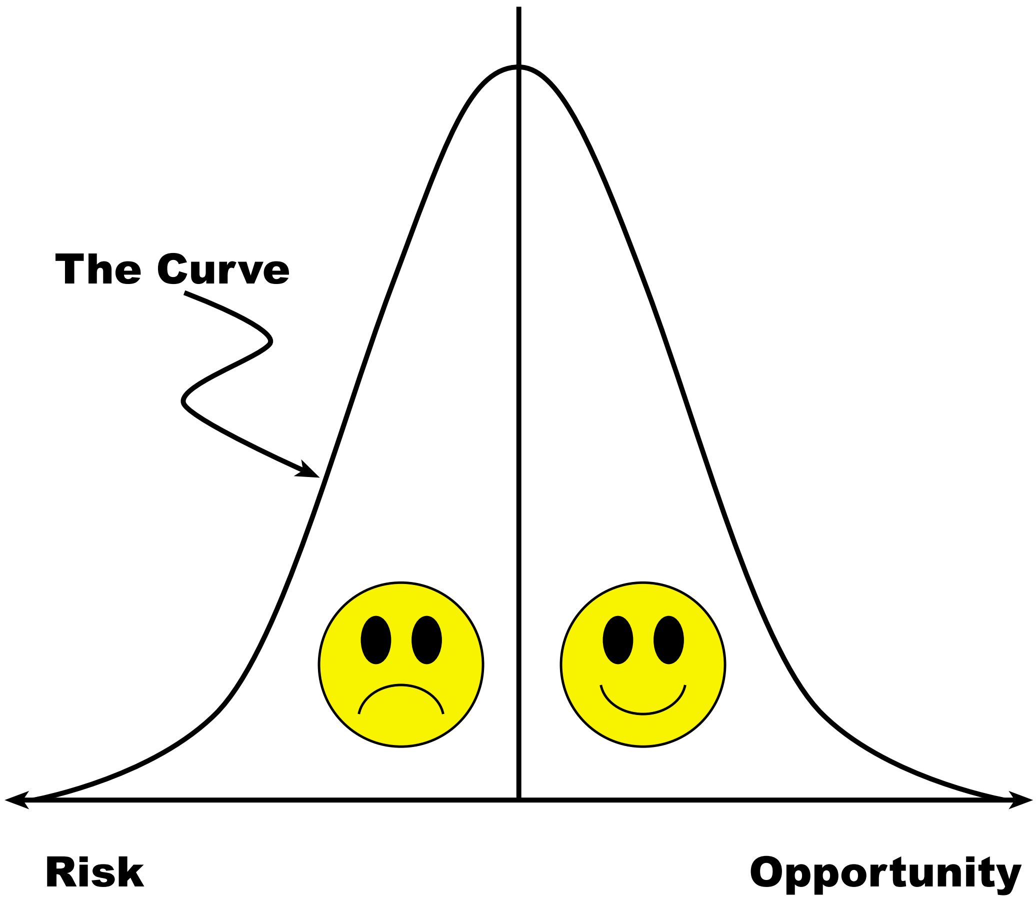
Global
Equity
Research

Managing the Curve



Improving risk-adjusted returns

Alexander M. Ineichen, CFA
+44-20-7568 4944
alexander.ineichen@ubsw.com

UBS Warburg

Contents

page

Executive summary

- Portfolio managers can use their knowledge about individual stocks more effectively by using options. Entry and exit strategies can be executed more effectively.
- By using options, managers can implement their views more efficiently than simply choosing to underweight or overweight a stock. Options give managers more opportunities to use their stock selection knowledge.
- In addition, options allow portfolio volatility to be reduced, or allows the return to be more attributable to stock picking and less to market volatility.

Putting it crudely, managers of skill-based strategies manage the curve, while managers of market-based strategies do not. By 'the curve' we mean the dispersion of returns around the mean, that is, volatility and other absolute measures for risk. If the sole goal of the portfolio manager is to beat a market benchmark, the risk of the portfolio is almost entirely driven by the market. In other words, the relative return manager is active with respect to exploiting investment opportunities, but passive with respect to managing risk. This report is designed to make the point that active managers should be active in both tasks: seeking return by exploiting investment opportunities as well as managing the curve.

The value added by an active manager is a function of skill and investment opportunities. It is clear that more opportunities means more value added with the same level of skill. In other words, a manager with positive skill will be able to add more value if he manages the curve. Managing the curve *actively* means more opportunities to add value. The manager will be in the position to reflect his view on stocks more accurately by running different risk profiles and changing these risk profiles based on the analysed information. The increased flexibility of using stock options results in more opportunities.

Over the course of the bull market, pension funds and life insurance funds could build up a capital surplus (assets exceeding liabilities) through a high equity weighting. The high returns of equities justified high equity weightings and excess capital served as a cushion for higher portfolio volatility. Over the past two years, the excess capital disappeared (or, in some cases, turned into a deficit) whereas the portfolio volatility has not. In future, institutions could be focusing more closely on risk-adjusted returns as opposed to just returns. The name of the game could become managing the curve.

Overview and structure

This report is targeted at investment managers who currently do not use stock options to manage their equity portfolio, that is, who do not yet 'manage the curve.' One of the main assumptions made in this report is that an active manager should manage the curve – that is, should care about volatility and other absolute measures of risk. The assumption goes as far as referring to a benchmarked manager as a passive manager. If a manager does not manage the curve, that is, volatility and higher moments of risk, then the market does it for him. If, for example, market volatility is at 10%, portfolio volatility is likely to be around 10%. If market volatility is around 50%, portfolio volatility is around 50%. In other words, defining risk as active risk (that is, relative to a market benchmark) and the management of active risk utilises the tools of the passive manager. There is nothing wrong with passive money management: to the contrary. As we have stressed in previous reports[1], passive management in information-efficient markets makes sense as the costs of obtaining an analytical edge are prohibitively high.

Derivatives are often considered as complicated financial instruments. Often derivatives experts are referred to as 'rocket scientists,' implying that if you have not been part of NASA's Apollo program, it is unlikely that you are going to understand derivatives any time soon. However, the *use* of derivatives is fairly straightforward. In this respect derivatives are similar to cars: a car is a highly complex piece of engineering. However, it only needs a couple of driving lessons in combination with common sense to unlock the benefits of the machine and control risk. Most of the drivers do not really understand what happens when they press the accelerator. The same is true for derivatives. In addition to common sense, it needs some elementary understanding of the basic strategies and how it changes portfolio risk parameters. A money manager does not necessarily have to understand the *Archimedes exposure path* or *exponential generalised autoregressive conditional heteroskedasticity* (EGARCH) for derivatives to add value to his stock selection.

In the first part of this report (starting page 6) we discuss the investment philosophy of absolute return managers. The content is taken from our efforts in conducting research on the hedge fund industry. Readers familiar with our AIS research effort can skip to page 20 where we start discussing option strategies.
There are some differences between the relative return and the absolute return approach. One major difference is with respect to defining and managing risk, or managing the curve. The absolute return manager defines risk as *total risk*, while the relative return manager defines risk primarily as *active risk* (that is, risk is measured in relative terms). The most extreme form of defining risk as active risk is with a pure index fund. There the full replication (all moments of the return distribution) of the benchmark index is the major objective. Traditional active managers care about both, active as well as total risk. Options allow these risks to be managed more efficiently.

---

[1] See for example UBS Warburg *'The Search for Alpha Continues'* (2001)

Starting on page 20, we discuss some basic options strategies and how the equity manager can use options to more efficiently match his fundamental view of the stock with options. Stock options most often imply a prospective return distribution which is, statistically speaking, fairly normal. That is how stock options are priced. If a manager has a view on a stock that differs from the normal distribution, the rational action is to exploit the difference. We could take this one step further and argue that it is his fiduciary duty to act on the information. If the manager's views are different from the market's – whether it is the stock market's view or the options market's view – he should consider this divergence as an opportunity to add value.

When we say this is the rational action by a manager, we mean the following: suppose a skilful manager believes a stock has roughly a 10% chance of trading above 50 during the next three months. (Suppose the current price is 45.) If option prices imply that the stock has a 30% chance of trading above 50 in the next three months, he should sell the 50 strike three-month call. Just as every stock trade is subject to bad luck, not every option trade will be successful after the fact. But if the manager repeatedly acts on these opportunities, he will more effectively manage risk and this should translate into superior long-term performance.

On page 29 we discuss selling calls in somewhat more detail. We end the report with a discussion on some issues relating to volatility (Appendix starting page 41). Volatility is used as a term for risk as well as for uncertainty. All terms are related but not synonymous. One could argue that the definition of risk is exposure to uncertainty. (Or as Warren Buffett puts it : 'Risk comes from not knowing what you're doing.') In this sense, volatility is a fair proxy for risk. However, volatility is measurable whereas uncertainty is not. The relevance in the context of this report is that the financial industry has not yet spent a great effort on focusing on risk-adjusted returns. The return, irrespective of absolute or relative, has been far more important than risk. This could change. In future, investors could start focusing on risk-adjusted returns more closely than it has in the past. In the US, mutual fund managers are already very sensitive to risk-adjusted returns, especially as defined by their Morningstar rating. The rating is very similar to a Sharpe ratio. But the pressure to deliver superior risk-adjusted returns could be growing elsewhere, too. If this trend continues, using options to manage risk will likely become inevitable.

The author would like to thank Larry Chen, Stephen Fulford, and Scott Mixon for their invaluable contribution to this report. The author is solely responsible for any errors, omissions and ambiguities.

Managing the curve

Relative return managers increasingly have no incentive to manage the curve

Putting it crudely, absolute return managers manage the curve, while relative return managers do not (or to a much lesser degree). By 'the curve' we mean the dispersion of returns around the mean, that is, volatility and other absolute measures for risk. If the sole goal of the portfolio manager is to beat a market benchmark, the risk of the portfolio is primarily driven by the market. In other words, the relative return manager is active with respect to exploiting investment opportunities, but passive with respect to managing risk. This report is designed to point out that active managers should be active in both tasks: seeking return by finding investment opportunities as well as managing risk. This might or might not be a departure from the status quo, where it is understood that the end investor (such as pension funds, life insurance companies, retail investors) should manage portfolio volatility.

Absolute return focus[1]

Introduction

Managing surprises by introducing a market benchmark

An absolute return manager is essentially an asset manager without a benchmark or where the benchmark is defined relative to the risk-free asset. Benchmarking can be viewed as a method of restricting investment managers so as to limit the potential for surprises, either positive or negative. By defining a market benchmark and a tracking error band, the plan sponsor gives the manager a risk budget in which he is expected to operate. Recent legal action in the UK by a pension plan sponsor probably will mean that the relative return industry will be even more 'benchmark-aware' than it already was.[2]

Parts of a benchmarked long-only portfolio's return is attributed to skill, parts to chance

Separating skill from luck is one of the major goals of analysing the performance of a particular manager, regardless of whether he is running long-only or absolute return money. In any sample of managers, a small percentage is bound to have exceptional performance (both positive and negative). Managers with exceptional positive performance will attribute the excess return to skill. Those who perform exceptionally poorly are unlikely to blame lack of skill but 'bad luck' as the cause of their performance.

Playing roulette is a negative-sum-game for the players, but is statistical arbitrage for the casino

Grinold and Kahn (2000) argue that 'nearly half of all roulette players achieve positive returns on each spin of the wheel.' This means that the wheel most often stops on red or black (as opposed to 0 or 00).[3] Even the existence of very large returns (such as when the ball stops on a single number bet like 7) does not prove skill. However, the expected return of the roulette gambler is negative. Over the long term, they all lose. The casino, on the other hand, has positive expected returns and wins (as long as it has enough cash or credit lines to live through a bad evening). Running a casino, an insurance company, or the national lottery is a business called statistical arbitrage. The operators win as long as they can survive

---

[1] This sub-chapter draws on material from UBS Warburg (2002a) and Ineichen (2002a,b).

[2] A pension fund sued a large asset management firm for negligence resulting in 10 percent underperformance against the benchmark. The case was settled out of court. It was estimated that the asset manager paid around £70 million ($107 million) compensation.

[3] European wheels most often only have only one zero. If you are a gambler, play in Europe: the house edge is smaller (unless you happen to play in the welfare-heaven of Sweden, where profits are capped at thirty times principal).

statistical outliers, that is, large but few occasional outflows or losses. Statistical arbitrage is one strategy executed by absolute return managers.[1]

Assessing competitive edge of a manager before investing is difficult and time-consuming

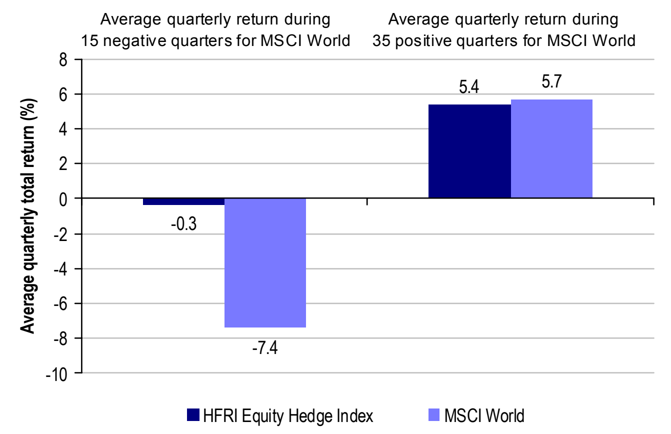
The practical issue arising from performance analysis is that it requires a certain amount of data points before any conclusions can be drawn with a reasonable degree of confidence. For example, to analyse yearly returns, 16 years of observations are needed to judge whether a manager is top quartile (has an information ratio of 0.5) with 95 percent confidence. As the normal life span of an asset manager is less than 16 years, a 16-year monitoring period seems rather impractical. Assessing qualitative aspects (investment philosophy, trading savvy, risk management experience, infrastructure, incentive structure, etc.), that is, bottom-up fundamental research and due diligence is the only way around this issue. A manager's competitive edge can be analysed ex ante. A manager's track record is ex post by definition.

