTAs. The firm's registration (CTA or CPO) is dependent on the activities in which a company is engaged. A firm that trades for U.S. investors registers as a CTA. CPOs are firms that pool investors' money into a fund or allocate to outside CTAs. Funds are investment vehicles, not legal entities like CTAs and CPOs, and they are registered with the NFA as offerings of a CTA or CPO.

Early CTA fees were high. In an age of highly inefficient markets, and CTAs' ability to take advantage of them, investors were able to pay the high fees and still make money. Markets today are far more competitive and liquid, and therefore more efficient, with a predictable effect on fees. Today's management and incentive fee structures are considerably more favorable to the investor. As fees overall have come down over the years, and as management fees have decreased relative to incentive fees, the driving forces for the CTA and the investor have become more directly aligned.

As CTAs fine-tuned their investment trading methods to include a broader range of exposure, the increased need for diversification and proper balance required a level of precision that was not possible in a small managed account. As a result, the minimum investment requirement for individuals to open managed futures accounts rose considerably, effectively locking out smaller investors. This led to the development of both public and private funds where the investor's assets could be pooled and traded in a fund product. The next logical step was for the funds to be diversified among a number of traders, resulting in the rise of CPOs. A CPO offers investors the advantage of a customized mix of trading programs to meet their investment objectives. A CPO can also provide the investor an extra edge in trader selection, asset allocation, and portfolio rebalancing.[18] Just as a CTA may

18. For an interesting overview of some of the issues involved in selection, allocation, and rebalancing, see Schwager's book, *Managed Trading: Myths & Truths*.

diversify among multiple markets and methods, so a CPO may diversify among multiple traders.

The two most common investment vehicles in the managed futures industry are *managed accounts* and *funds*. Managed accounts are simpler and less expensive than funds to establish and operate. To open a managed account, an investor goes to an FCM, completes all related paperwork and disclosure statements, negotiates the commission rate, and then the account is up and running. In order to execute trades on behalf of a customer in a managed account, a CTA is given a limited power of attorney. Managed accounts have the advantage of being completely transparent, liquid, and under the investor's control, with the disadvantage of having potentially unlimited liability. A fund, on the other hand, requires legal representation, a private placement memorandum, an annually audited financial statement, and often an outside administrator to provide independent reporting to the investors. Funds have the advantage of liability protection for the investor and the pooling of assets,[19] with the disadvantage of reduced transparency, liquidity, and investor control.

Funds open to the general public must be registered not only with the CFTC and NFA, but also with the SEC and Financial Industry Regulatory Authority (FINRA). While the performance of the investment is tied directly to trading in the futures markets, which is the realm of the CFTC, the investment itself is in shares of a financial product, which comes under the aegis of the SEC, thus needing additional regulation. The fund must be filed with both the CFTC and the SEC, and approval from both commissions must be granted before the fund is offered to the public.

---

19. National Futures Association, *Opportunity and Risk,* 46.

Private funds require registration under Regulation D with the CFTC and NFA, but generally not with the SEC and FINRA. However, if offered to more than 35 non-accredited investors, they are subject also to SEC registration.

Private funds open only to qualified eligible persons (QEPs), are not subject to the same stringent requirements as other funds, the presumption being that certain investors do not need the same level of protection if their financial acumen is likely to be higher than that of average investors. QEPs include those who meet portfolio requirements of at least $2 million in investments, at least $200,000 on deposit through an FCM, or half of the previous two requirements combined. In addition, there are 12 different categories of QEPs who do not have to meet a portfolio requirement. These are shown in the following table.

Figure 5

QEP Categories

CPOs in operation for at least two years, or with at least $5 million under management, or their principals	CTAs in operation for at least two years, or with at least $5 million under management, or their principals
Investment Advisors in operation for at least two years, or with at least $5 million under management	FCMs or their principals Brokers, dealers, or their principals
Qualified purchasers	Knowledgeable employees
Certain exempt pools	Certain exempt trusts
501c3 Organizations founded by QEPs	Entities owned exclusively by QEPs
Non-U.S. persons or entities	

CFTC Rule 4.7 describing the QEP exemption covers ten pages and is far more detailed than the cursory summary given here. Also, CFTC rules are subject to change. For current and complete information on this important exemption, refer to the CFTC's website.

Trading a number of individual managed accounts can be a burden to a CTA, especially a small one. Trading a single fund in its own account is much simpler from standpoints of trade allocation, auditing, tracking brokerage expenses, etc. Funds are also less transparent and less liquid for the investor. The high transparency of managed accounts makes reverse-engineering of trades theoretically possible, raising trust and security issues. For these and other reasons, some CTAs do not offer managed accounts, but require that investment money be placed in their own fund to be traded.

Once the decision has been made to invest either in a fund or in a managed account, the money to be invested does not go to the CTA, but is deposited into a bank account through an FCM, or is sent to the bank account at the fund's administrator. FCMs are regulated by the CFTC and NFA and can be audited by the exchanges.

The money from any investor trading on a U.S. exchange must be segregated (that is, held in a separate bank account than the general funds of the FCM). U.S. investors' monies traded on non-U.S. exchanges must be secured—separated, but less stringently than segregated funds.

Fees and commissions charged by FCMs have been under constant pressure over the years. In the 1980s, FCMs were able to charge their managed futures customers $50-$75 or more per round turn. Today, a common round turn can be under $10. With this ever-increasing squeeze on commissions, FCMs need increased volume to make up the difference. Hence, FCMs have become more involved in raising investment money by introducing investors to CTAs and CPOs in much the same way Capital Introduction Groups connect investors to hedge fund traders. These introductions help traders increase the amount of money under management, which increases trading volume, which benefits the FCMs by feeding their main engine, which is clearing trades.

The integrity of the marketplace itself is guaranteed by the exchanges and their clearing members. In the United States, trade contracts are guaranteed by the exchanges, which in turn are guaranteed by their FCMs, who in turn guarantee each other. In the United Kingdom, a default fund is in place, which is populated by general clearing members. Should the fund be depleted through the failure of a clearing member, additional equity is raised from among the other members to satisfy the remaining debt. Such structures vary around the world, but increasing standardization is occurring with the mergers of more and more exchanges, banks, and other trading industry entities.

Now that the history of futures markets and the development of the managed futures industry has been summarized, and the roles of the various participants and regulators has been reviewed, it is time to turn to the characteristics of managed futures, and the current practices and specific trading methods in the industry.

Characteristics of Managed Futures

Before exploring the current state of managed futures, it is important to explain how the managed futures industry functions. Their major characteristics must be understood, as well as how they differ from other investment vehicles and why they matter in the financial realm. To address these vital topics, this section will first focus on the five defining attributes of managed futures: liquidity, non-directionality, volatility, cash efficiency, and transparency.

Liquidity – With regard to liquidity, note first that more than $1.5 trillion in market value is traded every two weeks on the stock exchanges of the United States. While this is clearly a great deal of money, it is even more astounding to realize that America's futures exchanges do that much business *every day*. The growth in the number of contracts available to be traded and in the volume of contracts traded has made managed futures an efficient and reliable marketplace. Capacity for initiating or covering exposure is extensive and growing. As the futures markets have matured, competition among market makers has increasingly narrowed bid/ask spreads across the board. Daily price limits help to prevent runaway markets by prohibiting trade outside a predetermined price range that is reset daily to key off the previous day's closing price. This provides a 'cooling off' period, during which traders and investors can reassess their positions in a dispassionate atmosphere. Limit-up or limit-down moves can create liquidity problems, and it is during these events that the options markets see a significant increase in trading volume, as traders seek to accomplish synthetically in the options what price limits will not let them do in the futures.

For the trader, liquidity means smaller slippage through enough volume to narrow and deepen the bid/ask spread, and to allow large orders to be processed efficiently. This means that under normal market conditions, traders can make trades of significant size without the fear of being unable to complete the entire trade, and with confidence that competition on both sides of the market will minimize the market impact of any one trade.

For the investor, liquidity means freedom from the kind of lock-ups often imposed in the hedge fund world. By utilizing managed accounts, an investor can liquidate positions at any time, while in managed futures funds, liquidity is generally on a monthly basis. Because traders are able to liquidate positions on a daily basis, they are able to provide investors this monthly liquidity. Because of this freedom, traders and investors are able to participate in a cycle in which they may easily move in and out of markets, which in turn improves the overall liquidity of those markets and creates the opportunity for unique product structures.

Non-directionality – With a buyer for every seller and a seller for every buyer, the futures markets are a zero-sum game. For every long position, there is a corresponding short position. The futures exchanges were founded by hedgers for hedgers in order to lock in prices. The hedgers were on both sides of the market then, as they are today. Although speculators have joined them and are the principal source of liquidity, trading futures remains a zero-sum game within its own context, with equal long and short positions. However, because they are derivatives, they can be arbitraged to outside cash instruments or used in other ways as portfolio diversifiers. When used this way in a managed futures program, the futures markets enter another context in which both the speculator and the diversifier can end up winners.

As a hedging vehicle, the futures markets derive volume and value through arbitrage with the underlying cash markets, ironing out market inefficiencies and providing genuine price discovery.

Unlike the securities world, a managed futures program is free from the dual burden of up-tick rules and the need to borrow the underlying when shorting. Also unlike equities, in managed futures margin for shorts is the same as margin for longs. These are tremendous advantages because of the safety and flexibility they provide.

In addition, non-directionality provides traders with the opportunity to produce *alpha* (non-*beta* returns). When *beta* (non-diversifiable, systematic, real risk) is identified, the CAPM can be used to determine a required rate of return. The resulting return adjusted for risk (RAR) is a benchmark expectation that may be used in performance evaluation. Any returns deviating from that expectation are called *alpha*, and *alpha* is measured in terms of outright additional return (positive or negative) and expressed as a percentage. For example, if a portfolio for which the CAPM expects a return of 7% actually produces a return of 10%, the additional 3% would be the *alpha*.
The simple formula for *alpha* is:

Figure 6

$$\alpha = \text{PortfolioPerformance} - \beta \times \text{BenchmarkPerformance}$$

$$\beta = \rho \times \frac{\sigma_p}{\sigma_b}$$

$$\rho = \text{correlation of PortfolioPerformance and BenchmarkPerformance}$$

$$\sigma = \text{volatility} = \text{standard deviation}$$

This traditional concept of *alpha* as relative excess return was first proposed in 1968 by Michael Jensen when he developed a way to measure that return. Over the years, it has become the most popular return-to-risk measurement in use.[20] A trader can generate *alpha* by constructing a portfolio that outperforms the benchmark, actively trading the elements of the portfolio in order to outperform the benchmark, or overlaying the benchmark with an active, non-directional investment portfolio.[21]

For the trader, non-directionality means the ability to go long or short with equal ease. The efficient nature of the market itself means that trader skill is the source of returns. This return, regardless of the underlying market, is *alpha*, which is a key characteristic of managed futures trading. Equities, bonds, and hedge funds all provide *beta*; in other words, their returns and profit are directly tied to the performance of the underlying market. Because futures traders trade independently of the underlying, they are capable of providing *alpha* on top, or independent, of the return of the underlying, and also on top of any other *beta*-driven investment.

For the investor, non-directionality means the availability of diversifying protection through negative correlation in adverse markets, positive correlation when the overall portfolio is profitable, and with little or no correlation when measured against all market conditions. Market events will occur in which correlations lag, producing temporary performance setbacks, and these must be expected. During these events, *alpha* and options can provide buffers to smooth the performance of the investment until the market stabilizes.