A car without brakes

Absolute return strategies have an asymmetric return profile when compared with long-only strategies

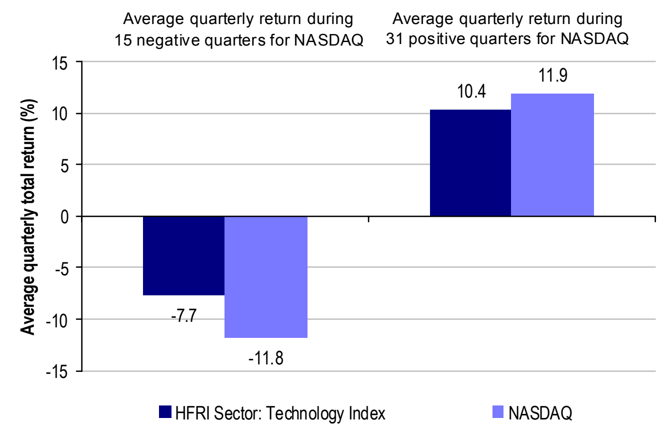
The most comparable strategy to long-only equity is long/short equity. In the past, long/short hedge funds have underperformed long-only strategies in strong bull markets and outperformed in bear markets. The underperformance in bull markets is normally smaller than the underperformance in bear markets. This means the return profile of absolute return managers is non-linear (asymmetrical to the market), whereas it is linear with long-only managers.

Chart 1: Return profile of long/short managers



Source: Hedge Fund Research, Datastream, UBS Warburg (2000)
Note: Based on US dollar total returns; Q1 90-Q2 02.

Chart 2: Return profile of technology long/short managers



Source: Hedge Fund Research, Datastream
Note: Based on US dollar total returns; Q1 91-Q2 02.

Chart 1 shows the average quarterly returns of the HFRI Equity Hedge Index (equity long/short strategies) when the MSCI World was positive and negative respectively. We have subtracted 100 basis points per quarter off the returns of the hedge fund indices to account for potential survivorship bias.[2] Chart 2 compares an index of hedge funds specialising in technology stocks with the Nasdaq index. Note that typically absolute return managers specialised in a sector have a stronger long bias than the more generalist manager.

---

[1] The irony is that the public perceives absolute return managers to be like gamblers, whereas they are actually more like someone running a casino. Their expected return is positive.

[2] Academic literature estimates hedge fund index returns to be inflated by around 200-300 basis points per year.

Absolute return managers have an asymmetrical return profile by design

Over the 12 and a half years ending in second quarter 2002, the average total return in US dollars for the MSCI World index was 5.7% in the quarters where the index was positive. The average negative return was 7.7%. This is more or less symmetrical. In the quarters where the MSCI World was positive, long/short managers, on average, had a return of 5.4% net of fees. In the negative months the average return was a negative 0.3%. In other words, the return profile is asymmetrical. One could go on and argue that long/short managers do not add value during a market tailwind but preserve wealth when market environment changes and investors face a headwind. The annualised 12-and-a-half-year return and the volatility for the two time series in Chart 1 were 20.3% and 9.3% for the long/short equity index and 7.0% and 14.6% for the MSCI World total return index. Chart 2 shows the same asymmetry for long/short managers in the technology sector. There, too, the correlation is high but the outperformance in falling markets is higher than the underperformance in rising markets.

No need for brakes going uphill

The main reason why traditional funds underperform in down markets is that the freedom of operation is limited with traditional asset managers and more flexible with absolute return managers. If you are in a car without brakes going uphill, you will do fine. However, going downhill you will need brakes to manage your risk. Hence, long-only strategies are occasionally compared to a car with no brakes.

Avoiding negative compounding

Avoiding financial losses is a laudable concept

If an investor loses 50% of principal, he will need a 100% return just to get back to break-even. At a rate of 7.2% it takes ten years to double an investment. Downside protection from the investors' point of view and avoidance of negative returns from the managers' point of view are different sides of the same coin. Jim Rogers (2000) puts it as follows:

> *The trick in investing is not to lose money. That's the most important thing. If you compound your money at 9 percent a year, you're better off than investors whose results jump up and down, who have some great years and horrible losses in others. The losses will kill you. They ruin your compounding rate, and compounding is the magic of investing.*

Avoiding losses is intuitive but has no foundation in modern portfolio theory

Jim Rogers (who, apart from being a successful absolute return investor, also taught finance at Columbia University) might or might not have had the institutional investor in mind when he was writing the above statement. Chances are that the investment philosophy needed rephrasing if the intention was to reach out to readers of *The Journal of Finance*. However, waiting until the approach of avoiding negative compounding is touted in financial textbooks and (with a lag) marketed by financial consultants, might turn out to be as wise as Don Quixote fighting windmills.

Focus on either market benchmark or P&L

Table 1 is an attempt to explain the investment philosophy of absolute return managers. Both absolute and relative return managers would argue that they were not hired by investors to lose money. The fundamental difference between the two investment philosophies lies in the aversion to absolute financial losses and the definition of risk. Relative return managers define risk as *active risk* whereas absolute return managers define risk as *total risk*. The former is driven by a market benchmark, the latter by a P&L.

Table 1: Different approaches to creating value

	Long-only buy-and-hold strategy				Alternative investment strategies			
	MSCI World	S&P 500	NASDAQ Comp.	Nikkei 225	Equity market neutral	Equity Hedge	Macro	Fund of Funds
Dec-1998	100	100	100	100	100	100	100	100
Dec-1999	125	121	186	137	107	144	118	126
Dec-2000	109	110	113	100	123	157	120	132
Dec-2001	91	97	89	76	131	158	128	135
Jun-2002	83	84	67	77	133	157	135	139
Return 1999 (%)	25	21	86	37	7	44	18	26
Return 2000-Q2 02 (%)	-34	-30	-64	-44	24	9	15	10
Q2 02 vs. peak (%)	-34	-33	-69	-73	0	-5	0	0
Break-even return* (%)	52	50	221	266	0	5	0	0
Years to break-even at 8% pa	5.5	5.2	15.2	16.9	0.0	0.6	0.0	0.0
Est. break-even at 8% pa	Dec-2007	Sep-2007	Aug-2017	May-2019	at high	Feb-2003	at high	at high

Source: Hedge Fund Research, Datastream, Ineichen (2002b)
* Return required to break even from previous peak
Note: Based on total return indices in US dollars except Nikkei 225 (based on price returns in yen).

Active managers should not only care about end-of-period wealth but also during-the-period variance

Orthodox financial theory suggests that investors should focus on the long term. It also suggests that investors will generate satisfactory returns if they have a long enough time-horizon when they buy equities. This may or may not be true.[1] The problem faced by absolute return managers is that they might not live long enough to experience the long-term. Absolute return managers do not care if the probability of equities underperforming bonds over a 25-year period is low. Moreover, absolute return managers are interested in how they get there – that is, they are interested in *end-of-period* wealth as well as *during-the-period* variance. This report is designed to show that all active managers should be managing the latter. If during-the-period variance is left to the market to be determined, the manager is following a passive approach with respect to risk management.

Not managing the curve is hardly an active approach to managing assets

Table 1 summarises what we mean by 'avoiding negative compounding.' Table 1 shows four long-only buy-and-hold portfolios, as well as four alternative absolute return strategies. The absolute return manager could argue that the first four columns have nothing to do with asset management or risk management. Absolute return managers want to make profits not only when the wind is at their back but also when it changes and becomes a headwind. Absolute return managers will therefore use risk management and hedging techniques – this is where the asymmetrical return profile

[1] Arnott and Bernstein (2002) for example argue that it is only true for investors buying at market lows such as 1982. See also UBS Warburg '*Return Expectations*' (2002a).

discussed earlier comes from. From the point of view of absolute return managers, relative return managers do not use risk management,[1] and do not manage assets as they follow benchmarks. They are trend-followers by definition.[2]

Managing active risk is essentially the approach index funds use to manage risk

In other words, the relative return manager is long; hence the term long-only. The relative return manager, again from the point of view of the absolute return manager, has no incentive, no provisions to avoid losses.[3] One could argue, the future of *active* management involves risk management whereby risk is defined as total risk and not active risk. The term active risk will be associated with passive management and managing tracking risk will be the risk management tool of the passive investor.

Absolute return managers have numerous incentives not to lose principal

Table 1 shows that an investment in the four equity indices in December 1998 would have ended in losses by June 2002, despite the phenomenal performance of equities in 1999. The fourth row from the bottom measures the percentage from the peak in local currencies. The high losses make it clear why Japanese investors are not as averse to hedge fund exposure as, for example, UK pension fund trustees.[4] It also illustrates one of the incentives of absolute return managers. An absolute return manager would try to keep this figure at zero, firstly, because he has his own money in his fund and does not want to lose it and, secondly, most hedge fund managers have a high watermark. This means that they only can charge an incentive fee from new profits, that is, the fund has to make up for any losses before it can charge its performance fee. For example, a fund falling to 80 from 100 and then rising back to 100 will not charge a performance fee on the 25% profit from 80 to 100. A third incentive to avoid losses is the fear of redemptions.

Time-weighted versus dollar-weighted rates of return

Dollar-weighted rates of return matter

Nearly all analysis in the asset management industry is based on *time-weighted* rates of return. However, the most relevant metric from an investor's perspective is *dollar-weighted* rates of return or their internal rate of return (IRR). For example, Manager A earns 20%, 20% and -10% in years one to three, while Manager B earns -10%, 20%, and 20%. In both cases, the time-weighted return is the same (9% average annual compound rate of return). However, the dollar-weighted rate of return between the two managers will likely be vastly different for nearly all investors. The only exception is for investors that neither invest nor withdraw assets. These investors would have earned the same IRR by investing with either manager. If the investor was a saver, contributing US$100 per year, they would

---

1 Note that for example Lo (2001) expresses a diametrically opposing view. Lo (2001) argues that 'risk management is not central to the success of hedge funds' whereas 'risk management and transparency are essential' for the traditional manager.

2 In 1994, George Soros was invited to deliver testimony to the US Congress on the stability of financial markets, particularly with regard to hedge funds and derivative activity. Soros believed that the Banking Committee was right to be concerned about the stability of markets, saying: 'Financial markets do have the potential to become unstable and require constant and vigilant supervision to prevent serious dislocations.' However, he felt that hedge funds did not cause the instability, preferring to blame traditional institutional investors, who measured their performance relative to their peer group and not by an absolute yardstick. 'This makes them trend-followers by definition.' From Chandler (1998).

3 This is not entirely correct: A relative return manager has an incentive to grow funds under management, that is avoid funds under management falling because fee income is determined based on the absolute level of funds under management.

4 Demand for hedge fund products is larger from Japanese institutional investors than it is from UK institutional investors.

earn US$120, US$264 and US$328 with Manager A at the end of years one to three, respectively, but US$90, US$228 and US$394 with Manager B. The increase in wealth produced by each fund ($328 versus US$394) is dramatically different even though the time-weighted return is the same. This effect is more pronounced the greater the degree of variation in returns. Earning 9% per year results in US$357 at the end of period three, that is, is in between the two other outcomes. Accumulation of wealth is much more reliable (less risky) the lower the total risk.

Return illusion

Excess volatility is not necessarily a sign of comfort

To the casual observer, the return of 86% on the NASDAQ index in Table 1 on page 9 may look high even if it is followed by a retreat of *only* 64%. However, if US$100 had been passively invested in the NASDAQ Composite Index at the beginning of 1999 and transaction costs were zero, the portfolio would have declined to US$67 by the end of June 2002 (an US$86 gain in 1999 followed by a US$119 loss in 2000/2002). This compares with US$133 for a portfolio of equity market neutral absolute return managers, US$139 for the average fund of hedge funds or US$135 for a diversified exposure to global macro managers.[1] High returns as observed on the NASDAQ are good for headlines and selling financial magazines. However, these returns are an illusion in a long-term context. A volatile market-based strategy with returns such as 86% per year is an indication that the return figure might change sign and the recovery period take a while.

Risk illusion from time diversification

Whether time reduces risk or not is open to debate

An often-debated phenomenon in finance is the benefit of time diversification. Some argue that equities are safe in the long-term.[2] The argument goes as follows: equities have a 60% probability of outperforming government bonds over a one year period and a 95% outperformance probability over 25 years. In addition, long-term volatility is normally lower than short-term volatility. The apparent conclusion, therefore, is that investing in equities is foolproof as long as one has a long time horizon. The debate surrounding whether time reduces risk is often referred to as the *time diversification controversy*. Another school of thought argues that time diversification is an illusion and that a longer time horizon does not reduce risk.

---

[1] The irony here is that macro funds are often considered as the most speculative investment vehicles in the financial landscape as the managers are the most extravagant and their investment process is the least transparent. However, what is often overlooked is that the different personalities and loose investment mandate results in huge diversity among macro managers. This diversity means that the returns from different macro managers have a low correlation because their performance is attributed to different factors, opportunities and investment approaches. This diversity allows to substantially reducing portfolio volatility by combining different macro managers.

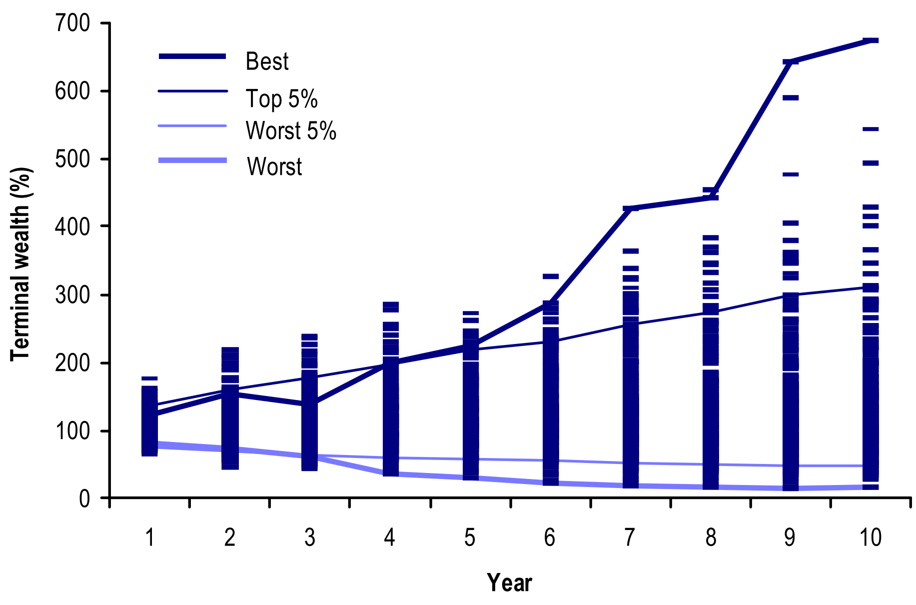
[2] Swank et al (2002) for example recommend pension plans to be 100% invested in equities, that is, recommend portfolio concentration as opposed to portfolio diversification: 'While an appropriate investment strategy depends on a number of factors, many of them plan-specific, in many cases we believe it is in the best interest of both the pension plan's sponsor and its participants to invest the plan's assets entirely in equities. Certainly plans must maintain the liquidity necessary to make annual contributions and benefit payments, but many plans have the financial stability and liquidity to handle a downturn in the market even if invested 100% in equities. For these plans, any amount not invested in equities simply reduces the long-term growth of assets with no offsetting benefit.' It seems unlikely that the authors would have drawn the same conclusions, had the analysis been done with Nikkei 225 or MSCI Europe index returns instead of S&P 500 returns.

Not all long-term track records are positive

The illusion (or misconception) of time reducing risk arises, we believe, from a misunderstanding of risk. It is true that the annual average rate of return has a smaller standard deviation for a longer time horizon. However, it is also true that the uncertainty compounds over a greater number of years. Unfortunately, this latter effect dominates in the sense that the total return becomes more uncertain the longer the investment horizon. Had a long-term investor with a 100-year investment horizon decided to put money into the US stock market in 1900, he would have compounded at a reasonable rate. However, other choices were other large markets such as Argentina, Imperial Russia, Germany or Japan. The 100-year return of these markets was materially different from the US experience.[1]

The following three charts are based on a statistical method (bootstrapping with replacement) which allowed us to simulate 1,000 10-year histories of the UK stock market.[2] This sort of analysis allows a manager to assess, for example, VAR (Value at Risk) measures for a portfolio. The 1,000 time series are based on real (that is, adjusted for inflation) monthly returns between January 1950 and May 2002. Every tick shows a simulated real terminal value after years one to ten. The bold lines show the best and worst time series after ten years from the 1,000 runs. The fine lines show the best and worst 5% runs (that is, the 90% range). In other words, 90% of the 10-year readings are in between the two fine lines. In the graphs only 255 runs are shown due to software limitations. However, the best and worst runs are based on the 1,000 iterations.

Chart 3: Possible terminal wealth after ten years



Source: UBS Warburg

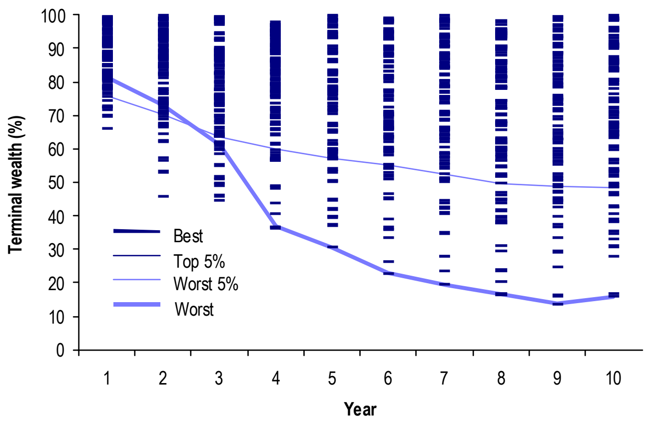
[1] See UBS Warburg (1999) for an analysis of long-term volatility in equity markets.

[2] History is only one outcome from an indefinite number of possible outcomes. Drawing conclusion from one experience from a large sample is, statistically speaking, unwise. There are only two ways to increase the sample size to allow statistically significant conclusions to be drawn. One is looking at other markets, the other re-sampling the returns to synthetically create many possible histories.

Chart 3 shows that the possible terminal values increase with time (as expected). The worst reading of the 1,000 iterations for one, five and ten years was a terminal wealth of 56 (equal to a real loss of 44%), 31 (-69%), and 16 (-84%) respectively.

Chart 4 below shows the potential destruction of wealth on a real basis, that is, after adjusting for inflation. Note that the lows become lower over time. Note also that the bold light blue line in Chart 4 looks somewhat like the Nikkei 225 between 1990 and 2000 – that is, an unlikely but possible scenario. Chart 5 shows the full dispersion of 1,000 iterations (same as Chart 3) with a log scale.

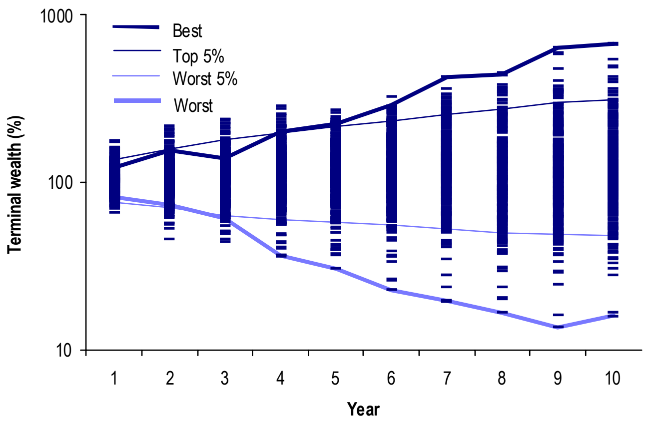
Chart 4: Potential destruction of principal



Source: UBS Warburg

Note: Vertical axis in the graph is cut off at 100% to show the worst outcomes only.

Chart 5: Potential dispersion of wealth (log scale)



Source: UBS Warburg

Note: Log scale.

A volatile investment is even riskier when there is uncertainty with respect to the investment horizon

One eye-opener is the difference between the probability of suffering a loss at the *end of the investment period* and the probability of suffering a loss *during the investment period*. The former is very small and the latter large by comparison. The practical significance is that large absolute losses are very uncomfortable for most investors, private as well as institutional. The difference between 15% and 18% rates of return seems relatively small. The impact on ending wealth is considerably larger ($3,292 versus US$6,267 compounded over 25 years for a US$100 initial investment). Thus the variation or risk in end-of-period wealth does not decrease with time. Further, this analysis specifies no utility function for the investor. If an investor was uncertaint as to when they would withdraw money, the variability in ending wealth would further diminish the value of the risky investment over the safer investment. Note that the worst portfolio after the ten-year period was not necessarily the worst portfolio in the first few years (Chart 4 and Chart 5).

Focus on risk-adjusted returns

The financial industry has not yet paid a lot of attention to risk-adjusted returns. Pure returns or, in some cases, active returns, are the main focus point when performance is presented to investors and/or prospects. In Table 2 we try to make the point that two portfolios with the same return are not necessarily the same.

Table 2 below shows the difference between achieving an 8.1% annual return over a ten-year period with volatile returns and with stable returns (first four columns). The volatile returns are annual total returns in US dollars for an investment in the MSCI World index for the ten-year period ending in 2001 (in reverse order). The stable returns were calculated for volatility to equal 1.58%, that is, one-tenth of MSCI World return volatility. Note that the ten-year period covered a large part of the 1990s, which is generally considered to be one of the greatest decades for equity investors in the history of financial markets. The last two columns show the equity of a leveraged investment in the vehicle with a volatility of 1.58%. The leverage factor to match a volatility of 15.8% was 6.7:1, that is, debt of 570 for 100 in equity. The last column shows the returns on equity of this leveraged investment.

Table 2: Volatile versus stable returns

	Unleveraged				Leverage = 6.7:1	
Year	Volatile Returns (%)	Year-end Wealth ($)	Stable Returns (%)	Year-end Wealth ($)	Year-end Wealth ($)	Returns (%)
		100		100	100	
1	-17	83	9.6	110	165	64.9
2	-13	72	6.6	117	214	29.7
3	25	90	9.6	128	290	35.5
4	24	112	6.6	137	347	19.7
5	16	130	9.6	150	435	25.5
6	13	147	6.6	159	502	15.3
7	21	178	9.6	175	605	20.6
8	5	186	6.6	186	683	12.9
9	23	229	9.6	204	804	17.7
10	-5	218	6.6	218	895	11.3
Average return per year		9.2		8.1	25.3	
Compound annual rate of return		8.1		8.1	24.5	
Volatility		15.8		1.58	15.8	
Sharpe ratio (5%)		0.20		1.96	1.23	

Source: UBS Warburg

Once investors seek risk-adjusted returns, during-the-period variance will matter

The view of an absolute return manager is that many investors underestimate the impact of negative years on overall wealth creation. The first strategy in Table 2 looks superior because the average of the simple returns is 9.2% whereas it is only 8.1% for the second strategy. However, once the compound annual return of 8.1% is put into context with the variance of the returns, the investment with the stable returns does not appear to be inferior. As a matter of fact, if end-of-period wealth as well as during-the-period variance (that is, risk-adjusted returns) matter, the investment with the more stable returns is superior. For the stable return investment to result in a volatility of 15.8% the investor could use leverage of around 6.7:1. The compound annual return would increase to 24.5%.

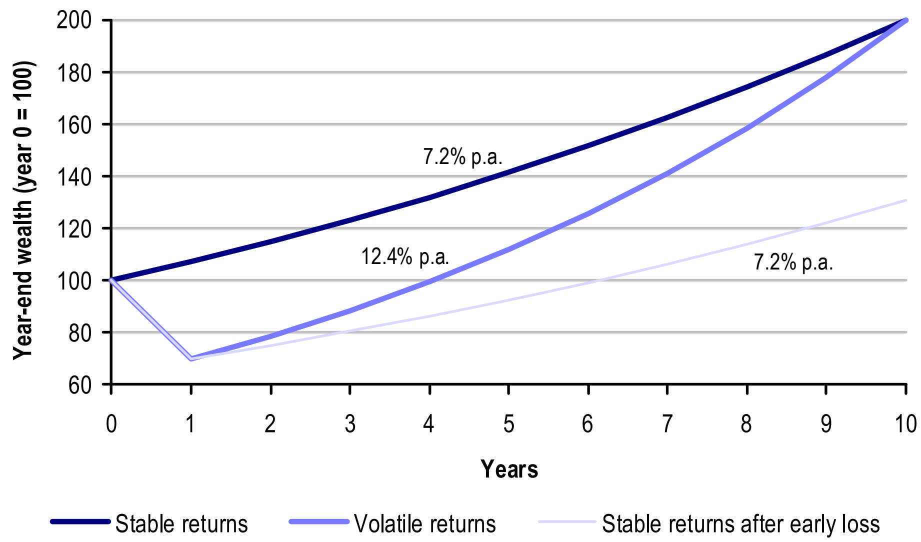
Many absolute return managers probably subscribe to Benjamin Graham's rule of investing:

> *'The first rule of investment is don't lose. And the second rule of investment is don't forget the first rule. And that's all the rules there are.'*

'Risk comes from not knowing what you're doing.' Warren Buffett

Today this is considered Wall Street wit and regularly used for entertainment purposes. However, the notion has probably more than just entertainment value. It is the reason why absolute return managers are more than just relative return managers with cash as their benchmark. It is also the reason why many investors regard investing more as alchemy (Soros, 1987) or art (Yale Endowment, 2001) than as pure science. Chart 6 below is another way to show that volatility (during-the-period variance) matters to end-of-the period wealth.

Chart 6: Different ways of doubling an initial investment of 100



Source: UBS Warburg

Early losses can have a disastrous impact on long-term performance

Chart 6 shows two ten-year investments that double over the ten-year period. The dark blue line is a 100 investment growing at 7.2% over a ten-year period. The light blue line experiences a loss of 30% in the first year. The growth rate required to match the 7.2% growth rate in the remaining nine years is 12.4%. If the second investment grows from 70 after the first year at a rate of 7.2%, the end-of-period wealth accumulates to only 131. The annualised return would result in a compounded annual growth rate of only 2.7%. To an absolute return manager, an investment vehicle where there is no provision to manage volatility is, to phrase it in a politically correct way, sub-optimal. Note that in many continental European countries, the equity culture began in the late 1990s. It is not unreasonable to assume that for some investors the 2000/2002 bear market was their first experience with equities as an asset class.

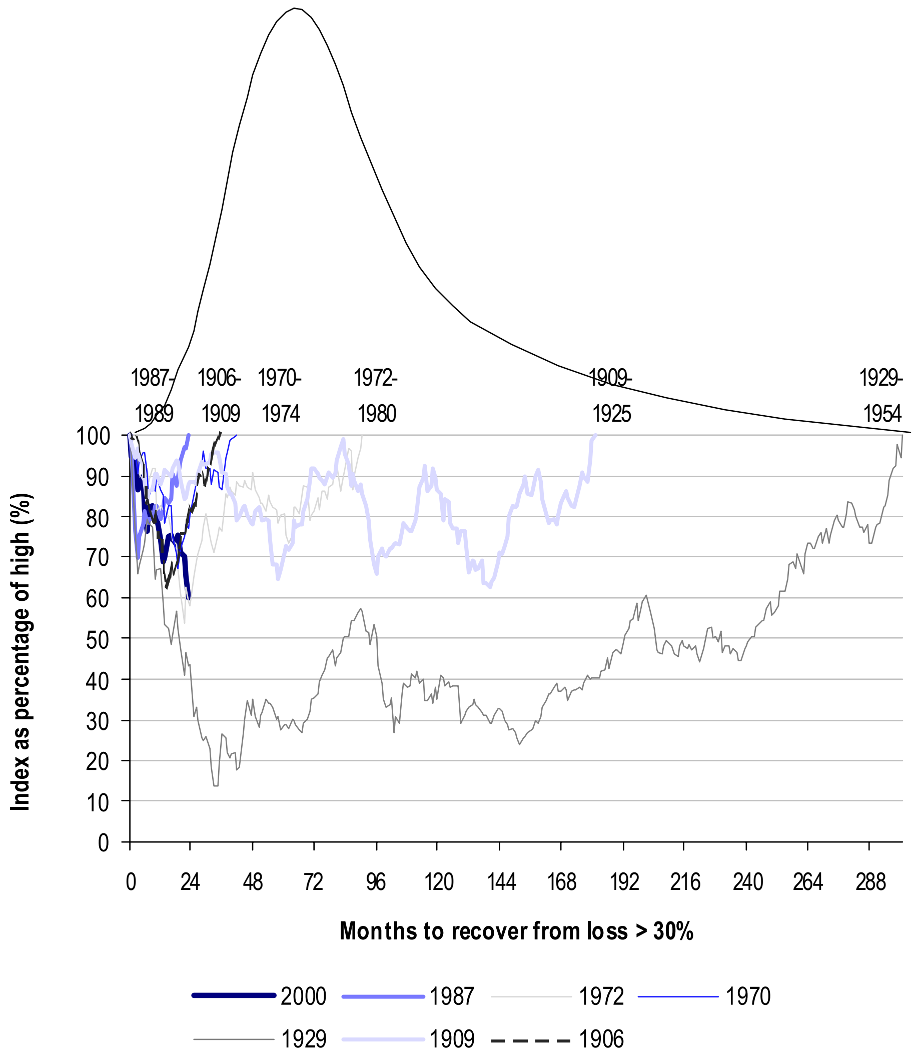
Chart 7 below is a further indication that risk reduction from time diversification is an illusion. Chart 7 shows six instances in the twentieth century of the S&P 500 index losing more than 30% of its value and the time it took to recover the losses.[1] The bold dark blue line shows the current bear market. The index peaked in August 2000, that is, around 24 months ago.[2] The year in the legend indicates the previous high and the

[1] In previous research we referred to this graph as 'under water' perspective. It shows how long a market or any other barometer of wealth took to recover losses. See for example UBS Warburg '*Food for Thought*' (2002b).