---

20. Darling, Mukherjee, and Wilkens, "CTA Performance Evaluation" 82-83; and Russell Investment Group, "Jensen Alpha."

21. Keep in mind that the accuracy of the performance measurement is dependent on the benchmark chosen for comparison. See Index Investor, "Separating Alpha From Beta: Portable Alpha."

Volatility – The amplitude of fluctuation in the process of price-discovery, volatility (or *sigma*) represents risk. The ability to measure that risk permits the identification of inefficiencies which can be exploited by traders. The managed futures space has long been perceived by traditional investors as a volatile market environment. However, unlike stocks and bonds markets, which are directly subject to the volatility of the underlying investment, managed futures offers a variety of ways to control and use volatility to the trader's advantage, allowing volatility to represent the opportunity to capitalize on market inefficiencies. There is always a price at which it makes economic sense to assume risk, and the higher the risk the higher the required price. This understanding provides an expectation of positive *alpha*, even as position risk is being actively managed in volatile market environments.

The greatest danger in a volatile market is a short-gamma position, which is the increase and/or decrease of market exposure at disadvantageous price levels. In other words, a short-gamma position is a market position that has a growing loss as an adverse move continues. Trend following methods have a long-gamma nature to them, in that they have positive skewness with infrequent large gains accompanied by frequent small losses. Trend following exposure tends to grow as the market trend develops. The increasing exposure yields a greater gain per tick for the futures trader in the same way an increasing *delta* (i.e. futures equivalents) yields a greater gain for the options trader. The option trader's increased *delta*, provided by gamma, parallels the trend follower's increased number of contracts. The options trader's losses through erosion parallel the trend follower's losses through entries and exits in choppy markets.

For the trader, volatility means that, independent of market direction, market movement can be exploited by trader skill to produce *alpha*. Exposure can be managed through diversification. Just as in basic MPT, where diversification mitigates risk, so futures traders can diversify across contracts, sectors, and methods in order to balance out their risk. Directional volatility can be exploited by the long-gamma nature of trend following.

For the investor, volatility means opportunity and risk, and the benefits brought to both. Investors have the advantage of being able to diversify their assets across multiple traders and methods, either directly through managed accounts, or indirectly through managed funds and CPOs.

Cash Efficiency – Managed futures offers a unique way of managing risk through cash efficiency. It is possible under most market conditions to establish long or short positions while putting up only 10-20% of their cash value. This makes dynamic risk management possible. Cash efficiency makes it easy for the managed futures trader to move risk exposure up or down as needed and to earn real returns in any currency.

Risk does not have to be quantified in order to be perceived. It is human nature to consider and evaluate risk, even when the only tool available is intuition. For example, it is common knowledge that a $20,000 windfall would be better invested as a down-payment on a house than used for a trip to the casino. In the human mind, the standard perceptions of riskiness may cause an aversion to leverage. Unfortunately, investment opportunities do not normally present themselves in such a black-and-white fashion. Their shades of grey need to be quantified in order to be accurately evaluated, and this is where RAR comes into the picture. RAR means that the value of an investment's return must always account for the level of risk involved. The level of cash efficiency in managed futures means that it has an exceptional and dynamic ability to manage RAR. Returns adjusted for risk will be discussed in further detail later in this chapter.

For the trader, cash efficiency means the freedom to trade large notional accounts without being hindered by cash management. With the standardization and integrity of exchange-traded futures contracts, margin is easy to calculate and budget. Low margin rates permit significant cash efficiency, with excess capital available to be used either for risk management or for exposure opportunity, making customized investment solutions efficient and affordable.

For the investor, cash efficiency means the ability to increase exposure without borrowing additional capital, leaving excess cash available for investment or trading. The question should never be between leveraging or not; the question should always be about the relationship of the potential risk to the expected benefit. Each investor has different levels of both expected returns and risk tolerance. The higher the RAR, the more leveraging makes sense. Cash efficiency allows an investor to lever up to an RAR that is appropriate for that investor's objectives and risk tolerance. With pinpoint accuracy, the cash efficiency offered by a program of managed futures permits the construction of a diversifying portfolio that meets the highest investment objectives through the most cost-effective and prudential use of capital.

Transparency – Exchange-traded futures and options prices are continuously updated and made available to the public. Market depth and volume are tracked and published by the exchanges, and carried by data services such as Bloomberg, Reuters, and CQG. In this way, market moves are immediately known everywhere and to all. Add to this the transparency of the managed account, in which all positions are known, and it means that the value of a portfolio can be calculated at any time. In addition, the managed futures industry answers to regulators, making the industry itself transparent and accountable.

For the trader, transparency means that historical data is available for research, real-time market prices are available to use for generating signals, and market 'color' (depth, volume, open interest, market sentiment, etc.) is available for the decision-making process. The growth of electronic data dissemination has fueled the growth of quantitative trading methods through the transparency that it provides.

For the investor, the transparency available is dependent upon the way the investment is structured. Funds often have limited levels of transparency, while managed accounts offer complete transparency, giving the investor updated and full knowledge of account status and value. In addition, regulatory oversight produces a facet of transparency that protects the investor from fraud. This transparency ultimately provides the investor with a significant amount of direct authority over the investment.

Understanding these characteristics is fundamental to understanding the world of managed futures. While only non-directionality is unique to managed futures, the other characteristics exist in quite different forms in other investment classes. The way these five characteristics—liquidity, non-directionality, volatility, cash efficiency, and transparency—play out in managed futures allows them to be combined without incurring additional risk, ultimately offering unique opportunities to generate *alpha*.

Managed Futures Analysis

Modern Portfolio Theory (MPT) applies to any component of an investment portfolio, and the Capital Asset Pricing Model (CAPM) can be used to measure any component of a portfolio. These measurements are not confined to individual market investments, but may also be used to evaluate sectors, traders, and even other spaces (e.g. managed futures, hedge funds, etc.) when they are being considered as portfolio additions.

As Markowitz emphasized in the 1950s, the investment story is about more than just returns; when being evaluated, returns must be adjusted for risk. The return adjusted for risk (RAR) is simply a reflection of the amount of risk it takes to achieve a particular amount of profit, or return. For example: if Investment A and Investment B each pay a return of $200 profit, which one is a better choice? The answer lies in rephrasing the question. The real question is: if Investments A and B were each applied at the same level of risk exposure, which one would yield a greater profit? If Investment A were twice as risky as Investment B, equal amount of risk exposure would yield only half the profit for Investment A. Hence, at an equal level of risk, Investment A really only pays a return of $100 profit, while Investment B pays the full $200. Therefore, Investment B is the better choice because of its higher RAR. Every investor has his or her own risk preference, and RAR allows for the maximization of returns consistent with that preference. Before a strategy can be added to a portfolio, its RAR and its value as a stand-alone investment must be proven to be sound.

The managed futures industry has been a valid stand-alone investment space for the past several decades. Its value as an investment in and of itself is evident in its staying power and growth over five decades, but it can also be measured, using a variety of tools currently available to measure RAR. There are many ratios available, four of which are vital for the alternative investments specialist to know. These are the Sharpe Ratio, Sortino Ratio, Calmar Ratio, and Omega Ratio.

The Sharpe Ratio is a measurement developed by William F. Sharpe, to determine excess RAR—the variability of the returns.

Figure 7

$$\text{Sharpe Ratio} = \frac{R - R_f}{\sigma}$$

$$\begin{aligned} R &= \text{annualized return} \\ R_f &= \text{risk free interest rate} \\ \sigma &= \text{annualized standard deviation} \end{aligned}$$

The Sharpe Ratio provides a return-to-risk ratio that can be used to compare a particular investment with others, including both its upside and downside risk. The ratio is an industry standard that helps investors differentiate between investments that pay well because they are strong, and investments that pay well because they are risky. The higher the ratio, the better the performance of the portfolio and the higher the expectation of excess return for a given level of risk.

Convenient and easy to calculate, the Sharpe Ratio is a very good first step, but it fails to reflect real risk as well as it intends because it does not account for the investor's risk preferences, it presumes a normal distribution of returns, and it punishes positive returns.

The Sortino Ratio is a measurement developed by Brian Rom, building on the research of Frank A. Sortino to address the deficiency of the Sharpe Ratio's use of standard deviation. It removes the upside deviation (good volatility) from the Sharpe Ratio, leaving only the standard deviation of negative asset returns (bad volatility, or semi-standard deviation) to determine the RAR of the portfolio.

Figure 8

$$\text{Sortino Ratio} = \frac{R - MAR}{\sigma^{-}}$$

$$\begin{aligned} R &= \text{annualized return} \\ MAR &= \text{minimum acceptable return} \\ \sigma^{-} &= \text{annualized semi-standard deviation} \end{aligned}$$

The Calmar Ratio is a measurement of return relative to maximum drawdown (typically over a period of three years). Unlike the Sortino Ratio, which uses a semi-standard negative deviation, the Calmar Ratio uses a worst case scenario in its determination of RAR.

Figure 9

$$\text{Calmar} = \frac{R}{MDD}$$

$$\begin{aligned} R &= \text{annualized return} \\ MDD &= \text{maximum drawdown} \end{aligned}$$

all over a specific period

As evidenced by the equation itself, the Calmar Ratio is one of the easiest to calculate and to understand. Small draw downs and high returns produce the best Calmar Ratios. Let's look at some simple fictitious assets and calculate a few example Calmar Ratios.

Figure 10

Calmar Example *36 month period*

	Annualized Return *in %*	Draw Down *in %*	Calmar *ratio*
A	4.85	3.38	1.43
B	12.00	6.00	2.00
C	9.50	10.00	0.95

The Calmar Ratio can be looked at as an intuitive innovation on Sortino, but much faster, clearer, and easier to estimate and interpret. Among this group of assets, B has the best Calmar Ratio, implying that asset B has done the best job of controlling its draw down in relation to its return over the last 36 months.

On its own, Calmar does not provide a particularly deep understanding of an asset. It leaves many questions unanswered about how returns were distributed and what happened before the past 36 months. However, as a supplement to other ratios such as Sharpe and Omega, Calmar can provide additional insight about the recent draw down risk. No single analytic is the perfect solution for measuring risk and performance. Utilizing and understanding multiple performance measurements is the only way to build a more complete understanding of an asset's returns.

The Omega Ratio is a measurement derived from the whole distribution to account for the presence of extreme events (e.g. a fat left tail). It does not make assumptions about any particular underlying asset distribution function, investor preference, or other restrictions.

Figure 11

$$\text{Omega Ratio} = \frac{\displaystyle\int_{MAR}^{\infty} (1 - F(x))\,\mathrm{d}x}{\displaystyle\int_{-\infty}^{MAR} F(x)\,\mathrm{d}x}$$

$$\begin{aligned} MAR &= \text{minimum acceptable return} \\ F &= \text{cumulative distribution function of returns} \end{aligned}$$

Utilizing the Omega ratio for asset selection is quite straightforward: the higher ratio is preferred. The following table shows the returns for three assets accompanied by standard statistical analysis. The Sharpe and Omega ratios are both calculated, with a risk-free rate set to 4%.