[2] Based on month-end returns, the S&P 500 peaked at 1,517.68 on 30 August 2000. Based on daily returns, the peak was at 1,527.45 on 24 March 2000.

date in the graph indicates the year where the previous all-time high has been reached, that is, losses recovered. The density function above the chart is an indication for the probability of the time it takes to reach the previous high of August 2000.

Chart 7: Time to recover large losses



Source: UBS Warburg
Based on monthly data. July 2002 inclusive.

The time losses take to be recovered is uncertain

The point of this illustration is that there is huge uncertainty as to when markets will recover. There are always seers who are particularly bullish, forecasting a fast recovery. There are also always perma-bears, arguing that 1929 is all over us again. However, the future is probably most accurately assessed with a probability function as schematically drawn above the chart above. This means, putting it crudely, US and European markets might or might not recover losses fast.[1] There is uncertainty. Managing portfolio volatility actively is the only solution to deal with this kind of uncertainty.

[1] In UBS Warburg *'Return Expectations'* (2002a) we show that predicting the economic cycle has very little predictability value for the stock market, as equity markets can de-synchronise from the economic cycle for decades.

Managing volatility

Market determines volatility of portfolio of benchmarked manager

The portfolio of most long-only managers closely tracks the benchmark. When the benchmark has a volatility of around 10% (as some developed equity markets had around 1995), then a long-only portfolio will have a volatility of 10%. When the volatility of the benchmark increases to 25% (as in most developed markets in the period 1997-2000), then the benchmarked portfolio will have a volatility of around 25%. This makes sense because it is in line with the mandate, that is, mimicking the benchmark market index.

Table 3: Long-only compared with market neutral and long/short equity strategies

	Long-only	Alternative (absolute return) strategies			
(%)	MSCI World (Total return) Index	HFRI Equity Market Neutral Index	HFRI Statistical Arbitrage Index	HFRI Equity Hedge Index	HFRI Equity Non-Hedge Index
1990	-16.5	15.5	11.2	14.4	-7.2
1991	19.0	15.6	17.8	40.1	57.1
1992	-4.7	8.7	10.8	21.3	22.8
1993	23.1	11.1	12.6	27.9	27.4
1994	5.6	2.7	4.7	2.6	5.1
1995	21.3	16.3	14.2	31.0	34.8
1996	14.0	14.2	19.6	21.8	25.5
1997	16.2	13.6	19.4	23.4	17.6
1998	24.8	8.3	10.1	16.0	9.8
1999	25.3	10.8	-1.3	46.1	41.8
2000	-12.9	14.6	8.9	9.1	-9.0
2001	-16.5	6.4	1.2	0.4	0.7
Return per year	6.99	11.09	10.68	20.32	17.33
Volatility	14.59	3.28	3.87	9.26	14.91
Sharpe (5%)	0.14	1.86	1.47	1.65	0.83
Return for 1.86 Sharpe ratio	32.13	11.09	12.20	22.23	32.72

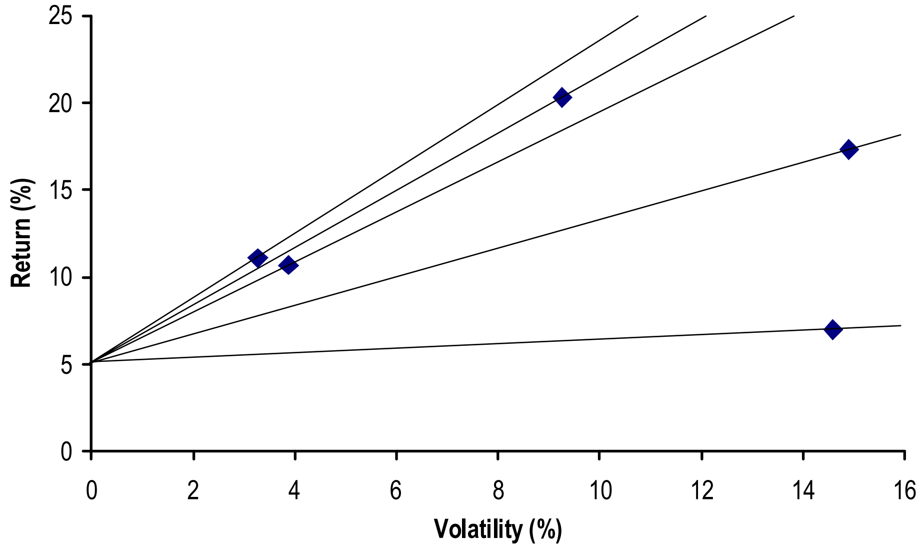
Source: Hedge Fund Research, Datastream

There are different approaches to managing equity risk and portfolio volatility

Table 3 shows five different ways of managing equity risk and portfolio volatility. The first is the traditional long-only way, where there is no incentive to manage volatility or higher moment risk. The MSCI World was used as a proxy for a long-only portfolio. The four other equity strategies involve managing downside market risk to different degrees. The HFRI Equity Market-neutral and HFRI Statistical Arbitrage indices are both relative-value strategies where market risk is fully hedged at all times. The two other strategies are long/short strategies. In Equity Hedge, managers have a small long-bias, and in Equity Non-hedge there is a large long-bias. From these five investments, the Market Neutral has the highest risk-adjusted returns, whereas the MSCI World has the lowest. Assuming an investor has a risk budget for equity-like risk, which of the five investments is superior to the other four?

Chart 8 below shows the five investment styles from Table 3 in two-dimensional mean-variance space. The vertical axis shows the historical return whereas the horizontal axis measures the volatility. The five lines resemble capital market lines which should originate at the risk-free rate on the return axis.

Chart 8: Risk/return trade-off of five equity investment styles



Source: Hedge Fund Research, Datastream

The steepness of the capital market line matters

The five (capital market) lines originate at the risk-free rate, which is most often assumed to have zero risk.[1] The line is drawn through the risk/return point in the graph. The steepest line is considered the best. It is not important where the dot is. The reason why the position of the dot is irrelevant is because of the use of leverage. If an investor has a risk budget (risk appetite) of 9.26% as the second best investment in Chart 8, he could borrow money and invest in the best investment. Assuming the investor borrows money at the risk-free rate, invests in the best investment and accepts a volatility of 9.2%, the resultant return would be around 22.2%, that is, approximately 190 basis points higher than the second best investment with the same volatility. If the investor is ready to accept the volatility of the most volatile investment (which also happens to be the worst investment from the five), that is, a volatility of 14.59%, he can lever up and invest in the best investment. The return of using leverage and investment in the best investment would result in an annual return of around 32.1%. This seems to be a big difference to the 7.0% in the MSCI World. The steepness of the lines in Chart 8 measure risk-adjusted returns (Sharpe ratios).

There is only one capital market line (in theory, that is)

Where does this analysis fail? First, hedge fund data is inflated for various reasons. Survivorship bias is probably the most prominent reason why hedge funds indices are inflated. Second, volatilities are most likely too low – that is, Sharpe ratios are too high. The main reason for volatilities being too low is fact that some hedge fund positions are based on appraisals as opposed to liquid assets valued on a mark-to-

[1] An investment at the risk-free rate is considered risk free. However, volatility is not zero. The ambiguity derives from the fact that in financial theory volatility (annualised standard deviation of returns) is used as a proxy for risk. Most of the theoretical models are simplistic and assume a single decision period and a single risk-free rate. Obviously life is more complicated and the riskless bond is not riskless if it must be rolled.

market basis. However, these measurement imperfections are unlikely to explain the 2,471 basis points between the best investment in Chart 8 and the worst.

Conclusion

Balancing investment opportunity with the potential to suffer a financial loss

At the end of the day, all investors have an absolute return focus. Asset managers, therefore, should have an eye on absolute returns regardless of whether they operate under the paradigm of relative returns or absolute returns. Large losses have a large impact on end-of-period wealth. In this sense, reducing volatility should matter to all active managers. Managing the curve should be considered conservative.

Benchmarking leads to inefficient processing of information

By conducting bottom-up company research, the active equity manager gets a view on a company's stock. This view normally translates into a transaction and a position. However, if the only tool is to buy or not to buy stock, most of the bottom-up research is lost. In other words, managing equity risk on a long-only basis is inefficient. To some extent, the introduction of a benchmark is a contradiction: on the one hand the plan sponsor wants the manager to add value, on the other, through introduction of a benchmark, he does not allow the manager to use the tools to most efficiently add value.

Using options can add value to an active manager balancing investment opportunity with risk

If a manager defines risk as total risk instead of active risk, volatility and avoiding losses matter. This will mean that the views will result in transactions other than just overweight or underweight relative to a market benchmark. By using options, the manager will be able to more accurately reflect his fundamental view of the stock.

Using options to manage the curve

Passive managers do not manage the curve

One of the assumptions made in this report is that if a manager does not manage volatility and higher moments of risk, then the strategy is a market-based (as opposed to skill-based) strategy. This assumption is based on the observation that if a manager does not manage the second moment (volatility) and higher moments of the return distribution, it is the market that does it for him. An index fund manager, for example, has the goal of replicating the return distribution of the underlying benchmark. He does not manage the curve.

Benchmarking means leaving the market determining portfolio volatility

An active equity manager in the US or UK in the mid-1990s had a volatility of around 10%, as volatilities at the time were around that level (see Chart 29 on page 45). In the subsequent years, volatilities have tripled due to a combination of several factors (such as the Asian crisis in 1997, the Russian default crisis in 1998, increased uncertainty due to high equity valuation). Long-only portfolios, as a result of increased volatility, became more volatile as the market became more volatile. Hence the term 'market-based.' The market determines the volatility of a long-only portfolio where the manager replicates the benchmark without managing volatility or higher moments of the distribution.

Active managers should manager the curve

We believe that an active equity manager should not accept the volatility and higher moments of the market benchmark as a given. This is what passive managers do: establish exposure to the market whatever it does. An active manager should actively manage the curve. In this respect, using options can add value. The value added comes in the form of efficiency improvements in terms of execution and matching positions with the portfolio manager's view. Using options allow the construction of risk and return profiles otherwise not feasible or possible. More short-term opportunities to manage total risk should result in superior long-term performance.

Not managing the curve is an inefficient way of actively allocating capital

One of the reasons why many investors (as well as many long-only managers) have accepted the fact that the long/short approach is superior to the long-only approach when managing equity risk is the following: both managers collect and evaluate information. However, the long-only manager cannot use all the information and analysis as he cannot sell short[1] and cannot change his risk profile to reflect his views. The long/short manager has more flexibility for his positions and risk to reflect his views. The long/short manager therefore processes information more efficiently than the long-only manager. Or put differently: if we think of the value added of an active manager being a function of skill and investment opportunities, then it is clear that more opportunities means more (ex-ante) value added with the same level of skill.[2] In other words, a manager with positive skill will be able to add more value if he manages the curve. He will be in the position to reflect his view on stocks more accurately by running different risk profiles and changing these risk profiles based on the analysed information. The increased flexibility of using options results in more opportunities. At the end of the day, more opportunities means more value added for an active manager with positive skill.

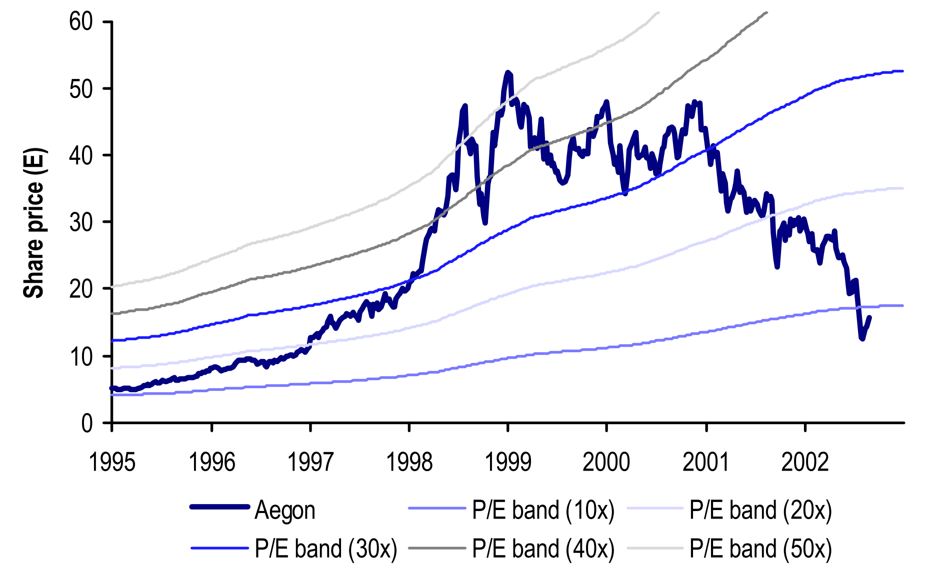
---

[1] We have shown elsewhere (e.g., UBS Warburg 'In Search of Alpha' [2000]) that selling short and managing an underweight position in a stock relative to a market benchmark is not the same.