Figure 12

Omega Example *Jan 2005 - Dec 2005*

	A	B	C
January	6.74	4.02	1.65
February	0.93	4.02	3.43
March	8.02	3.58	4.70
April	1.63	3.58	4.20
May	0.35	3.58	0.89
June	0.93	6.56	1.65
July	3.48	6.12	6.74
August	0.93	3.58	8.01
September	1.63	3.58	1.65
October	4.76	3.58	6.74
November	4.19	2.31	3.43
December	5.47	2.95	0.89
Sharpe	0.94	1.03	0.69
Omega	2.54	2.25	2.01
Avg Excess Return	1.08	1.19	0.79
Standard Deviation	4.00	4.00	4.00
Skewness	0.23	–1.22	0.23
Excess Kurtosis	–0.85	0.10	–0.72

It is easy to see that Sharpe suggests that asset B is the preferred investment. First looking at the statistics, we notice each asset has the same volatility. This allows us to concentrate on return and other characteristics for making our asset choice. Asset B has the highest average excess return (average return with the risk-free rate removed), making it the Sharpe preferred asset.

Looking at the Omega ratio we see that asset A is the preferred asset. To understand the difference in preference between Omega and Sharpe, we need to review the higher statistical moments in the distribution of returns (see Skewness and Kurtosis). By way of explanation, let's consider asset B to be a short gamma strategy, perhaps a manager selling naked put options on the S&P 500 Index. Further, asset B's skewness is significantly negative with a higher occurrence of extreme events below the mean. Excess Kurtosis further indicates some degree of fat tails. Considering this additional information, it is clear that asset B has greater risks than the Sharpe ratio would suggest.

Contrast this with asset A. Perhaps asset A is the returns from a trend following manager. The lower excess return makes this the second choice for Sharpe. However, asset A is Omega's preferred asset. Why? Consider asset A's positive skewness, which suggests there is a higher probability of extreme performance greater than the mean. The Omega ratio is able to capture this information because it is the ratio of area above and below a chosen threshold. Additionally, Omega prefers asset A over asset C even though asset A and C have very similar skewness and excess kurtosis. In this case asset C doesn't have the return expectation to be a top choice.

Skewness is the aberration of the distribution of returns on an investment, when compared to a symmetrical distribution. When viewed in a graphic format, positive skewness (in which expectations of outlying events are more positive than that of a symmetrical distribution) shows the entire structure bearing to the right of symmetrical, while negative skewness shows the entire structure bearing to the left of symmetrical.

Kurtosis is the slope of this distribution, and is therefore known also as the volatility of volatility. A high kurtosis shows a greater distribution towards the tails and away from the mean, resulting in a visual of a low and broad peak with fat tails. A low kurtosis shows just the opposite.

With these analytics, we can evaluate the benefits of managed futures as seen through the lens of this kind of approach to measuring RAR.

Thus, this study has begun to prove the quantitative value of managed futures. The question must now be asked: what value do they bring to a traditional portfolio?

For the purposes of our analysis, the following standard data streams will be used throughout this text, and their names will be simplified as shown below:

CISDM CTA Asset Weighted Index as *Managed Futures*

S&P 500 as *Stocks*

Lehman Brothers US Bond Index as *Bonds*

CISDM Equal Weighted Hedge Fund Index as *Hedge Funds* [22]

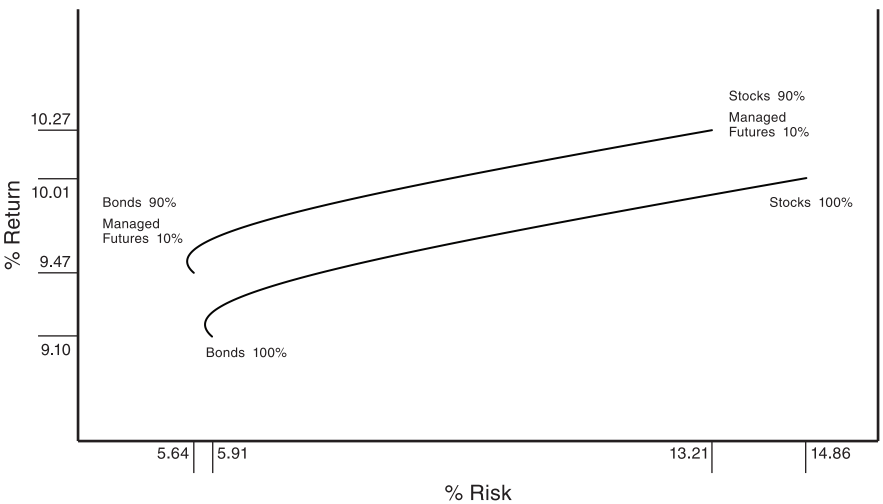
22. Stock and bond data from Bloomberg; managed futures and hedge fund data from CISDM.

Managed Futures and Traditional Portfolios

Since 1983, managed futures have been shown to be a valuable addition to traditional portfolios, sparking significant growth in the managed futures industry. MPT ultimately seeks what is known as the 'efficient frontier.' Carl Peters defines this as 'that combination of assets that have minimum combined variance at all possible levels of return.'[23] The graph below shows an optimal portfolio profile containing the asset classes of stocks and bonds at a desired level of risk to reward, and what happens with the addition of a third asset class. As shown in all points, the addition of managed futures moves the curve up and left, increasing the return and decreasing the risk at any given point.

Figure 13

Efficient Frontier | Stocks & Bonds | Stocks, Bonds & Managed Futures
1980–2006



23. Peters, *Managed Futures*, 12.

In addition to the efficient frontier, the analytic tool set used earlier can be used again, this time to measure managed futures as a stand-alone investment, and to evaluate portfolios in different combinations.

Figure 14 [24]

Investment Class Analysis *1990 – 2006*

	Managed Futures	Stocks	Bonds	Hedge Funds
Sharpe	0.64	0.32	0.80	1.58
Sortino	1.38	0.60	1.89	2.19
Calmar	0.96	0.18	1.39	1.29
Omega	2.08	1.62	3.02	4.14
Skewness	0.72	−0.48	−0.41	−0.33
Kurtosis	2.36	0.91	0.63	3.44

The following tables show that when a program of managed futures is added to stocks, bonds, and hedge funds, all ratios are improved, skewness is improved, and with the exception of bonds, kurtosis is improved.

24. All values labeled kurtosis are displaying the excess kurtosis.

Figure 15

Portfolio Analysis *1990 – 2006*

	Stocks	Stocks 80% Managed Futures 20%	change
Sharpe	0.32	0.45	0.13
Sortino	0.60	0.82	0.22
Calmar	0.18	0.26	0.08
Omega	1.62	1.81	0.19
Skewness	–0.48	–0.28	0.20
Kurtosis	0.91	0.81	–0.10

	Bonds	Bonds 80% Managed Futures 20%	change
Sharpe	0.80	0.94	0.14
Sortino	1.89	2.09	0.20
Calmar	1.39	1.90	0.51
Omega	3.02	3.36	0.34
Skewness	–0.41	–0.01	0.40
Kurtosis	0.63	1.56	0.93

	Hedge Funds	Hedge Funds 80% Managed Futures 20%	change
Sharpe	1.58	1.73	0.15
Sortino	2.19	2.96	0.78
Calmar	1.29	1.79	0.50
Omega	4.14	4.77	0.62
Skewness	–0.33	0.13	0.46
Kurtosis	3.44	1.98	–1.46

Figure 16

Portfolio Analysis *1990 – 2006*

	Stocks 60% Bonds 40%	Stocks 55% Bonds 35% Managed Futures 10%	change
Sharpe	0.47	0.55	0.08
Sortino	0.90	1.03	0.13
Calmar	0.34	0.41	0.07
Omega	1.94	2.08	0.14
Skewness	−0.35	−0.21	0.14
Kurtosis	0.59	0.60	0.01

	Stocks 50% Bonds 30% Hedge 20% Funds	Stocks 45% Bonds 27% Hedge Funds 18% Managed Futures 10%	change
Sharpe	0.67	0.76	0.09
Sortino	1.06	1.25	0.19
Calmar	0.45	0.57	0.12
Omega	2.22	2.39	0.16
Skewness	−0.50	−0.33	0.17
Kurtosis	0.89	0.79	−0.10

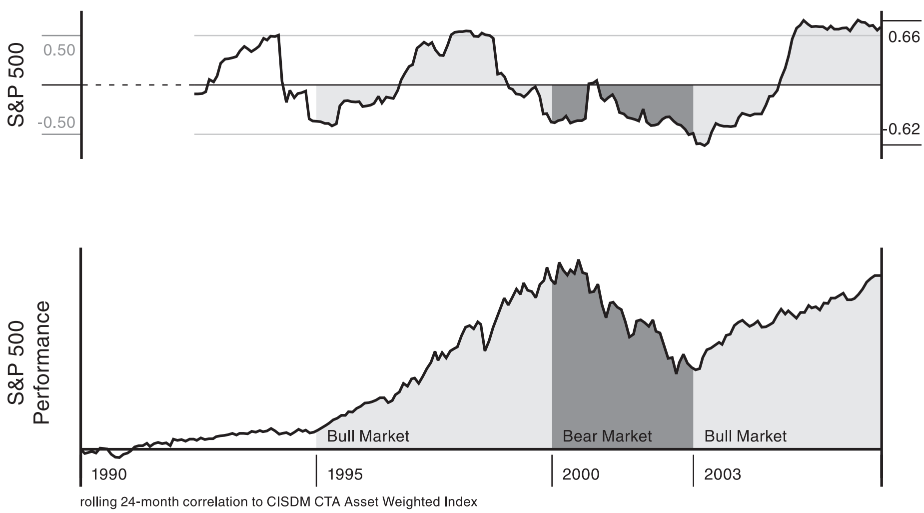
Here we see that the addition of managed futures to a traditional portfolio of stocks and bonds improves everything but kurtosis, which remains almost unchanged. However, when a program of managed futures is added to a traditional portfolio that also has a hedge fund component, even the kurtosis is improved.

These illustrations show that managed futures have historically improved the RAR of a traditional portfolio, and that they have done it better than hedge funds. Looking at the contribution made by managed futures to a traditional portfolio of stocks and bonds shows that it not only increases RAR, but that it also does something even better: it reduces risk *and* increases returns.

When applied appropriately to a traditional portfolio of stocks and bonds, a program of managed futures can produce a high negative correlation in a bear market, and a small positive correlation in a bull market.

Figure 17

Correlation to Managed Futures During Bull & Bear Markets



Correlations of managed futures to the traditional portfolio are more negative (or less positive) than that of hedge funds. This correlation, combined with positive skewness and small kurtosis, means that managed futures can achieve a more consistent expectation of added value than other asset classes. On a risk-adjusted basis, the managed futures industry has a return-to-risk profile similar to stocks and bonds. The Sharpe Ratio of managed futures is lower than that of hedge funds because it does not carry many of the risks that other types of investments do, while still providing a significant diversifying effect. Managed futures does not make trade-offs in liquidity, transparency, and other risk-reducing investment vehicle characteristics, so it does not require as high a risk premium. Pure *alpha* that also acts as a diversifier is stunning, which is why research shows that managed futures should be added to any traditional portfolio, including those that already have a hedge fund component.[25]

Identifying & Measuring Risk

The first challenge for anyone in the financial world is to identify, measure, and mitigate risk. Modern Portfolio Theory recognizes the need to address the risk inherent in any portfolio and suggests diversification methodology to minimize it, thus enhancing the quality of the returns by making them more reliable. As Bob Litterman put it, 'Modern portfolio theory has one, and really only one, central theme: In constructing their portfolios, investors need to look at the expected return of each investment in relation to the impact that it has on the risk of the overall portfolio.'[26] This is the RAR that was discussed earlier. Managed futures has already been shown to have

---

25. For more information on this topic, and academic proof of these claims, see Chance, Kat, Lintner, and Peters.

26. Litterman, *Modern Investment Management,* 11.

a strong return adjusted for risk, and the ability to improve portfolio performance and to reduce portfolio risk. The following tools for risk management are critical to managed futures in order to help maximize their contribution to any portfolio.