[2] This line of argument is based on the 'law of active management' from Grinold (1989) and Grinold and Kahn (2000).

The following example should illustrate that an active manager will have a different prospective return distribution in mind when viewing the world in absolute return space. Chart 9 below shows the share price of Aegon from January 1995 to 24 July 2002. In addition we have added five PE bands based on trailing earnings per share in increments of ten starting with a PE ratio of 10 times.

Chart 9: Aegon share price with PE bands



Source: Datastream
Based on weekly returns and trailing 12-month rolling EPS. Prices until 23 August 2002.

Options allow total as well as active risk to be managed more efficiently

When a stock goes through the roof (or, in this case, valuations soar) it is unlikely that the active manager remains indifferent with respect to the ex ante return distribution. There is a strong incentive to reduce the underweight as the stock soars, because the marginal contribution to tracking error normally increases as the stock rises. However, the use of options should allow the active investor to manage both active and total risk. A stock trading at 50 times earnings is unlikely to have the same expected return distribution as at six times earnings (as Aegon at the end of July 2002), irrespective of outlook for inflation, nominal interest rates, and expected (read: uncertain) EPS growth.

The use of stock options is an opportunity for an active manager to add value. There are basically four strategies: buying a call or put option or selling a call or put option.

Option strategies

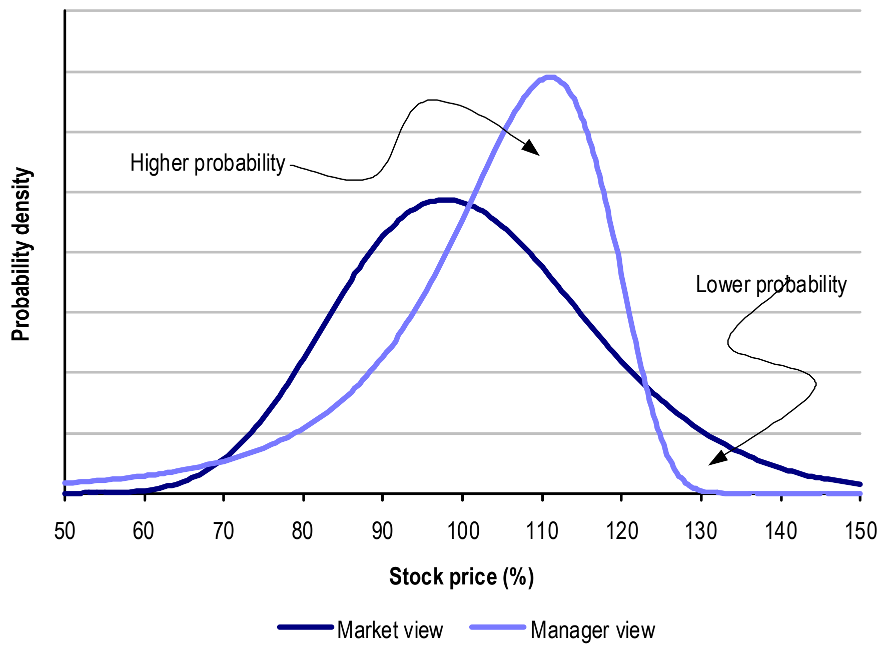
Selling a call option

Selling call options is probably the most frequently executed strategy of active money managers. We discuss the covered call and the buy-write strategy in more detail on page 29.

Selling a call is an alternative way to exit a long stock position

The main benefit of all option strategies is that the manager can more accurately reflect his view on the stock. If, for example, the stock has rallied but the manager does not want to sell at this level, what can he do? He can sell a proportion of his holding and buy another stock with the proceeds from the sale. In this case the volatility or higher moments of the return distribution on a portfolio level are not affected. However, he could also sell a call option to reflect his uncertainty about whether the stock went too far or still has some potential. If he sells a call that is 10% out-of-the-money, he not only manages his exit strategy but also the volatility of the overall portfolio. By selling a 110% call two scenarios are possible: either the call gets exercised or not. If the call gets exercised (stock rallies further above the strike price) the manager sells at the strike price. In this case the sale price of the stock is the strike plus the premium for selling the call. If the stock does not reach the strike price at maturity, the call does not get exercised. This means the manager does still hold stock. However, he received a premium for allowing someone else to buy at 110% in the case of the stock rallying further.

Chart 10: Active view of call seller



Source: UBS Warburg

Chart 10 compares two probability distributions of potential outcomes (stock prices) after a certain period. The dark blue line is the log normal distribution as implied by the options market. The light blue line shows the assumed view of the active manager. A variation to Chart 10 is a manager with a uniform distribution of prices over some range. That is, the probability is the same over some range, say, 80 to 130. The graph would look like a box. This corresponds to a manager with a view such as 'At a PE ratio of 15, the stock is a buy. At a PE of 25, it is a sell. In between, I don't have a strong view. I think it will trade in that range.' He might really want to sell that 130 call. He might even want to sell the 80 put, if he strongly believes the market won't go below the bottom of the range. This scenario might be quite realistic for some managers.

Manager can manage exit more efficiently by using options

Chart 10 shows that the active view of the manager puts a higher probability of the stock trading at a level below 120% of spot. There is a disproportionately lower probability of the stock trading much higher. The mean expected return could be the same in both cases. One of the main points we would like to bring across in this report is that the manager's view does not necessarily have to be log normal around the target. If the manager has a view which deviates from a normal distribution, the most efficient way to reflect this active view is through the use of options. Chart 10 puts the probability of the stock trading between 100% (the current price) and 120% at 37%. The skewed distribution of the manager implies a probability of 59%. For this manager, the 110% and 120% calls are trading too expensive as his idiosyncratic probability distribution differs from that of the market. Not considering them is 'leaving money on the table.'

Selling option premium generates income

An alternative way of looking at the received option premium is as an extra dividend, that is, as income. The income is related to the possibility that the stock trades above 110% at the time when the call was sold. However, if the manager thought that the probability of the stock exceeding 110% at the time of the call sale was very small, not selling the 110% is extremely inefficient. In this case, the only reason for not selling the call is that the benchmark index does not sell an out-of-the-money call too. However, this will hardly be classified as active economic judgement by our descendants.

Under certain circumstances, not selling options could be considered irrational

The extreme case would be if the manager decides today to sell at 110% if the stock increases to that level and does *not* sell the 110% call. This is sub-optimal behaviour because the manager would be worse off in both circumstances: if the stock goes to 110% he would sell at 110% but not have received a premium. If the stock does not go to 110% he continues to hold the stock but has not received a premium. This, obviously, assumes there is no new information to make him change his views between the time he decided what to do and the time the stock ran up.

Selling call options reduces portfolio volatility

A further advantage of selling a call option is that it reduces portfolio volatility. The reason why it reduces portfolio volatility is because a call option has a positive correlation with the underlying stock, as one of the pricing variables of the call option is the price of the underlying stock. If one sells an instrument with positive correlation one effectively adds negative correlation. Adding instruments with very low, or even negative, correlation to an existing portfolio does reduce portfolio volatility. Since it reduces upside volatility much more than downside volatility, the manager requires a premium.

Selling a put option

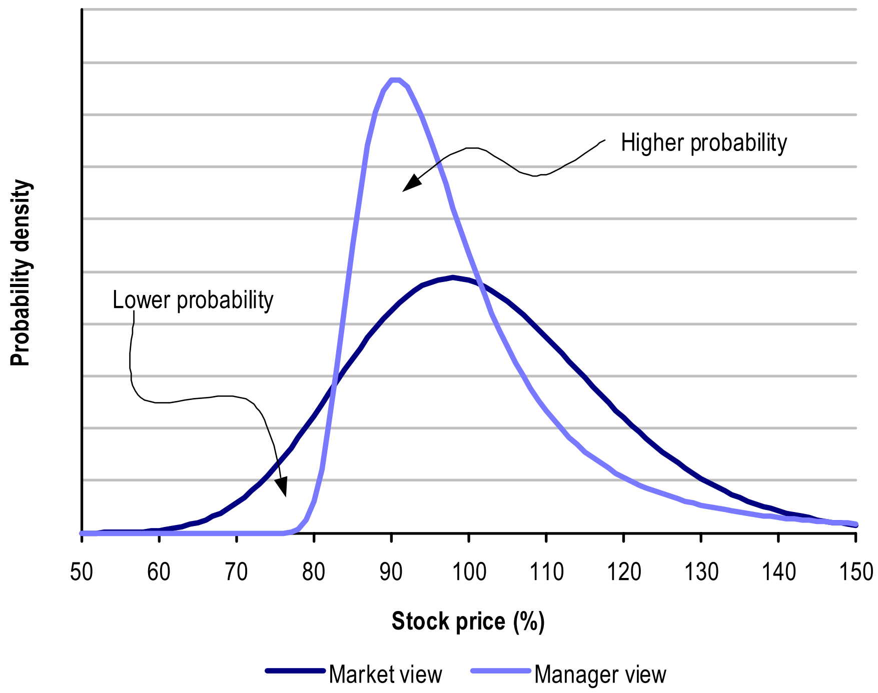
Selling a put option is an alternative to buying stock today

Selling a put option should best be viewed as an alternative to buying stock. If a manager likes a company but does not like its current stock price, that is, believes the stock is trading too high, he has three options: wait until the stock price falls and buy then, buy a little instead of a lot, or sell a put option. The strike price of the put option should be set at the level at which the manager wants to buy. If the stock drops to the target level, the put is exercised and the manager buys the stock at the strike price. However, his purchase price is reduced by the option premium for selling the put option. If the stock does not fall, the manager does not buy the stock as the short put option is not exercised. This is not of great concern to the manager, as the price at which he was willing to purchase was not hit. Unless he changed his mind with respect to valuation, he should not care if the stock trades away since the stock is only getting more expensive.

Selling a put means actively managing the entry into a position

Chart 11 shows how the active view of a manager could deviate from the markets' view. The manager's view in Chart 11 is not normal. The manager puts little probability of the stock falling below a certain level. If this is the case in combination with the manager not wanting to buying stock outright at today's price, selling an out-of-the-money put option is an efficient way to reflect the manager's active view. The probability of the stock lying between 80% and 100% of spot in the log normal and idiosyncratic manager distribution in Chart 11 is 39% and 61% respectively.

Chart 11: Active view of put seller



Source: UBS Warburg

Put sale could reduce portfolio volatility

The effect on the overall portfolio's volatility will depend on whether cash for the potential stock purchase has been set aside or not. If the manager invests the present value of the strike price at the risk-free rate then the transaction is comparable with the direct purchase of the stock. In this case, the cash plus short put option combination will reduce portfolio volatility because on a mark-to-market basis this position under most circumstances will be less volatile than the stock position. In addition the correlation of the money market plus short put position could be less correlated with the rest of the portfolio than the long stock position. This lower correlation further reduces portfolio volatility. The reason for the money market/option combination having lower correlation is because of the non-linear features of options as well as the introduction of a further variable to the portfolio: implied option volatility. Implied option volatility is one of the key variables for option pricing. This volatility may move when prices change, (often falling when stock prices rise and rising when stock prices fall). This effect can offset or even overwhelm the effect of a stock price change.

Buying a call option

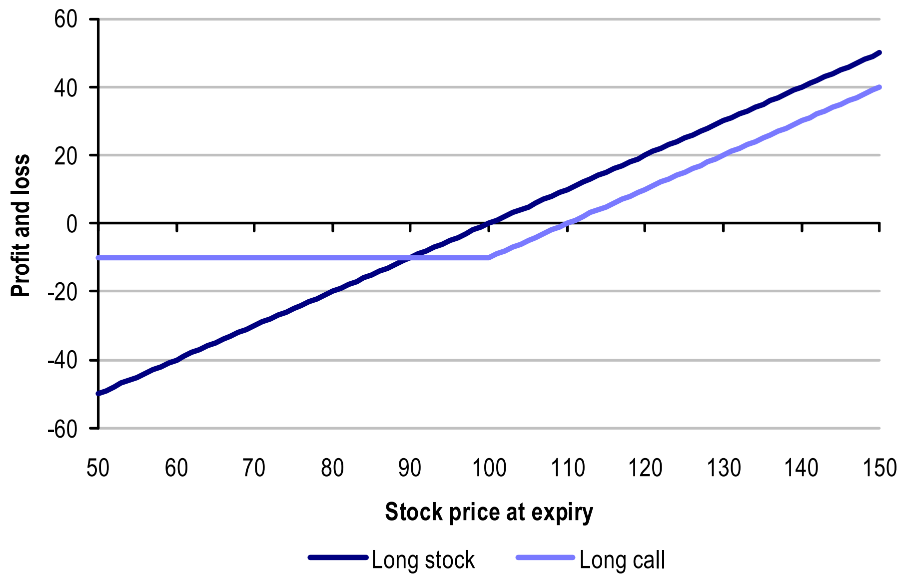
A long call position is less risky than a long stock position

One of the great ironies in finance is that options are perceived as risky. This perception is carried by the popular press and some investment professionals unfamiliar with derivatives.[1] The irony stems from the fact that a long position in a call option is less risky than a long stock position. Why?

A call option is a long stock position with an insurance policy attached to it

A call option is nothing else than a long stock position where the strike price is financed through debt and where the debt is secured through a put option. In other words a call option can be replicated by buying stock, financing the strike through debt and buying a put option. A put option is an insurance against financial loss, in the case of equities a falling stock price. In other words, the put option makes sure that the financial loss does not exceed the debt, that is, the strike price.[2]

Chart 12: Long call versus long stock position



Source: UBS Warburg

The main attraction of buying calls is that the maximum loss potential is known in advance

If we compare a long call option position with a long stock position with respect to managing the curve it becomes clear why a call option is less risky. By buying a call option instead of a stock, the buyer only wants upside exposure but no or limited downside exposure. With respect to the curve, this means he wants the right hand side of the curve but not the left-hand side. It is obvious that the call seller

---

1 We made an attempt to demystify derivatives in UBS Warburg's *'20th Century Volatility'* (1999).

2 One could argue that life assurance companies who have to comply with a resilience test to warrant regulatory solvency should have an exposure similar to a call option (the hockey stick in Chart 12). That way they would not be forced sellers in a market panic situation.