The initial Mean-Variance framework was done by Harry Markowitz. Recognizing two forms of risk, systematic and unsystematic (or specific), Markowitz aimed to reduce overall risk by reducing specific risk through diversification. Diversifying by investing in products with low correlation improves RAR. However, since past performance does not guarantee future results, the art of quantifying both risk and expected returns requires much more than simply looking back at price history.

The next major step in the development of MPT after Markowitz was the Capital Asset Pricing Model. It identifies systematic risk as the real risk of a portfolio, the assumption being that the unsystematic risk can be successfully and adequately mitigated through diversification.[27] The resultant risk is the *beta*, or the non-diversifiable risk, of the portfolio. The model uses this to determine the necessary rate of return in order for an asset to be a value-enhancing addition to the portfolio, and thus is a model for pricing assets. In its basic form, CAPM assumes maximizing expected return while minimizing volatility, efficiency in the marketplace, and uniformity of information among investors. The Black-Litterman model, presented by the Goldman Sachs Research Group, allows for the inclusion of investor opinions about single instruments or their combinations in a systematic and quantitative fashion. It was developed to address the behavior problem inherent in standard mean-

---

27. Darling, Mukherjee, and Wilkens, 83.

variance portfolio optimization by making CAPM equilibrium its center of gravity.

Identified risk[28] must be measured, but risk can be calculated in a number of different ways. It is not always what it seems at first glance, because it has differing dimensions. Just as it is essential to view an object from different angles in order to ascertain its true shape, so it is imperative to estimate risk in multiple ways in order to discover all of its aspects, especially those that would otherwise remain hidden. The three most common approaches to evaluating risk are testing for value at risk, estimating expected shortfall, and performing a stress test.

Value at Risk (VaR)[29] is a method of measuring the asset value at risk of being lost in an investment portfolio, given a particular holding period with no changes to the portfolio during that period, and a particular confidence level. The most common confidence levels used are 95% and 99%. A portfolio two-day VaR of $3 million at a 95% confidence level means that there is a 95% probability that losses sustained by the portfolio over the next two days will not exceed $3 million, and a 5% chance that losses will be greater than that. VaR can better be used to manage risk in managed futures than in hedge funds or stocks due to the transparency and cash efficiency of managed futures. As a method of calculating risk, VaR is useful, but should be used in conjunction with additional tests (see below) because it relies too heavily on its assumptions and its estimates of correlations and volatilities

28. Unless otherwise indicated, 'risk' refers specifically to market risk. Other forms of risk also exist and need to be managed, including but not limited to: Credit, Operations, Liquidity, and Legal. See Litterman's *Modern Investment Management,* 27.

29. For an excellent concise history of the development of the VaR system at JP Morgan, see Holton's *Value-at-Risk*, 18-19.

to be used alone. It also fails to account adequately for the extreme left (or negative) tail in the returns distribution curve. This creates the need for Conditional VaR (CVaR), also known as expected shortfall.

Expected shortfall is the average amount of asset value expected to be lost in cases that exceed the confidence level of a given VaR. In the example above, the VaR fails to provide a specific expectation of losses in the aberrant cases. It tells us to expect losses of more than $3 million in such cases, but how much more? Expected shortfall attempts to identify an average loss that can be anticipated when markets move unexpectedly.

A stress test is a market simulation applied to a portfolio to determine how it will perform during periods of different financial crises that cause extreme market moves. Such testing can include using historical market events, fictional scenarios, or a combination of both.

Although the managed futures industry includes both futures and options, this text has focused predominantly on futures, as they are easier to understand and to use as examples. However, options are a vital part of the industry. From 1997-2006 options averaged 19% of the CBOT's total trading volume. Given their importance, it is necessary that the managed futures professional possess a working knowledge of them. There are many unique approaches to futures options,[30] but here, for the sake of simplicity and clarity, we will provide formulas for call and put European style options from only one: the Black model.

30. Two books highly recommended to anyone seeking a thorough working knowledge of options are Cottle's *Options: Perception and Deception*, and Natenberg's *Option Volatility & Pricing*.

Figure 18

Black Model

$$c = e^{-rT}[F\Phi(d_1) - K\Phi(d_2)]$$
$$p = e^{-rT}[K\Phi(-d_2) - F\Phi(-d_1)]$$

$$d_1 = \frac{\ln(\frac{F}{K}) + \frac{\sigma^2 T}{2}}{\sigma\sqrt{T}}$$
$$d_2 = d_1 - \sigma\sqrt{T}$$

σ = volatility
Φ = cumulative distribution function of standard normal distribution

c = call option price
p = put option price
r = risk free interest rate
T = time to expiration in years
F = price of an underlying futures contract
K = strike price

All options models must take into account underlying price movement—not only how it affects simple options prices at a given level of volatility, but also how it affects volatility itself and the volatility skewness. All options models must also account for time, strike, interest rates, style,[31] and of course the Greeks—behavioral characteristics of options that are each represented by

31. European style permits the exercise of an option only at expiration, while American style permits exercise at any time during the life of an option.

a Greek letter. The Greeks are the key components of any options risk analysis program, and they can be explained by the Black model as follows:

Delta – The first partial derivative of the option price with respect to underlying price.

Figure 19

$$\Delta_c = e^{-rT}\Phi(d_1)$$
$$\Delta_p = e^{-rT}\Phi(d_1) - 1$$

Delta is an indicator of the rate of change in the price of an option in response to a change in the price of the underlying contract. *Delta* is also the probability of an option being profitable. This quantifier permits an option to be used as a synthetic proxy for a corresponding percentage of the underlying contract.

Gamma – The second partial derivative of the option price with respect to underlying price.

Figure 20

$$\Gamma_c = \Gamma_p = e^{-rT}\frac{\phi(d_1)}{F\sigma\sqrt{T}}$$
$$\phi = \text{density function of standard normal distribution}$$

Gamma is the rate of change of an option's *delta* in response to the price movement of the underlying contract.

Rho – The partial derivative of the option price with respect to interest rates.

Figure 21

$$
\begin{aligned}
\rho_c &= TK\mathrm{e}^{-rT}\Phi(d_2) \\
\rho_p &= -TK\mathrm{e}^{-rT}\Phi(-d_2)
\end{aligned}
$$

Rho is the amount by which an option's theoretical value changes in response to a change in interest rates.

Theta – The partial derivative of the option price with respect to time.

Figure 22

$$
\begin{aligned}
\Theta_c &= \frac{F\mathrm{e}^{-rt}\phi(d_1)\sigma}{2\sqrt{T}} + rF\mathrm{e}^{-rT}\Phi(d_1) - rK\mathrm{e}^{-rT}\Phi(d_2) \\
\Theta_p &= -\frac{F\mathrm{e}^{-rt}\phi(d_1)\sigma}{2\sqrt{T}} - rF\mathrm{e}^{-rT}\Phi(-d_1) + rK\mathrm{e}^{-rT}\Phi(-d_2)
\end{aligned}
$$

Theta is the amount by which an option's theoretical value erodes in response to the passage of time.

Vega – The partial derivative of the option price with respect to volatility.

Figure 23

$$V_c = V_p = F\mathrm{e}^{-rT}\phi(d_1)\sqrt{T}$$

Vega is the amount by which an option's theoretical value changes in response to a given change in volatility.

How to measure the risk of both futures and options exposure has been discussed, but perhaps the most important part of risk management is the partnership of the trader, the CPO, and the investor. Communication among them is the key to creating and maintaining the best decision making process possible with the fewest surprises. All three are involved in some aspect of the management of portfolio risk, using the unique characteristics of the industry as tools. The characteristics that are most useful in managing risk are transparency, cash efficiency, liquidity, and diversification.

In order to manage risk, it is essential first to know the exposure of each investment. The transparency of managed futures makes it possible to monitor risk consistently, because all the positions are known. Once the risk is identified and measured, the way is already clear to draw up almost any battle plan, because the cash-efficiency of managed futures makes it easy to use leverage to increase or decrease exposure, as the risk environment dictates. Once the plan is in place, the combination of liquidity and non-directionality allows traders to get in and out of positions as necessary with minimum slippage, and, as MPT clearly shows, diversification further reduces risk.

Managed Futures Portfolio Construction

The construction and management of a portfolio requires setting expectations of an underlying's price and quantity—valuation and allocation. Valuation needs to be determined in terms of RAR. Returns, however, are not the whole story, because different investors have different risk tolerance levels, so there is no single optimal level of risk for everyone. Risk, and the capacity to tolerate it, can be viewed as a resource in itself that must be carefully budgeted, making the source and strategic distribution of risk a paramount consideration. Once the components of a portfolio have been valued and allocated, the performance of the portfolio is measured and appropriate steps are taken to make adjustments to optimize the portfolio. This measurement and optimization cycle is an ongoing process throughout the life of any investment portfolio, in the never-ending quest for the efficient frontier of maximum return for minimum risk.

The two basic forms of portfolio management are passive and active:

Passive management can be understood as non-interference in an assembled portfolio. Passively managed portfolios are generally *beta*-only index products designed for benchmark returns.[32] Fees are low for passive management because no additional management skill is needed beyond the design and construction of the portfolio itself. Passive programs can be used to approximate a benchmark's performance.

32. Examples of benchmark indices used in academic research are: S&P Managed Futures, Barclay Hedge, MLM Index, Stark 300 Index, New Edge CTA Index

Active management is the hands-on trading of a managed futures account. It is dynamic and focused, and it is a hallmark of the managed futures professional. Active traders must be keenly attuned to daily market movement, well prepared with scenario intervention points, and well connected to brokers and other purveyors of market 'color.' They are responsible for everything from the tweaking of an established position to its profitable closing or unprofitable elimination. In short, active traders use their skill to provide *alpha*.

For the CPO, active management means both strategic and tactical asset allocation. Strategic asset allocation attempts to create and maintain an equilibrium portfolio that will yield the best RAR for the long term. Tactical asset allocation adds the ability to take advantage of short term opportunities on top of a balanced portfolio. This takes the form of ongoing changes in allocation to traders, sectors, or methods, meeting changes in the market.

For the CTA, active management means the development and application of trading systems and disciplines in the pursuit of *alpha*. This manifests itself in the creation and optimization of trading methods and the evaluation of their performance.

Managed Futures Trading Models

No two traders are alike because no two people are alike. This inherent variety provides a diversity to the world of managed futures that reflects each trader's unique approach to identifying opportunity, using strategy, and managing risk. Unlike many other asset classes, because of the depth, efficiency and non-directionality of futures trading, many traders use these instruments as their canvas to express trading skill. This leads to significant diversity among trading strategies and methods.

Development of trading models begins with information. In this case, the information set is twofold: fundamental and technical. Perhaps the best way to view these two approaches is to recognize that the fundamental trader is concerned with value, while the technical trader is concerned with price. Another way of putting this is that the former is qualitative, and the latter is quantitative.

Fundamental analysis attempts to determine the value of an underlying commodity or security through the use of indicators. These indicators can be economic, such as Fed interest rate policy announcements, or the monthly U.S. unemployment figures, which affect financial instruments like bond and currency futures; they can also be natural, such as a storm or disease that affects farm commodity futures. They can be event driven, such as Chernobyl, or 9/11; they can even be about the market itself, such as market depth or market gossip.