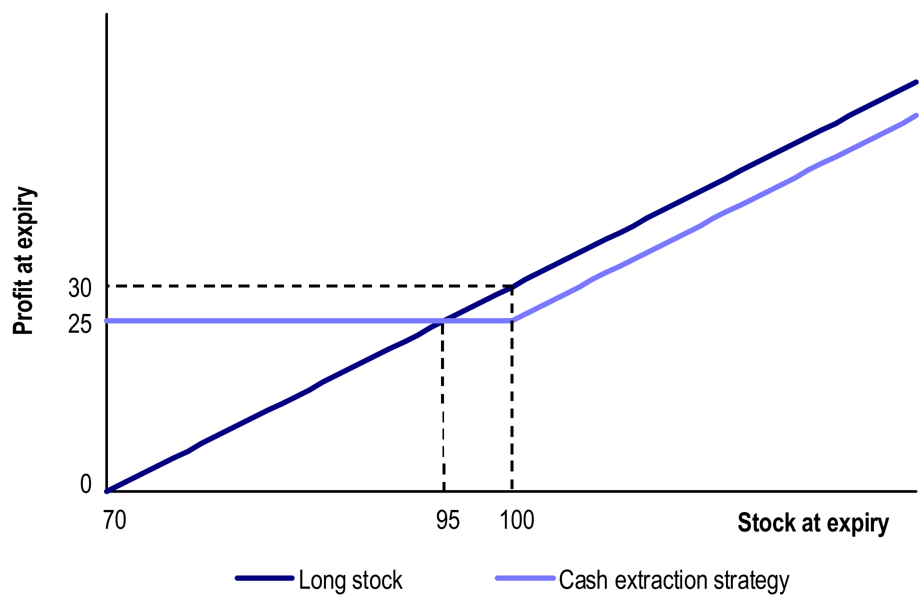
requires a premium for being exposed to the left-hand side of the curve. The 'option hockey stick' in Chart 12 compares the long call with the long stock position.

The cash extraction strategy is an alternative way of exiting a long stock position

Switching from a long stock position into a long call position is a practical way of taking profits but still retaining some upside potential. This strategy is normally called 'cash extraction' as cash is taken out of the position (extracted) and replaced with only an option on the upside. The strategy is also called 'stock replacement' as the stock is replaced with a call. Assuming a stock has rallied, a manager has four options: do nothing, take profits, sell a little bit, sell stock and retain upside through a long call position. Doing nothing means the manager does not actively manage the curve. This is fine if the manager has increased his price target and perceives the stock equally attractive as before the rally. Taking profits might be a good idea, if the stock is now perceived as fairly priced and there are plenty other investment opportunities for reinvesting the proceeds from the stock sale.

Assuming an investor had bought a stock at 70 that is now trading at 100. He decides to lock in some profit and retain some upside potential. He sells the stock at 100 and buys the three-month at-the-money call option for 5. The investor has effectively sold the stock at 95, which is 25 (35.7%) above the purchase price of 70. This is now the minimum return over the remaining three-month period. However, the upside potential (albeit reduced) is retained through the call option. The option gives the holder the right to purchase the stock again so it can be 'replaced' in the portfolio if the price rises and the portfolio manager wishes to retain the equity. Chart 13 shows how the profit of 25 can be locked in, even in the case of the stock trading below 95 in three months' time.

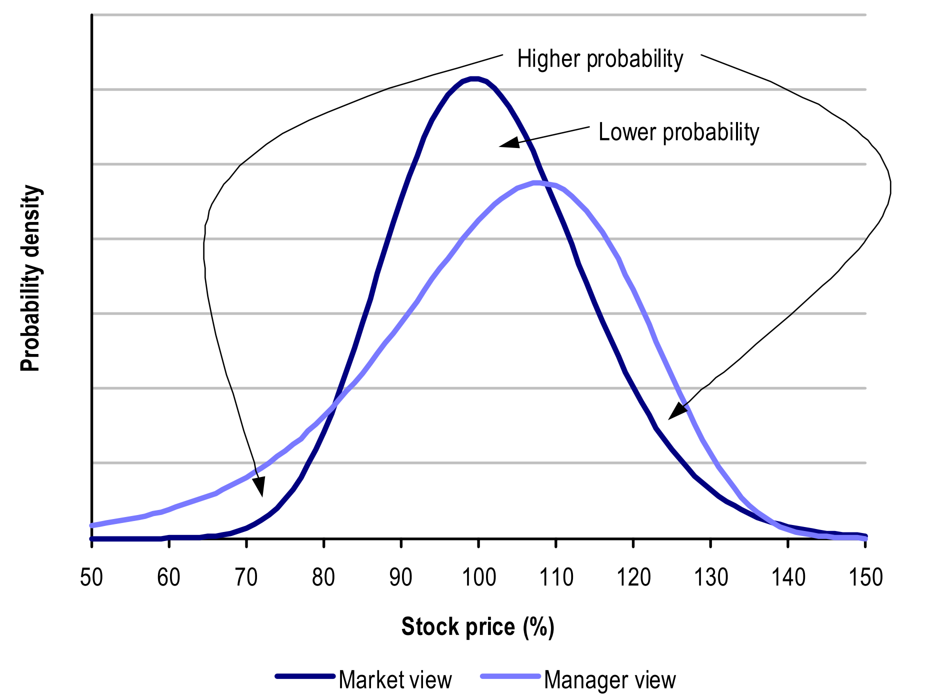
Chart 13: Long stock versus cash extraction strategy



Source: UBS Warburg

Chart 14 shows an active view where it would make sense to switch from long stock to long call. If the manager's assessment of the stock reveals that there is a high probability that the stock might retreat (after for example a rally) but there is also some upside potential, an efficient way to manage the curve is to sell the stock and replace it through a long position in calls.

Chart 14: Possible view of active call buyer (cash extraction)



Source: UBS Warburg

An active manager might have a directional view on volatility

There are further reasons to buy calls. In Chart 14 we have drawn the manager's distribution wider than the distribution implied by the market. This means the manager has an active view on the volatility of the stock. Not only is the manager's view (expressed through the light blue line in Chart 14) non-normal, the manager's view on future volatility is higher than the volatility implied in options. In this case it also would make sense to buy options in general, as the options are too cheap when compared with the manager's assessment of the future direction of the stock.

Buying a put option

Buying puts as alternative to selling stock short

There are two reasons to buy a put option: to express a negative view on a stock or to hedge a long stock position. Some absolute return managers buy deep in-the-money put options instead of selling a stock short. This might be the case when there is no stock available to borrow or when borrowing stock is prohibitively expensive. Selling stock futures (where available) is a further alternative to short selling.

Put purchase is short stock with hedge against rising prices

An alternative way of viewing the purchase of a put is as short stock position with an insurance policy against losses occurring if the stock rallies. Just as a long call position is a long stock position with an insurance against falling prices, a long put position is a short stock position with an insurance against rising prices.

Purchase of puts reduces risk

The purchase of put options on stocks is not done very often by active managers. More often index puts are bought to hedge market risk. The effect of buying puts on the portfolio is primarily risk reduction. By adding a long put option to a portfolio, one essentially adds an instrument with negative correlation to the rest of the portfolio (what hedging is all about). A typical strategy would be to buy index put options. If the index on which the options are drawn is similar to the benchmark of the manager, portfolio volatility is reduced. This means the future return will be less attributable to changes in the market and more to the stock-picking of the manager.[1] Through the purchase of put options, the manager can move from a market-based strategy to a skill-based strategy. If the long positions outperform the benchmark (which is the reason why the manager is in business), the absolute profit of the manager will be attributed entirely to his stock picking skill, as the market variance has been hedged.[2]

Conclusion

Rocket scientists are normally not active equity managers

As we have noted in the overview section at the beginning of this report, one need not be a mechanical engineer to drive a car. Neither need one be a rocket scientist to add value through options.

Options allow processing information more efficiently

Options allow the active equity manager to more closely reflect his idiosyncratic view on a stock in absolute return space. In other words, there are efficiency improvements in terms of matching information with portfolio positions. The use of options increases the opportunity set. Entry and exit strategies can be executed more effectively. In addition, options allow portfolio volatility to be reduced or allow the return be more attributable to stock picking and less to market volatility.

---

[1] Note that the first hedge fund (Alfred Jones) was founded on the principal to receive a return attributable to stock picking while immunising market volatility. Jones merged two investment tools: short sales and leverage. Short selling was employed to take advantage of opportunities of stocks trading too expensive relative to fair value. Jones used leverage to obtain profits, but employed short selling through baskets of stocks to control risk. Jones' model was devised from the premise that performance depends more on stock selection than market direction. He believed that during a rising market, good stock selection will identify stocks that rise more than the market, while good short stock selection will identify stocks that rise less than the market. However, in a declining market, good long selections will fall less than the market, and good short stock selection will fall more than the market, yielding a net profit in all markets. To those investors who regarded short selling with suspicion, Jones would simply say that he was using 'speculative techniques for conservative ends.' Brinson, Hood, and Beebowers' (1986) seminal paper 'Determinants of Portfolio Performance' argued that asset allocation (as opposed to stock picking) is the primary factor in determining the overall risk and potential return of a portfolio. This paper, potentially, could be the reason why during the 1990s the (passive) long-only approach has became mainstream, whereas Alfred Jones approach (long/short) was a niche.

[2] Assuming of course index options have been bought for the entire portfolio which is an extreme case.

Selling calls revisited

There is no clear-cut definition in the derivatives literature as to what exactly a covered-write, covered call or buy-write is. We believe it makes sense to make the following distinction:

- Covered-write, and
- Buy-write.

We define a covered-write as a situation where a manager owns a stock and sells call options to manage his exit strategy. We define a buy-write as a situation where a manager simultaneously buys a stock and sells calls to manage his entry into the position. Buy-write strategies are occasionally referred to as 'buying stock at a discount.'

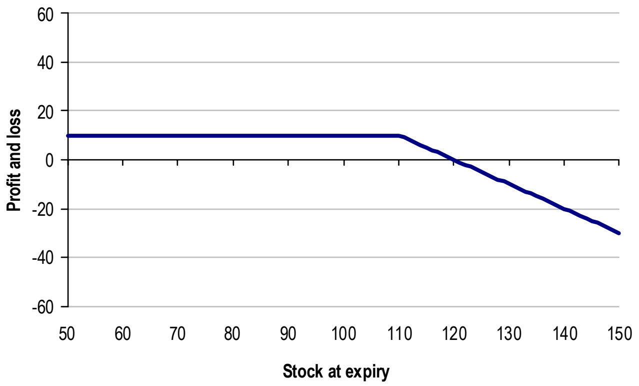
Covered-write

Selling a call option against a long position in the stock is called a covered-write

A covered-write is a position where the investor or manager holds a stock and sells a call option against that particular stock. The holding in the cash market, therefore, covers the short position in the call option. The opposite of a covered call position is a naked short or naked call. 'Naked' does not refer to the dress code of the manager but to the fact that the short option position is not covered by a cash instrument, that is, the potential loss of a naked short call position is unlimited.

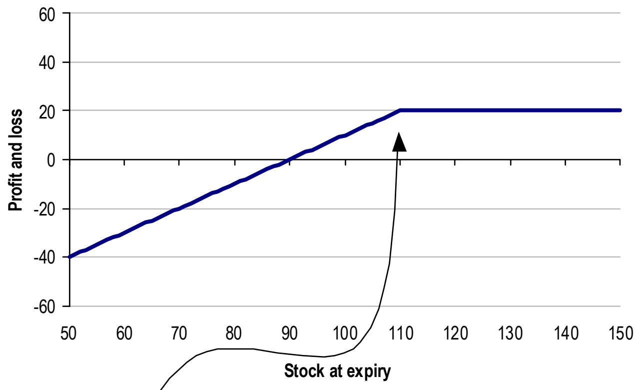
The following two graphs show examples where a call with a strike price of 110% of spot has been written. Chart 15 shows the pay-out diagram of a naked call, whereas Chart 16 shows the pay-out of a covered call.

Chart 15: Naked call



Source: UBS Warburg

Chart 16: Covered call



Source: UBS Warburg

Unlike cash instruments, options are non-linear

The single most important reason why derivatives are still broadly misunderstood, we believe, is because the pay-out diagram of options are normally not linear. In other words, there is usually a 'kink' in the pay-out profile of an options position or investment strategy which contains optionality.

A kink in the pay-out diagram means that there are different possible scenarios

The most practical way of reading these P&L diagrams is to think of as many future scenarios as there are lines. If, for example, a pay-out diagram has one kink (that is two lines) then there are two different scenarios, if there are two kinks (that is three lines) then there are three scenarios, etc. A long or short position in a stock has no kink.

Naked call

An option either gets exercised or it does not

Chart 15 shows the profit and loss profile at expiry of a call option. The stock at the time of selling the call option was 100, the strike price of the call option was 110 and the proceeds from selling the call option were 10.[1] There are two scenarios (since there is only one kink[2]):

(1) If the stock at expiry of the option closes below the strike price of 110, the call is normally not exercised. The profit to the investor is primarily the proceeds of 10 from selling the call.[3]

(2) If the stock at expiry closes above the strike price of 110, the call most likely will be exercised. The call seller will have to deliver the stock to the call buyer. If the call seller can buy stock at 111, he still would walk away from the trade with a profit. However, the profit would be reduced by the difference between 110 (level at which call seller sells stock) and 111 (level at which call seller has to buy stock for delivery to the call buyer).

The potential loss of a naked call sale is unlimited

At one point the losses of buying stock higher is balanced by the proceeds of 10 through the call sale. In Chart 15 it is the point where the pay-out line crosses the the y-axis (also referred to as break-even point). In the example, this is at 120. In theory, the potential loss of the naked call sale is unlimited. If the stock goes to infinity, the loss would be infinity minus 10 (which is pretty close to infinity). Margin calls would probably come in before losing an infinite amount of money. But a really large finite loss of principal is awful too.

Covered call

Potential loss is limited since short call is covered by long stock position

A covered call has a different pay-out profile from the naked call sale (Chart 16 on page 29). With the covered call sale (the covered-write) the short call position is covered by a long position in the stock. The similarity is the kink at the strike price of 110. There are two scenarios at expiry:

(1) If the stock closes below the strike price of 110 at expiry of the option, the call is unlikely to be exercised. In this case the covered call seller continues holding the stock. The return on investment is the proceeds gained from selling the call. This is the typical yield-enhancement scenario. In other words, the call sale is regarded as a ‘super-dividend’ which enhances the yield on the long

---

[1] These assumptions equate to an implied volatility of around 36% for a one-year option and 50% for a six-month call option.

[2] The kink is most often at a strike price. In other words, the pay-out changes depending whether the stock at expiry is above or below a strike price.

[3] Calculating the return on investment of a naked short call position is not straightforward. An imperfect way would be to relate the premium intake in relation to the cash put down as margin requirement. However, most institutional investors will have a credit line and will not pay a margin on a single option position level. The most practical solution would be to relate the proceeds of the naked call sale to the stock price at the time of the call sale. In the example this would equate to 10%.

stock position. Alternatively, the covered call is viewed as reducing the costs of holding stock.

(2) If the stock closes above the strike price, the call is likely to be exercised. In this case the covered call writer delivers the underlying stock to the call option buyer. The maximum loss potential, in the case of bankruptcy of the underlying company, is 100% which is slightly reduced by the option premium intake at the time of selling the call option. The maximum profit, on the other hand, is limited to the strike price (essentially the selling price of the stock) plus the proceeds from the call sale. In the example above this equates to 120 (strike price of 110 plus 10 from selling the call).

Selling call options is not a hedging technique

Occasionally, selling covered calls are considered as hedging. We believe that this is not necessarily the case. The covered call position is similar to that of a holder of a corporate bond: limited upside but full downside participation. The limited upside is known in advance and, in the case of default, the bond holder as well as the covered writer lose all the principal.

Difference between naked and covered call sale

The break-even point in absolute return space depends on the entry price of the long stock position

Unlike with the naked call sale, the break-even of the covered call sale is below the spot and strike price. In the example the break-even is 90 (spot price of 100 minus 10 from the call sale). This break-even point is somewhat arbitrary. It assumes a stock price of 100, that is, the stock price at the time of the call sale. However, the manager might have bought the stock one year ago at 50 or 400.

The covered call strategy can be viewed as potential exit strategy

Whether the investor had bought the stock at 50 or 400 will be of great influence with respect to the investor selling the covered call in the first place. In theory, however, it should not, but in the real world it certainly does.[1] To some extent the covered call strategy can be viewed as a potential exit strategy out of a long stock position. If the investor holds the stock currently priced at 100 and feels, based on his active judgement, that the stock is overpriced at the 110-120 level, he could sell a 110 call for a premium of 10.

Is the covered call strategy a win-win situation?

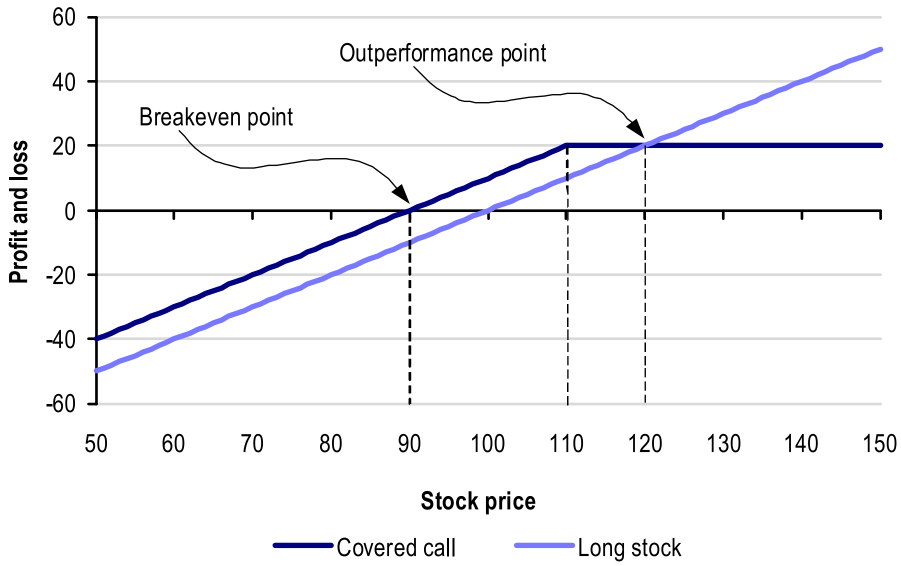
In this case the covered call sale becomes a win-win situation. Either the stock moves to a level where the investor wants to sell (the 110-120 level) or the stock does not. In the former situation, the manager got a higher exit price than if he sold the stock instead of the covered call. In the latter situation, irrespective of whether the stock buyer bought at 50 or 400, the entrance price level of the long stock position is reduced by 10.

---

[1] From an orthodox economics point of view there is no difference as the utility function is not dependent on the status quo. Subscribers to behavioural finances will have an opposing view. This view is primarily based on work done by Daniel Kahneman and late Amos Tversky. Kahneman and Tversky (1979) formulated prospect theory – essentially an opposing theory to expected utility theory. Utility theorists focus on accounts of preferences in rational decision making where an individual's preferences cohere with associated beliefs and actions. Utility refers to the scale on which preference is measured. Prospect theory is a mathematically-formulated alternative to expected utility theory. The value function of the prospect theory gives stronger weight to losses and is kinked at the reference point (status quo). Loomes and Sugdens' (1982) regret theory could explain that investors will decide differently if they bought the stock at 50 or 400. Regret theory suggests that negative utility from missing a plane by five minutes is a much worse than by missing the plane by an hour. In other words, the level at which a stock was bought will probably influence most investors with respect to capping the upside potential through a covered call sale.

Chart 17 below shows the covered call position compared with a long stock position.

Chart 17: Covered call compared with long stock position



Source: UBS Warburg

A covered call strategy does not always outperform a long stock position

As we (and most other investors and market observers) are rather sceptical towards win-win situations and free lunch plans, chances are that there is a catch. Chart 17 shows where the costs are, that is, from which level the covered call underperforms the outright long position in the stock. The covered call strategy, as one would expect, does not always perform better than a long position in the stock. Next to an absolute break-even point, there is also a relative 'break-even'. In other words, there is a level where the outperformance of the derivatives strategy changes into an underperformance. This level is occasionally referred to as 'outperformance point'.

The outperformance point is calculated as the strike price plus the premium from selling the call option

In the example given above (Chart 17) the break-even point is at 90. Below a stock price of 90 the investor starts losing money (assuming he bought stock at 100). The outperformance point is at 120 (strike price of 110 plus premium from call sale of 10). If the stock price is higher than 120 at expiry of the option the covered call seller will miss out. In other words, the cost of the covered call seller can be viewed as opportunity costs.

Is capping the upside potential of a long stock position counter-intuitive?

Capping the upside is not necessarily intuitive. One could argue that the reason for buying stock is to participate in the long-term upside potential of the underlying company. This would clearly speak against a covered call strategy.

We believe there are two main reasons where a covered call strategy makes sense:

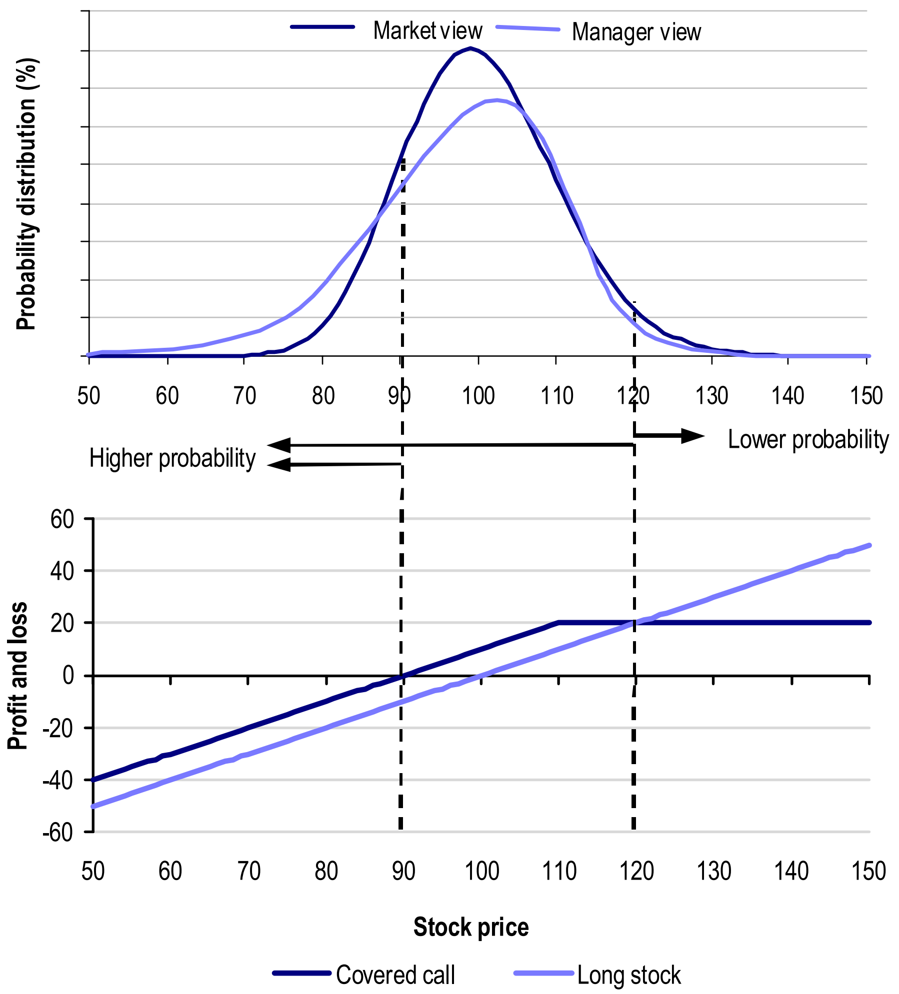
(1) Managing exit, and

(2) Yield enhancement.

Managing exit

Chart 18 combines the pay-out diagram with its break-even and outperformance point with the probability distribution of the stock as implied by the market as well as the subjective view of the manager.

Chart 18: Covered call write compared with manager view of the stock



Source: UBS Warburg

Covered call write has a high probability of outperforming long-only position in cash market

If a manager is bearish on a stock he simply sells the stock – end of story. However, a manager might have a more refined view on a stock than just 'to hold or not to hold.' The probability function in Chart 18 is the view of a manager who decided to hold the stock but believes there is little probability of the stock rising further than 120 and/or assesses the probability of the stock falling in price as larger than the option market implies. If the manager's subjective probability distribution (that is his view) is different in terms of volatility and/or higher moments (skewness[1]/kurtosis[2]), he should do a trade to reflect his view. Options can help. In the example above, the manager's view is that there is limited upside above 120. So, once he decides to keep the stock, he should sell that upside and receive a premium for giving up the upside. He will outperform the long-only stock position in all cases below 120. Note that the mass below the curve titled 'manager view' is much larger than the mass of the log normal distribution ('market view'). In other words, selling the 120% call is the most efficient way to express the manager's view on the stock.

Yield enhancement

Selling option premium could be viewed as yield enhancement

As we have mentioned earlier, the call premium of the covered call sale could be viewed as 'super-dividend'. The decision to sell a call, that is, sell the upside potential of a stock for an enhancement of yield, is to some extent driven by the volatility of the stock. If, for example, the stock of a food company traded with a volatility of 10% and options were trading at 50%, some investors would be selling calls at 50% implied volatility.

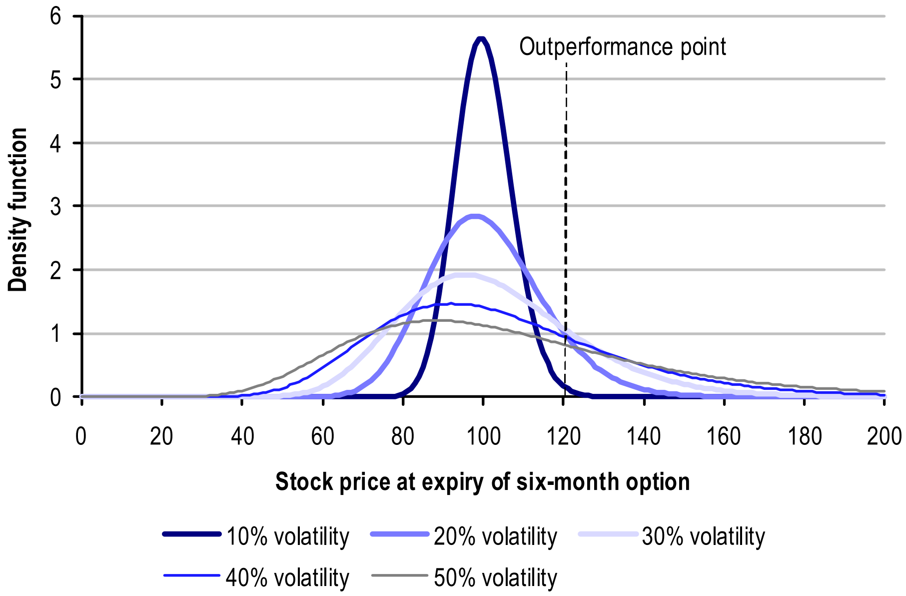
Chart 19 below shows five probability distribution curves with the same mean. Volatility ranges from 10% to 50% in 10-percentage-point increments. The periods are six months.

---

[1] Skewness measures the third moment of a return distribution. Skewness characterises the degree of asymmetry of a distribution around its mean. Positive skewness indicates a distribution with an asymmetric tail extending toward more positive values. Negative skewness indicates a distribution with an asymmetric tail extending toward more negative values.

[2] Kurtosis measures the fourth moment of a return distribution. Kurtosis is an indication of 'fat tails', that is kurtosis measures whether the observed data fall near the centre of a distribution or in the tails. Kurtosis characterises the relative peakedness or flatness of a distribution compared with the normal distribution. A kurtosis value less than that of a normal distribution indicates a distribution with a fat midrange on either side of the mean and a low peak. This is called a platykurtiotic distribution. A kurtosis value greater than that of a normal distribution indicates a high peak, a thin midrange, and fat tails. This is called a leptokurtotic distribution and is very often observed in time series of price return data.