Technical analysis focuses on price and quantitatively analyzes price history to exploit market behavior. This perspective works from the assumption that the market is always right, because it is the place where the bid meets the offer. This frees the trader from needing to discover all of the vectors at work on the market and provides increased flexibility to capture a wide variety of trading opportunities.

Decision methods generally fall into two main classes:

Systematic trading is algorithm based and is often known as computer-based trading. There is a fixed set of rules (system) for any market scenario, and no deviation from the rules is permitted. Systematic traders use quantitative trading strategies exclusively, making no trading decisions on their own. One notable advantage of this approach is that each trading system can be back-tested to determine its validity and to provide reasonable expectations of future performance.

Discretionary trading is a method in which either there is no algorithm, or deviations from the rules are allowed. At any given time, discretionary traders may use fundamental analysis exclusively, technical trading strategies exclusively, or some combination of both. The primary difference is that in discretionary trading, the traders are free to make their own trading decisions.

Diversity in the futures industry is multi-layered. Within each global region is a palette of market sectors, and within each sector is a wide array of futures contracts.

A trader can take the information set (fundamental, technical, or both) and the decision method (discretionary or systematic) and apply them across this broad spectrum of markets and market sectors, including, but not limited to the following list:

Figure 24

Futures Sectors

Commodities	Grains	*Corn, Wheat, Soybeans, etc.*
	Meats	*Live Hogs, Feeder Cattle, Pork Bellies, etc.*
	Metals	*Gold, Silver, Copper, etc.*
	Softs	*Coffee, Cocoa, Cotton, etc.*
	Energies	*Crude Oil, Natural Gas, Heating Oil, etc.*
	Miscellaneous	*Lumber, Dairy, Rubber, etc.*
Financials	Interest Rates	*Bonds, Bunds, Eurodollars, etc.*
	Foreign Currency	*Euros, British Pounds, Japanese Yen, etc.*
	Equity Indices	*S&P, KOSPI, DAX, etc.*
	Insurance	*Carvill Hurricane Index, Nationwide Catastrophe, etc.*

The levels of exposure to these different market sectors will vary, depending on individual method, market liquidity, and overall portfolio objectives. Relationships do exist between products within sectors, and between sectors themselves.

For example, corn feeds cattle, and so the price of one affects the price of the other. In 2004, when fears of mad-cow disease struck the U.S. beef industry, 65 nations imposed restrictions on U.S. beef products, and exports fell by more than 75%.[33] Corn likewise experienced a 25% decline in price during the same period.

In another example of inter-sector correlation, gold has long been a popular inflation hedge. From the second half of 2007 through the first half of 2008, crude oil more than doubled in price, setting off inflationary fears that drove the price of gold up by more than 40%.

One of the most infamous market events occurred on Black Monday, October 19, 1987, when the Dow Jones Industrial Average plummeted 508 points, taking the S&P 500 down 20.4% in a single day. In the ensuing flight to quality, the price of futures on the 30 Year US Treasury Bond gained an astounding 13.38% over the next five trading days. Here is an example of one market sector directly impacting another with dramatically high negative correlation, although correlation between the two sectors is traditionally low.

There is wide diversity, too, in trade duration. This is due to one of two things: the trader's choice or the trading model itself. The trades that are placed may last from seconds to years, and may capitalize on market inefficiencies anywhere in the world. Some traders limit themselves to trades of a specific duration, such as long-term or intra-day. Others do not limit themselves in this way, but may find themselves constrained by the particular strategy that is generating the trading signal. For extremely short-term trades, market access becomes an additional factor, as electronic trading permits

33. U.S. Meat Export Federation, http://www.usmef.org/TradeLibrary/Statistics.asp

entry and exit in a matter of fractional seconds, while the more circuitous route through brokers may take minutes, leading to differing market perspectives.

Trading Strategy Building Blocks

While trading strategies are many and varied, there are some characteristics common to all of them.[34] Three factors that are key to any trading system are entry, exit, and position size:

Entry is the point at which a trade is established, and is predetermined by the strategy being utilized.

Exit is the point at which a trade is closed, and there are three common varieties:

1. Profit Targets (Take Profit Exits) are exits that close profitable trades once they have reached their targeted profit potential.

2. Stops (Stop Loss or Fail Safe Exits) close unprofitable trades once they reach a predetermined level beyond which further risk is unacceptable.

3. Trailing Stops (Trailing Exits) are stops used on profitable trades to protect profit, while allowing for further gains.

---

34. For an excellent primer on constructing trading methods through regression analysis, see Anderson's *Market Timing Models*.

Position Size is the number of contracts to be held in a trade, and varies according to market volatility, trading strategy, portfolio mix, account size, market liquidity, and risk tolerance.

These three factors are present not only in simple market timing trades, but also in tactical asset allocation, in which a trader makes minor adjustments to complex strategies involving multiple markets or market sectors.

The entry is the first leg of any trade and may be triggered by a single factor or combination of factors derived from rules a trader, either systematic or discretionary, has pre-established, based on the trader's approach and strategy class. There are three major categories of entry signals: trend following, non-trend following, and pattern recognition.

Trend Following strategies are designed to find and take advantage of emerging consistencies in market motion.[35] Moving averages do this by tracking recent returns to suggest continued moves. Breakouts, on the other hand, observe general ranges of market motion and join the trend when the market moves outside of an expected range.

Non-Trend Following strategies are designed to exploit inconsistencies in market motion. They fall into the two major categories of counter-trend and relative value. Counter-trend approaches use oscillators to capture market reversals while relative value strategies capture the inefficient gaps between two correlated trading instruments.

---

35. While there are many books on trend following, one of the most recent and most readable is Covel's *Trend Following*.

Pattern Recognition strategies identify and capture systematic, abnormal market behavior. These predominantly emerge as shapes in price or volatility.

Trend Following Strategies

Trend following strategies are designed to identify and capture trends. A trend, in its simplest sense, is the direction that the market is heading. Since markets zigzag in a series of peaks and troughs, rather than moving in a straight line, it is the general direction of the zigzag that makes a trend. Predominant entry signals for trend following include moving averages, momentum, channel breakouts, and volatility breakouts.

Moving Averages

Moving averages are average prices over a given time period. Like the underlying market itself, the average changes every day, and moves along the price chart as a lagging indicator. The shorter the moving average, the more closely it will match the movement of the market price itself. Conversely, the longer the average, the more gradually the curve will change direction.

Three of the most common uses of moving averages include:

1. A buy signal when price is above a given moving average or set of moving averages, or a sell signal when the price dips below those levels.

2. A buy signal when a shorter-term moving average crosses up and over a longer-term moving average, or a sell signal when the shorter-term moving average crosses down under the longer-term moving average.

3. A buy signal when a set of moving averages align upward, or a sell signal when they align downward.

Momentum styles take this idea one step further and track the change of price over time, revealing accelerating trends.

Figure 25

Moving Average Example
10-day and 45-day SMA with price data

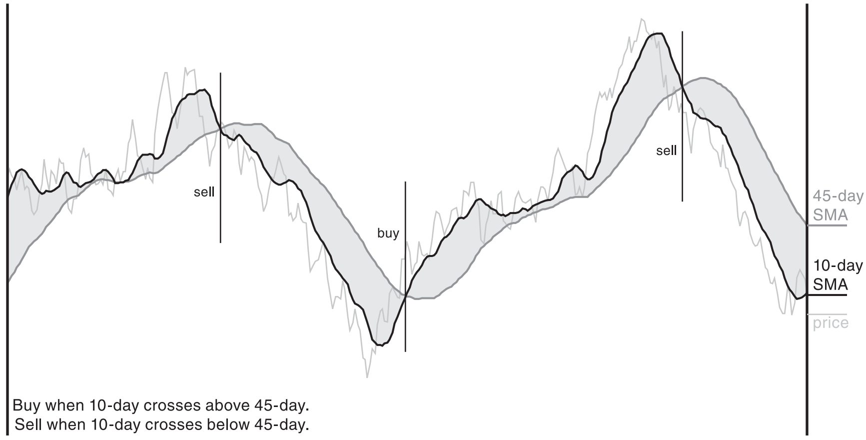


Figure 26

Simple Moving Average (SMA)

Description

In the simple moving average, the daily prices are equally weighted. As each new price observation is added to the series, the oldest observation falls away, creating a fresh average price that is then plotted on the chart.

Signals

Enter long if price > average.
Enter short if price < average.

Equation

$$SMA_t(n) = \frac{1}{n}P_t + \frac{1}{n}P_{t-1} + \cdots + \frac{1}{n}P_{t-(n-1)}$$

Figure 27

Weighted Moving Average (WMA)

Description

The weighted moving average controls its rate of reaction to the underlying price movement by changing the weights of the price observations. This tends to take the form of giving the greatest weight to the most recent price and progressively reducing the weights of price observations as they age, in order to increase the relevancy of the most recent observations.

Signals

Enter long if price > average.
Enter short if price < average.

Equation

$$WMA_t(n) = \omega_1 P_t + \omega_2 P_{t-1} + \cdots + \omega_n P_{t-(n-1)}$$

Figure 28

Exponential Moving Average (EMA)

Description

The exponential moving average combines the most recent price with the moving average values of the previous days in a series. As a result, older price data is not lost, and the average line tends to stay close to the actual price series.

Signals

Enter long if price > average.
Enter short if price < average.

Equation

$$EMA_t(n) = \alpha P_t + (1-\alpha)EMA_{t-1}$$

$$\text{most commonly}$$

$$\alpha = \frac{2}{1+n}$$

Figure 29

Momentum

Description

The momentum strategy calculates the slope of the market price over a specific time period. The magnitude of the slope indicates the strength of particular trends.

Signals

Buy when today's close > n days ago's close.
Sell when today's close < n days ago's close.

Equation

$$\text{Momentum} = \text{Close}_t - \text{Close}_{t-n}$$

Breakouts

Breakout strategies observe ranges of motion in the market and identify trends when they break through the boundaries. The concept applies to both price and volatility motion. There are many ways to create the ranges, but two of the most common are by using price channels and volatility.

Figure 30

Channel Breakout

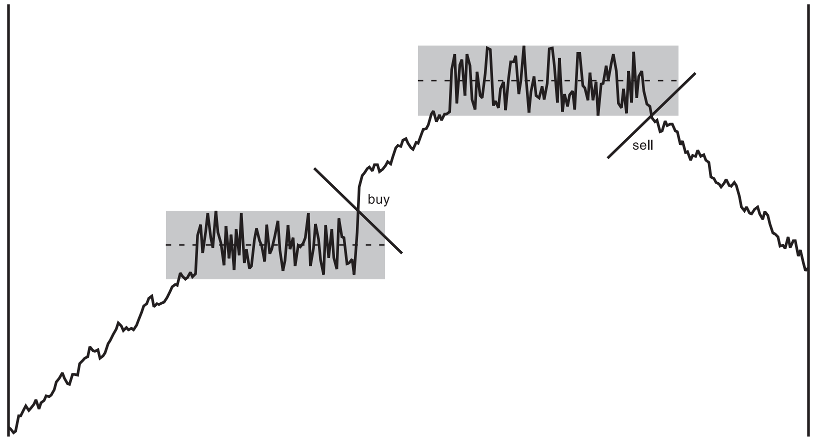


Figure 31

Channel Breakout

Description	Channels are created by plotting the range of new price highs and lows. When one side grows disproportionally to the other, a trend is revealed.
Signals	Buy when channel breaks upward. Sell when channel breaks downward.
Equation	$\mathrm{UpperBound} = \mathrm{HighestHigh}(n)$ $\mathrm{LowerBound} = \mathrm{LowestLow}(n)$ most commonly $n = 20$ days

Figure 32

Volatility Breakout

Description

Volatility breakout applies the same method for creating a channel based on volatility to trade trending volatility. Volatility breakouts can also be based on moves of standard deviation on the price curve.

Signals

Buy when the top trigger is passed.
Sell when the bottom trigger is passed.

Equation

$$\begin{aligned}\text{UpperBound} &= \text{ReferencePoint} + \text{factor} \times \sigma \\ \text{LowerBound} &= \text{ReferencePoint} - \text{factor} \times \sigma\end{aligned}$$

$$\text{most commonly}$$

$$\begin{aligned}\text{ReferencePoint} &= \text{Yesterday'sClose} \\ \sigma &= \text{volatility} \\ &= \text{average true range} \\ \text{factor} &= \text{trader determined}\end{aligned}$$

$$\begin{aligned}\text{average true range} &= MA\,(\text{true range, 20 days}) \\ \text{true range} &= \text{maximum of} \\ &\quad \begin{bmatrix} \text{Today'sHigh} & - & \text{Today'sLow} \\ \text{Today'sHigh} & - & \text{Yesterday'sClose} \\ \text{Yesterday'sClose} & - & \text{Today'sLow} \end{bmatrix}\end{aligned}$$

Non-Trend Following Strategies

Counter-Trend

Counter-trend strategies use oscillators to identify and capture reversals. Some of the most common oscillators used in counter-trend trading include Relative Strength Index, Stochastics and Moving Average Convergence/Divergence, each of which will be discussed in turn.

Figure 33

Relative Strength Index Example

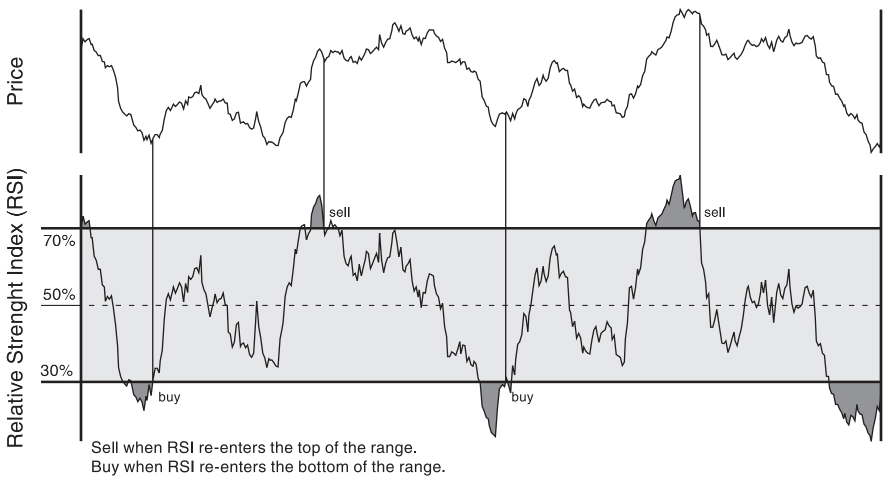


Figure 34

Relative Strength Index (RSI)

Description

Relative Strength Index *(RSI)* is an oscillator based on an index of 0 *(absolute market bottom)* to 100 (absolute market top), with 50 being neutral. The RSI attempts to determine the relative market strength of the current price of the underlying. To do this, the RSI compares the average price change of all up moves to the average price change of all down moves.

Signals

Buy when RSI < 30 *(oversold market)*.
Sell when RSI > 70 *(overbought market)*.

Equation

$$RSI = 100 - \frac{100}{1 + \frac{U}{D}}$$

$$\begin{aligned} U &= \text{average of all up days for the last } n \text{ days} \\ D &= \text{average of all down days for the last } n \text{ days} \\ & \quad \text{most commonly} \\ n &= 14 \end{aligned}$$

Figure 35

Stochastics

Description

The idea behind stochastics is that in uptrends, closing prices tend to remain near the high end of the price range, while in downtrends, closing prices tend to stay closer to the low end of the price range. Stochastics operate along the same 0 to 100 index continuum as RSIs, but formulas are used that produce two signal lines of %K and %D.

Signals

Buy when %K > 30 and crosses %D.
Sell when %K < 80 and crosses %D.

Equation

$$\%\mathrm{K} = \frac{\mathrm{Today's Close} - \mathrm{Lowest Low}}{\mathrm{Highest High} - \mathrm{Lowest Low}}$$

$$\%\mathrm{D} = MA\ \%\mathrm{K}$$

most commonly
MA over a 3 day period

Figure 36

Moving Average Convergence/Divergence (MACD)

Description

Moving Average Convergence/Divergence *(MACD)* is an oscillator that measures the difference between two moving averages *(MAs)*. A third MA line on the shortest time frame acts as a signal line through the middle, and trades are triggered when the other two cross above or below the signal line.

Signals

Buy when the 26 day MA and 12 day MA cross above 9 day MA signal line.
Sell when MAs cross below the signal line.

Equation

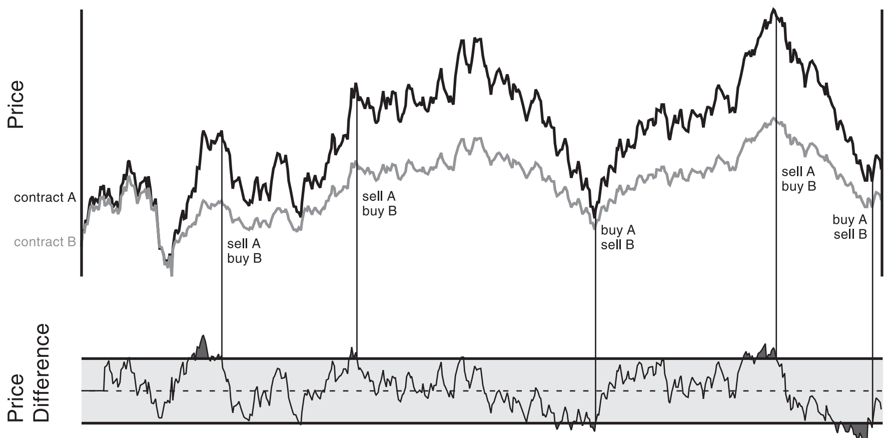
$$MACD = MA1 - MA2$$

Relative Value

Relative value strategies are built on the assumption that market response to price changes is inefficient. When there is a significant price difference, two contracts of high correlation will seek equilibrium. During the transition there will be a price gap that can be exploited.

Figure 37

Relative Value



Trade the spread when the relationship of the instruments is unbalanced.

Figure 38

Arbitrage

Description

Arbitrage strategies exploit the price differences of two correlated contracts. The contracts can involve different markets or different expirations of the same underlying at market neutral ratios.

Signals

Buy spreads when market will have to correct up.
Sell spreads when market will have to correct down.

Equation

$$\begin{aligned} \text{difference}_t &= \text{Close}_t(A) - \text{Close}_t(B) \\ &= \text{Price of } A_t - \text{Price of } B_t \end{aligned}$$

$$\begin{aligned} RSI(\text{difference}) &< 30,\ \text{Buy } A,\ \text{Sell } B \\ RSI(\text{difference}) &> 70,\ \text{Sell } A,\ \text{Buy } B \end{aligned}$$

Figure 39

Volatility Arbitrage

Description

Volatility arbitrage takes spread trading to the next level by using options instead of futures contracts. Unlike futures spreads, volatility arbitrage can also exploit inefficiencies in the volatility skew within a single expiration month of a single underlying futures contract.

Signals

Buy options when volatility will have to correct up.
Sell options when volatility will have to correct down.

Equation

$$\begin{aligned} \sigma_i &< [\sigma_e, \sigma_u] \text{ buy option and delta hedge} \\ \sigma_i &> [\sigma_e, \sigma_u] \text{ sell option and delta hedge} \end{aligned}$$

$$\begin{aligned} \sigma_i &= \text{implied volatility} \\ [\sigma_e, \sigma_u] &= \text{forcasted volatility range} \end{aligned}$$

Pattern Recognition Strategies

Visual Patterns

Visual pattern recognition uses graphical means to watch the markets for emerging patterns. There are many documented images that occur consistently enough to be meaningfully quantified.

While other strategies can be most clearly explained with formulas, the best way to describe the visual styles is to show a few of the key patterns.

Figure 40

Head and Shoulders

Description

Head and shoulders is a triple top, pattern with a *neckline (a confirmation line)* and is used as a bearish signal. Conversely, a headstand *(an upside-down head and shoulders)* once again with a neckline, provides a bullish signal.

Illustration

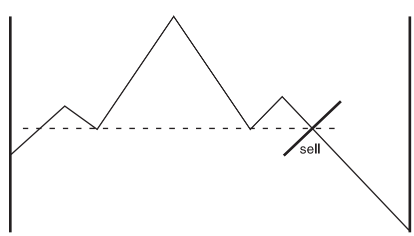


Figure 41

W

Description

Double top and double bottom look like 'M' and 'W' when graphed, the double top being bearish, and the double bottom being bullish. For a double top or double bottom to be valid, the market must break through the support line *(the point of the center angle of a double top)*, or through the resistance line *(the point of the center angle of a double bottom)*.

Illustration

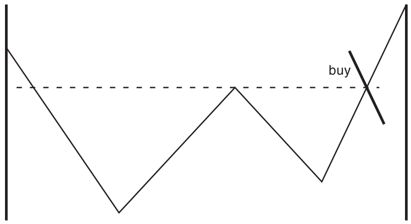


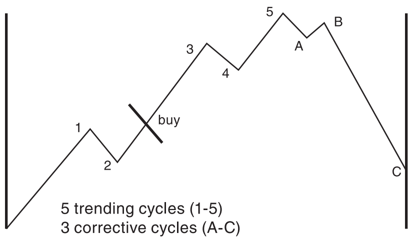
Figure 42

Elliott Waves / Fibonacci Sequences

Description

Built on the foundation of Fibonacci's sequence—a mathematical pattern established in the 13th century—Elliott Wave Theory essentially views markets in terms of cycles, and defines a complete market cycle as five trending waves with three corrective waves.

Illustration



For each of the signal generations, there are many criteria that must be met for the signal to verified and reliable. It is common practice to overlay different strategies for mutual verification and to set up other signal approval methods to validate a trading signal.

Fundamental/discretionary traders may or may not make use of these strategic building blocks. Managed futures traders put these together in ways that reflect their trading personalities, and some do so in such complex ways that each of the strategies involved become difficult to identify. In the end, what counts is trader skill in putting together trading concepts and consistently using them in a disciplined manner in order to maximize the benefits of a managed futures program.

Trading Model Validation & Testing

To trade, or not to trade: that is the question. Should every trade signal be accepted? If not, is there a systematic way of making this decision? Signals do not occur in a sterile environment, and therefore, they must be verified in order to be used with any level of confidence. Two approaches used for verifying signals are back-testing and filtering. Back-testing is a process of reviewing price history by using different time periods and scenarios to determine optimal conditions for the application of the model. Choosing the periods for back-testing is an art in itself. Different kinds of models require different kinds of back-testing. The rigorous trader will use many different time periods and methods of testing to find the best parameter set for robust system performance. This testing will never stop, because continuous improvements to systems require ongoing validation. Once a method becomes active, the trader will be able to apply it to a market environment, using filters to verify trade signals and to optimize the method's use.

Two popular filters are the Average Directional Movement Index (ADX) and the Vertical Horizontal Filter (VHF). These measure trend strength, and applying these filters to a trend not only permits entry point evaluation, but can also provide for changes in strategies, in response to sudden changes in the market. Lars Kestner refers to these as 'market regime changes.'[36] Additionally, in a multi-strategy trading program, filters help to determine the appropriate balance in the trading model at any given time.

Our ever-changing world carries with it the suggestion that nothing lasts forever, and trading systems are no exception. A trading model or trading strategy that has been successful over the past ten years may not be over the next ten. Kestner refers to this phenomenon as 'half life,' a term borrowed from the nuclear decay process.[37] It is a method for testing the attribution of the model or strategy's current value. This determines the point at which a deteriorating model should be discarded or replaced with a newer one. Once the RAR of a model or strategy begins to drop, it will continue to fall. It is important to know when to stop using it *before* it becomes unprofitable

---

36. Kestner, *Quantitative Trading Strategies,* 118-121.

37. Kestner, 94.

Trading Strategies - Due Diligence

When evaluating trading strategies from a due diligence standpoint, the two major considerations are the trading model itself and the trading system being used to apply it.

Trading Model – There are four major questions that must be addressed regarding trading models:

1. What is it? – A description of the broad underlying approach and the specific underlying strategies employed in the trading program.

2. Why does it work? – The trading manager's underlying hypothesis for why the strategy works and RAR expectations.

3. How is it maximized? – An explanation of how the trading manager maximizes the advantage they seek to capture. What kind of data do they use? What are their sources? How do they clean the data? How do they use the data?

4. Examples? – Representative historical examples of successful and unsuccessful applications of a given strategy, with commentary on why they succeeded or not.

Trading System Degradation – Once the general trading approach and specific trading strategies have been satisfactorily addressed, the next big question is that of system degradation. How durable is the system that is being evaluated? Four main issues need to be considered in order to provide a good understanding of this most critical area:

1. How quickly will competitors discover this edge and replicate it? – This can directly affect the speed of degradation over time.

2. How are the trades executed? – Poor execution can cause slippage resulting in immediate degradation.

3. How does the trading manager handle asset growth? – This is a multifaceted question covering style, strategies, research, etc.

4. Has the trading manager over-fitted the model to the current market? – If so, the system is less likely to work well over a longer time frame.

Trading Model Application

Each trader applies diverse trading models to market opportunities in his or her own way. The key is to harness the best of these unique approaches and assemble them into a customized investment vehicle, and fortunately, CPOs exist to provide multi-trader exposure for such diversification. The skill and insight that a CPO brings to the table makes it possible for diverse traders to be balanced for optimal portfolio exposure. CPOs provide access to multi-trader CTA investments in two distinct ways. First, in a fund-of-funds approach where the investment is made into multiple CTAs funds.

This is similar to the typical fund-of-funds product offered for hedge fund access. The second approach is to have managed accounts with multiple CTAs, and maximize the previously discussed benefits of CTA investment, including transparency and cash efficiency. Technically speaking, this is not a fund-of-funds, as no investments are made into funds, so it is referred to as a Manager-of-Managers program (MoM). A MoM program can also provide active portfolio and risk management, and has the opportunity to provide daily liquidity in specialized cases.

In addition, the CPO is a specialist who can provide active management on a daily basis. Just as traders use their strategies and skills to trade markets, so CPOs use their strategies and skills to trade traders. Creation and management of an investment portfolio is a specialized craft, and is best done by someone who focuses only on these activities. The assistance of a CPO provides investors with a level of diversification and confidence that would be difficult for them to achieve on their own.

Structured Investment Products

Today's managed futures industry is about more than just returns adjusted for risk. It is about *targeted* returns. It is about meeting specific investment needs and objectives. To this end, the creation of structured investment products provides the flexibility necessary to address the particular concerns of each investor. Through structured products, access to market exposure can be targeted to specific risk and return parameters and denominated in the investor's currency of choice. This means that both risk exposure and currency exposure can be customized. Structured products provide a way to financially engineer specific return characteristics with any investment vehicle. Whatever the need, a structured product can be crafted to meet it. Liquidity, transparency, cash efficiency, trader skill, and the elimination of both counter party and lock-up risk all combine to make managed futures an ideal vehicle for the application of structured products. The advantages provided by structured products in a managed futures context also make it possible to increase exposure (i.e. become more aggressive) at no extra cost. Created and applied through managed futures, whether custom designed or off-the-shelf, structured products provide outstanding economic engineering. It is this engineering that is making them a mainstay in the industry's future.

One of the earliest structured product applications was principal protection. Many investors shy away from investments labeled as 'alternative' because they perceive these as carrying more risk, and fear the loss of principal. By putting principal protection structures in place, investors who once feared the choppy waters of higher-risk investments are given a new level of freedom to explore the alternative investment space. A more recent application is portable *alpha*, or returns that do not utilize the *beta* of portfolio assets and thus provide diversification and the potential for added return. Investors need portable *alpha* if they want to expand a balanced portfolio's profit potential without adding additional risk.

Principal Protection—The history of structured products began in the 1970s, when the earliest structures were being built to protect principal. One type of principal protection today is the zero-coupon bond structure. In this type of investment, a bond without any interest-paying coupon attached to it is purchased for a discount to face value at redemption. The remaining cash is used for trading, so that the final payout includes both the original bond discount and any trading profits. Because managed futures trades on margin, the cash used for trading can be leveraged to provide what is often equal participation to a standard leveraged product. In short, the same trading size is available with a principal guarantee. So far so good, but this structure has two weaknesses. First, if losses reach a predetermined point, trading discontinues and the investor receives only the principal. Secondly, in early liquidation, the bond is subject to interest rate risk because the discount fluctuates until maturity.

In order to remove the bond risk, and to provide more flexibility regarding potential leverage (rather than purchase a zero-coupon bond), the same concept can be managed mathematically through Constant Proportion Portfolio Insurance (CPPI). Developed in the 1980s, CPPI provides a vehicle for dynamic hedging between funds and cash to guarantee principal. Because CPPI does not require the purchase of a bond, liquidation can be provided that is not subject to changing bond prices. However, the potential for a trading stop-loss still exists. In a CPPI, the underwriter of the structure guarantees the initial invested capital while providing for participation in the positive performance of a fund. The structure itself is a dynamic blend of a fund component and a fixed income component, the combination of which is referred to as the underlying. Depending on performance, the allocation to the fund can vary from 0% to more than 100%, and it generally begins at a high initial exposure. Attributes of this type of product may include high yield probability, principal guarantee, variable annual coupon, daily liquidity, daily determination of net asset value, broad market diversification, method diversification, and full transparency.

Portable Alpha – In the late 1970s, the concept of portable *alpha* made its debut, notably through Bridgewater, SSI, and First Quadrant. The goal was to create an *alpha* investment that was completely independent of the underlying portfolio *beta*. While not historically identified as a managed futures product, it was often the case that 'portable *alpha*' was managed futures trading (as defined by the instruments used) leveraged to provide the desired yield enhancement. Cash efficiency makes it possible for *beta* to exist as a leveraged product, leaving cash available for trading and producing *alpha*. This *alpha*, which is unrelated to the portfolio *beta*, is driven by trader skill and available to be ported onto any investment.

This simple overview has provided descriptions of the two major categories of structured products, including a basic presentation of each as they exist in the managed futures industry. Like trading styles, these two elemental applications can be combined in different ways. The driving force behind such products is to meet the specific risk-adjusted needs of investors. As the needs of investors change, structured products will expand to meet them.

The Future of
Managed Futures

Today there are over 1,500 different futures contracts available to be traded on more than 80 exchanges worldwide. This kind of broad diversity is coupled with ever-deepening liquidity on the futures exchanges, creating an ocean of opportunity that is both deep and wide. Depth and diversity are both hallmarks of managed futures, creating fascinating and continually increasing possibilities. Market depth is evident in the following tables showing assets under management and worldwide trading volume.

Figure 43 [38]

Managed Futures Industry's Assets & Volume

Year	Assets *in billions*	Change *in %*	Contract Volume *in billions*	Change *in %*
2000	39.4	—		
2001	43.4	+ 10		
2002	51.5	+ 19		
2003	81.6	+ 58	8.2	—
2004	130.2	+ 60	8.9	+ 9
2005	130.8	+ 0	10.0	+ 12
2006	168.4	+ 29	11.9	+ 19

Assets under management and global trading volume are both on a steady march upward, assisted by continuing advances in technology. As electronic trading takes hold at exchanges around the world, the ever-increasing volume of trades will mean deepening liquidity and declining transaction costs, thus providing a safe and efficient trading vehicle for the ever-increasing assets under management in the managed futures industry. The electronic platform

38. The Assets and Change data is provided by CISDM, while the Contract Volume and Change information is from Burghardt's "Volume Growth Accelerates."

and other advances in data processing and communications are helping to create a more global marketplace.

The Chicago Board of Trade (CBOT), as the oldest and one of the largest futures exchanges in the world, provides an excellent example of the impact of electronic trading on the futures markets. The CBOT introduced electronic trading in 1994, and it took nine years for the electronic volume of cyberspace to overtake the open auction volume of the trading floor. The electronic portion of CBOT volume rose from less than 1% in 1994 to 70% in 2006. Total trading volume at the CBOT more than tripled during the same time period. The open auction business conducted on the trading floor has not increased, but neither has it decreased. With the open auction volume remaining steady at a yearly average of just under 223 million contracts traded, it is clear that electronic trading is responsible for virtually all of the increased volume at the CBOT. The following table tells the story.

Figure 44 [39]

Chicago Board of Trade's Electronic Volume vs. Open Auction Volume

Year	Electronic *in %*	Open Auction *in %*	Electronic *in millions*	Open Auction *in millions*	Total *in millions*
1994	0	100	0	219	220
1995	0	100	1	210	211
1996	1	99	2	220	222
1997	2	98	6	237	243
1998	4	96	12	269	281
1999	4	96	11	243	255
2000	7	93	16	218	234
2001	20	80	53	208	260
2002	38	62	129	215	344
2003	52	48	236	199	455
2004	58	42	349	224	600
2005	65	35	438	210	675
2006	70	30	562	222	806

The electronic platform has clearly revolutionized trading at the CBOT, and the impact is felt at futures exchanges worldwide. Increased reliance on electronic execution should not only add efficiency to the marketplace, but also deepen liquidity and drive execution costs down, which in turn should clear the way for the increased use of high-frequency trading.

However, it is not just the growth in trading volume and the number of tradeable contracts that make managed futures increasingly attractive.

39. Table created from data provided by Chicago Board of Trade, Department of Market Data Products & Information, May 11, 2007.

The corresponding explosion in the development of trading methods and structured products, especially the expanding demand for portable *alpha*, constantly brings new value.

For the trader, the beauty of exchange-traded futures markets lies in the immediate awareness of market movement and the subsequent trading signal generation it enables. The global nature of managed futures means that the industry never sleeps, while electronic access to trading is creating a trajectory that may well make it possible to trade any market, in any place, at any time, in the very near future.

For the investor, the beauty of managed futures lies in the diversifying effect of its non-correlation to a traditional portfolio of stocks and bonds, its accountability to regulators, and its transparency. In other words, investing in managed futures helps to minimize risk, fraud, and guesswork, but it does even more than that. Managed futures is an asset class that also provides a clear expectation of positive *alpha*, but without the correlated *beta* component. The academics had it right all along, and the world of investments is sitting up to take notice.

Conclusion

As more and more people have begun to understand the importance of non-directional, cash-efficient trading, the managed futures industry has emerged from the world of private investors to play an increasingly major role in the world of institutional investors. These investors are looking for diversification, transparency, and liquidity, and the managed futures industry specializes in providing each of these benefits.

Diversification is no longer a luxury. It has been a necessity for the past several decades because of market volatility. Increasingly more investors, holding traditional portfolios of stocks and bonds, are discovering diversification through managed futures. The non-correlation over time horizons of varying lengths, along with specifically crafted negative correlation for adverse scenarios, together make a managed futures program the diversifier of choice. It also carries with it the expectation of positive portable *alpha* at no extra charge. This bonus, combined with negative correlation in specific scenarios and non-correlation over a broad range of time horizons, makes managed futures a superior vehicle for portfolio diversification.

Transparency is a hallmark of managed futures. As technology makes the world smaller and more connected, increased demand for accountability naturally ensues. Managed futures quickly and easily adapt to each new required level of disclosure, because the industry itself is inherently transparent. Products are exchange-traded, providing standardization of contracts and high confidence in the integrity of the transactions themselves. Positions are marked-to-market on a daily basis, making it possible to establish a realistic portfolio value every day. Managed accounts are transparent to investors and CPOs on a daily or even an intra-day basis. In addition, rigorous oversight makes managed futures transparent to both government and self-regulatory agencies.

Liquidity is the third member of the managed futures family. We have seen that the futures markets are both global and deep, making it easy for investors to get in or out of any position, at any time. As a liquidity vehicle, managed futures also provides significant leverage for free, providing investment flexibility that is unknown in other investment spaces.

Why managed futures? The simple answer is that managed futures are a significant way to improve returns while reducing risk. Smart money is never satisfied with the status quo of traditional returns. This is why cutting edge institutions and pension funds are increasingly turning to managed futures for portfolio enhancement that is unparalleled. Sophisticated methods offer profound flexibility in the pursuit of *alpha*. Non-correlation offers extraordinary diversification in the pursuit of risk reduction. This is how specific investment objectives can be identified and met. This is how to turn a good investment into a great one.

Bibliography

All websites accessed in 2007. While many are still accessable some are no longer so. Where feasable, we have attempted to re-access websites to verify their continung availability.

Anderson, Richard. *Market Timing Models* Burr Ridge: Irwin, 1996.

Anson, Mark J.P. *Handbook of Alternative Assets.* New York: John Wiley & Sons, 2002.

Avery, Kim and Mark H. Melin. "Portfolio Diversification Opportunities with Managed Futures." Chicago Board of Trade. http://www.cbot.com/cbot/pub/cont_detail/0,3206,1084+40858,00.html (accessed August 24, 2006).

Burghardt, Galen. "11,859,266,610 Volume Growth Accelerates." Futures Industry Magazine, March/April 2007, http://www.futuresindustry.org/fi-magazine-home.asp?a=1171 (accessed December 19, 2009).

Carew, Edna. *The Language of Money.* Melbourne: Australia and New Zealand Banking Group, 1996. http://www.anz.com/edna/dictionary.asp?action=content&content=gold_standard (accessed December 19, 2009).

Cavello, Angelo. "Portable Alpha." *State Street Global Advisors,* October 15, 2003. http://www.ssga.com/library/povw/angelocalvelloportablealpha20031002/page.html

CFTC. "About the CFTC." CFTC. http://www.cftc.gov/files/oirm/video/cftcmedia.htm (accessed December 17, 2009).

CFTC. "An Important Mission in the Ever-Changing World of Finance." CFTC. http://www.cftc.gov/aboutthecftc/ (accessed December 17, 2009).

CFTC. "CFTC Glossary." CFTC. http://www.cftc.gov/educationcenter/glossary/ (accessed December 17, 2009).

Chance, Don. *Essays in Derivatives,* New York: John Wiley & Sons, 1998

Chance, Don. *Managed Futures and Their Role in Investment Portfolios.* Oxford: Blackwell, 1994.

Chandler, Beverly. *Managed Futures.* Chichester: John Wiley & Sons, 1994.

Chicago Board of Trade. *"Our History."* CBOT - Our History, 2007. http://www.cbot.com/cbot/pub/page/0,3181,942,00.html

Code of Federal Regulations. Title 17: "Commodity and Securities Exchanges." Section 4.7. 2006.

Copeland, Tom and Vladimir Antikarov. *Real Options : a Practitioner's Guide.* New York: Texere, 2001.

Cottle, Charles M. *Options: Perception and Deception.* Chicago: Irwin Professional Pub, 1996.

Covel, Michael. *Trend Following: How Great Traders Make Millions in Up or Down Markets.* Upper Saddle River: Financial Times Prentice Hall, 2006.

Dannenberg, Alex. "Opening Up The Black Box." Derivatives Strategy.com. http://www.derivativesstrategy.com/magazine/archive/1999/0499col1.asp (accessed December 28, 2009).

Darling, Gwenevere, Kankana Mukherjee, and Kathryn Wilkens. "CTA Performance Evaluation with Data Envelopment Analysis." In *Commodity Trading Advisors: Risk, Performance Analysis, and Selection.* Edited by Greg N. Gregoriou, et al. Hoboken: John Wiley & Sons, 2004.

Edelman, Ric. "Tulip Bulbs and the Stock Market." *Inside Personal Finance.* http://www.ricedelman.com/planning/investing/tulipbulbs.asp.

Elliott Wave International. "Ralph Nelson Elliott." Elliot Wave International. http://www.elliottwave.com/info/ (accessed December 28, 2009).

Epstein, Charles B. *Managed Futures in the Institutional Portfolio.* New York: John Wiley & Sons, 1992.

FutureSource.com "World Regulatory Agencies and Central Banks" FutureSource.com http://futuresource.com/reference/agencies.jsp (accessed March 1, 2010)

Greenhalgh, Hugo. "Turning Theory Into Reality." FT Mandate. http://www.ftmandate.com/news/fullstory.php/aid/1272/Turning_theory_into_reality.html (accessed December 28, 2009).

Hedgeworks. "What is Calmer Ratio?" Hedgeworks. http://www.hedgeworks.com/main.nsf/6faf3bdf663bce748825702e004d8d54/$FILE/CalmarRatio.pdf (accessed December 28, 2009).

Hine, Thompson. "Fiduciary Landmines in Organizing and Operating Hedge Funds." Seminar presented at the Palmer House Hilton, Chicago, IL, May 17, 2007.

Holton, Glyn A. *Value at Risk: Theory and Practice.* Boston: Academic Press, 2003.

IndexInvestor.com. "Separating Alpha From Beta: Portable Alpha." IndexInvestor.com. http://www.indexinvestor.com/Free/alphaBeta.php?gclid=CNCkv7vz_IsCFQzDQQodwhE5Uw (accessed December 28, 2009).

Jaeger, Lars. *Managing Risk in Alternative Investment Strategies.* London: Prentice Hall, 2002.

Kat, Harry M. "Managed Futures and Hedge Funds: A Match Made in Heaven." In *Commodity Trading Advisors: Risk, Performance Analysis, and Selection.* Edited by Greg N Gregoriou, et al. Hoboken: John Wiley & Sons, 2004.

Kestner, Lars. *Quantitative Trading Strategies.* New York: McGraw-Hill, 2003.

Lintner, John. "The Potential Role of Managed Commodity - Financial Futures Accounts (and/or Funds) in Portfolios of Stocks and Bonds." In *Managed Futures.* Edited by Carl C. Peters. Chicago: Probus, 1992.

Litterman, Bob. *Modern Investment Management.* Hoboken: John Wiley & Sons, 2003.

Mackay, Charles. *Extraordinary Popular Delusions and the Madness Of Crowds.* 1841. Reprint, New York: Dover Publications, 2003.

Markowitz, Harry. *"Autobiography."* In Les Pris Nobel. The Nobel Prizes 1990. Edited by Tore Frängsmyr, 1990. http://nobelprize.org/nobel_prizes/economics/laureates/1990/markowitz-autobio.html (accessed December 28, 2009).

Martinelli, Lionel and Mathieu Vaissie. "Benchmarking the Performance of CTAs." In *Commodity Trading Advisors: Risk, Performance Analysis, and Selection.* Edited by Greg N Gregoriou, et al. Hoboken: John Wiley & Sons, 2004.

McLaren, John, Nancy C. Everett, and Thomas J O'Donnell, III. "Managed Futures" White Paper, Virginia Retirement System.

Murphy, John J. *Technical Analysis of the Futures Markets.* New York: New York Institute of Finance / Prentice Hall, 1986.

Natenberg, Sheldon. *Option Volatility & Pricing.* New York: McGraw-Hill, 1994.

National Association of Securities Dealers. "Security Futures – Know Your Risks, or Risk Your Future." *NASD Investor Information,* November 4, 2002. http://www.nasd.com/InvestorInformation/InvestmentChoices/NewFinancialProducts/index.htm.

National Futures Association. *National Futures Association Manual as of March 1, 2006.* Chicago: NFA, 2006.

National Futures Association. *Opportunity and Risk.* Chicago: NFA, 2006.

National Futures Association. *Trading in the Retail Off-Exchange Foreign Currency Market.* Chicago: NFA, 2004.

National Futures Association. "NFA's Role In The U.S. Futures Industry." *NFA | About NFA.* http://www.nfa.futures.org/aboutnfa/indexAbout.asp (accessed December 28, 2009).

Original Turtles. "The Turtle Story." *Where are Turtles Now?* http://www.tradingblox.com/originalturtles/story.htm (accessed December 28, 2009).

Peters, Edgar E. *Chaos and Order in the Capital Markets.* New York: John Wiley & Sons, 1991.

Richard Davoud Donchian Foundation. *"About Us: Founder Biography."* The Richard Davoud Donchian Foundation http://www.rddonchian.org/ (accessed December 28, 2009).

Ritholtz, Barry. "Crude Price History." The Big Picture. http://bigpicture.typepad.com/comments/2005/10/crude_price_his.html (accessed December 28, 2009).

Rockefeller, Barbara. *Technical Analysis for Dummies.* Hoboken: John Wiley & Sons, 2004.

Rotella, Robert P. *The Elements of Successful Trading.* New York: New York Institute of Finance / Simon & Schuster, 1992.

Sandrini, Francesco and Dermot Ryan. *"Appetite Whetted for Innovative Investments."* FT Mandate. http://www.ftmandate.com/news/printpage.php/aid/1273/Appetite_whetted_for_innovative_investments.html (accessed December 28, 2009).

SEC. *"Select SEC and Market Data Fiscal 2006."* SEC. http://www.sec.gov/about/secstats2006.pdf (accessed December 28, 2009).

Shwager, Jack D. *Managed Trading: Myths & Truths.* New York: John Wiley & Sons, 1996

Societe Generale. *Guide to Structured Investments.* London: Incisive Media Investments Limited, 2005.

Sowell, Thomas. *Basic Economics.* New York: Perseus, 2000.

Taleb, Nassim. *Dynamic Hedging: Managing Vanilla and Exotic Options.* New York: John Wiley & Sons, 1997.

Traders Accounting. "Lost in Translation: Foreign Exchange Tax Codes (Part III)." Traders Accounting. http://www.tradersaccounting.com/news_detail.php?newsid=33 (accessed December 28, 2009).

U.S. Meat Export Federation. "Export Statistics 2009." U.S. Meat Export Federation. http://www.usmef.org/TradeLibrary/Statistics.asp (accessed March 1, 2010).

Yeoman, R.S. *United States Coins.* Atlanta: Whitman, 2005.

Index

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

X Y Z

Symbols