Chart 19: Probability functions



Source: UBS Warburg
Assumption: mean simple return of 5%

Selling covered calls is an opportunity depending on the view of the stock

Assume the outperformance point is 120 as illustrated through the vertical dotted line in Chart 19 (strike price of 110 plus 10 for the premium). The probability of the stock trading below 120 in six months' time (that is below the outperformance point) is different for the five probability distributions. The probability of the stock trading below 120 in six months' time based on 10%, 20% and 30% volatility is 99.6%, 90.6% and 81.0% respectively. In other words, if the market implies a curve similar to the 20% volatility curve in Chart 19 whereas the manager has a view similar to the 10% volatility curve, it is irrational for the manager not to sell the 120 call. The only rational reason for the manager not to sell the call is defining risk as active risk and controlling active risk relative to the benchmark. However, in absolute return space the sale of the 110 call at 10 is an opportunity.

Professional option traders will pick up arbitrage opportunities

In the real world it unlikely that options trade at an implied volatility level of 50% while the underlying security trades at 10%. Neither will options trade at 10% when the stock trades at 50%. In other words, arbitrage and market competition will force options to trade not too cheap or not too expensive. If the relationship between options and underlying security trades out of line, professional option traders[1] will trade the option and do the reverse trade synthetically. However, a manager with an idiosyncratic view that is different from that in the option market has an economic incentive to trade options.

[1] Essentially anyone with efficient access to the options market and low trading costs.

Buy-write

Managing entry

With a buy-write strategy the manager controls exit as well as entry of underlying stock position

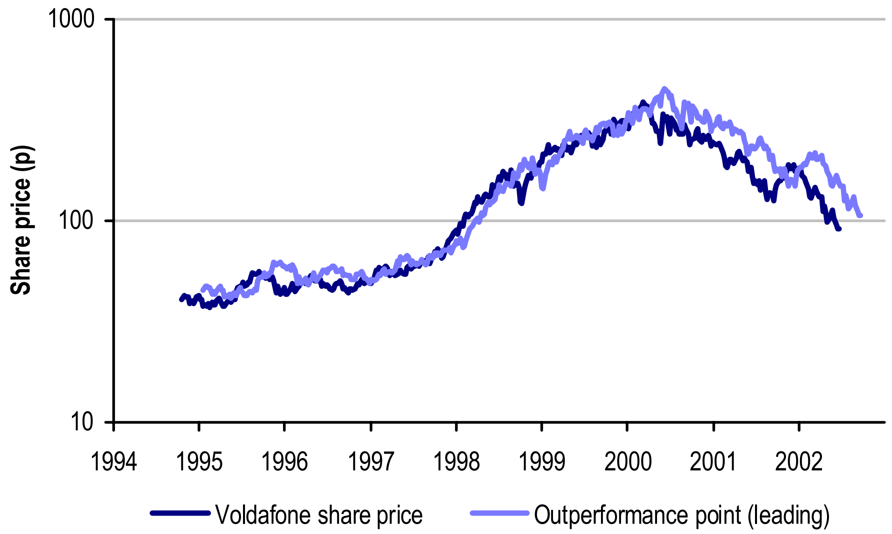
In a buy-write strategy the manger buys the stock and simultaneously sells a call against the stock. The written call is most often chosen to be out-of-the-money. To some extent a buy-write strategy is the same as the covered-call. The pay-off diagram is the same (see Chart 17 on page 32). The manager's view of the stock is also most often similar – that is, small idiosyncratic probability of the stock rising above the outperformance point. However, there is a difference. With a covered call strategy the manager to some extent manages the exit out of the stock, as highlighted earlier. With the buy-write strategy, the manager controls the entry as well as the potential exit of the position.

Buy-write strategy can reduce break-even level of a long stock position

Using the figures from above (stock at 100, strike at 110 and call at 10), the manager entering a buy-write strategy buys the stock at 100 and simultaneously sells the 110 call at 10. His break-even in absolute return space is at 90 and the outperformance point, that is, the point above which the long-only position yields a higher return, is 120.

The buy-write strategy can best be illustrated with a life example. In the following illustration we used Vodafone as an example. The stock went up a lot and then down a lot. We monitor implied volatility since 21 October 1994. In the following analysis, we have subtracted two volatility percentage points to allow for bid/ask spread and other costs. The strike price of the written three-month option was always 110% of the spot price (irrespective whether this strike was available in the exchange traded options market).

Chart 20: Vodafone share price versus buy-write outperformance point (log scale)



Source: Datastream, UBS Warburg

Chart 20 above shows the stock price of Vodafone from 21 October 1994 to 21 June 2002 based on weekly data in local currency (dark blue line). The light blue line shows the outperformance point of the above mentioned buy-write strategy. The time series of the outperformance point has been moved forward by three months.

Buy-write strategy outperforms more often than not

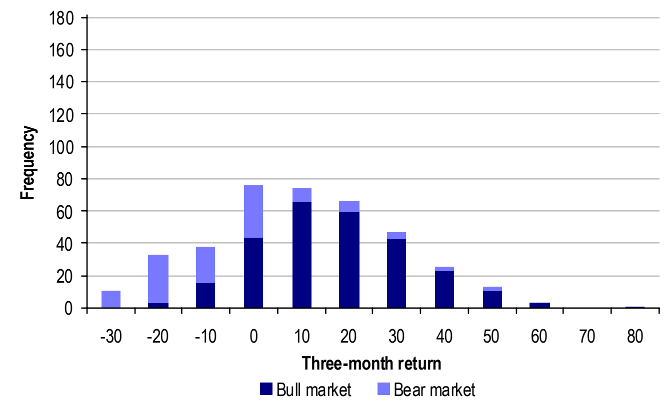
In the observation period there were 388 weeks. In 256 (66.0%) of the cases, the buy-write strategy outperformed the long-only strategy. However, it does not tell us anything about magnitude. If the frequent outperformance is small and the infrequent underperformance is large, then the strategy might not be as attractive as it appears from the analysis above.

Unsurprisingly there is no free lunch plan

In previous equity derivatives research (also published in Ineichen [2000]) we have shown that systematically selling option premium does not work. It would be rather strange if it did. Markets are not entirely inefficient. The point of this report is to highlight that if the idiosyncratic ex-ante return distribution of the manager differs from the distribution implied by the market, the manager should take action by trading options. For an active equity manager, abstinence from the stock options market is sub-optimal as the position does not efficiently reflect the manager's view.

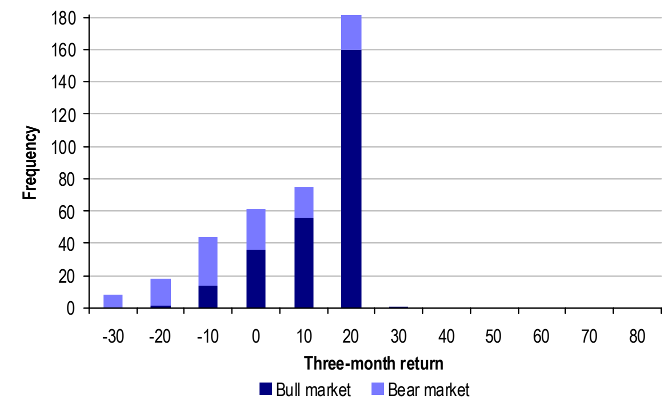
Chart 21 shows the frequency distribution of the magnitude of outperformance in pence. The reading of 11 (y-axis) under -30 (x-axis) means that from the 388 returns, 11 were between –40% and –30%. The dark blue bars measure the returns during the bull market (until 10 March 2000) while the light blue bars measure the returns during the bear market (March 2000 until 21 June 2002). Chart 22 shows the same analysis for the 388 returns of the buy-write strategy.

Chart 21: Returns of long-only strategy in Vodafone



Source: UBS Warburg

Chart 22: Returns of buy-write strategy in Vodafone



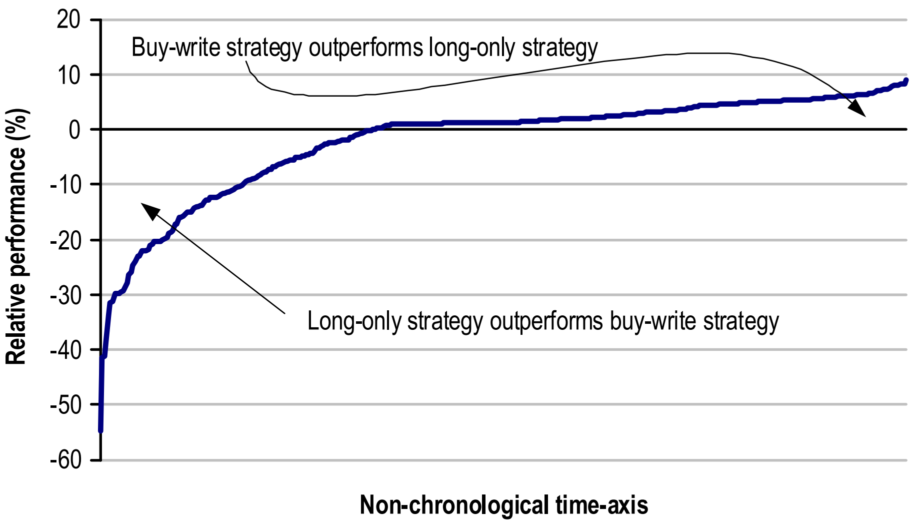
Source: UBS Warburg

Chart 21 and Chart 22 show the different return distribution in the above case of Vodafone. With the long-only strategy, returns are fairly log-normally distributed whereas the upside has been cut off in the case of the buy-write strategy.

Applying a buy-write strategy systematically does not add value

Chart 23 below shows why that systematically entering a stock position through a buy-write strategy does not add value. The chart shows the return of the buy-write strategy relative to the long-only strategy. A negative reading means that the buy-write strategy has underperformed the purchase in the cash market and vice versa.

Chart 23: Overall relative performance of buy-write strategy



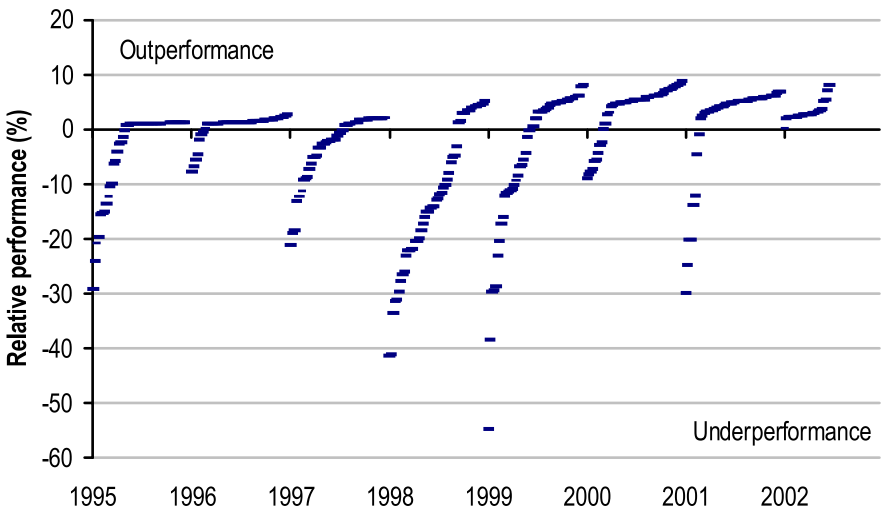
Source: UBS Warburg

The magnitude of the buy-write strategy underperforming the long-only strategy is large

Chart 23 shows (again) that the buy-write strategy outperforms more often than not. However, the magnitude of the occurrences when it underperforms are larger. The sum of the 132 (from 388) occurrences where the buy-write underperformed was -1,662 percentage points. The sum of the 256 readings where the buy-write outperformed was only 865 percentage points.

The buy-write strategy suits some market environments better than others. Chart 24 below shows the same illustration as in Chart 23 put per calendar year. The ticks show the weekly relative performance per calendar year in ascending order.

Chart 24: Yearly relative performance of buy-write strategy (Vodafone)

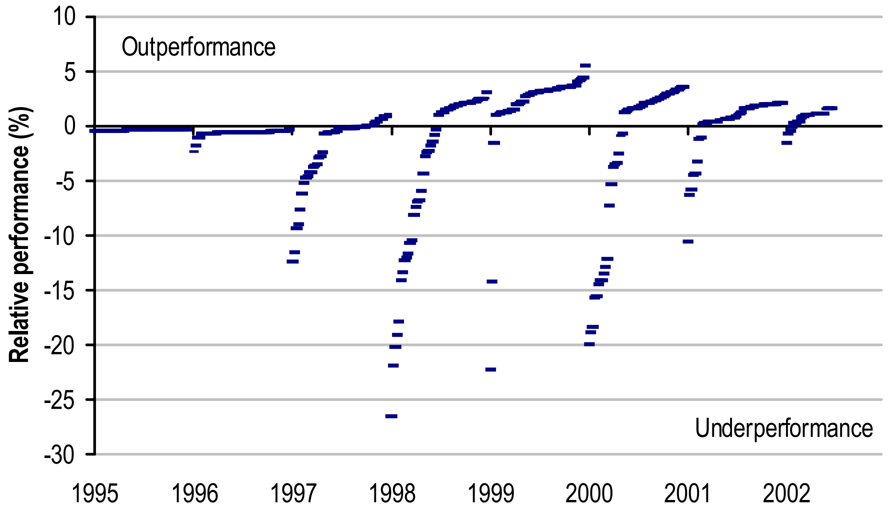


Source: UBS Warburg

Chart 24 reveals that the buy-write strategy in a roaring momentum driven market can substantially underperform the long-only strategy. A passive approach does not work. Only if the manager has an edge as well as an active view that differs from the view implied by the market does it make sense to favour a buy-write strategy over a long-only strategy.

Year-to-date, a buy-write strategy would have outperformed the long-strategy on all of the 25 occasions. In 1998 and 2001, the buy-write strategy would have outperformed the long-only strategy 37 and 8 times respectively.

Chart 25: Yearly relative performance of buy-write strategy (Unilever plc)



Source: UBS Warburg

Chart 25 above shows the same illustration for Unilever plc, which in terms of share price performance, hype, cyclicality and implied volatility had a completely different path than had Vodafone. However, the conclusions drawn from the prior example remain unchallenged if we use a different stock.

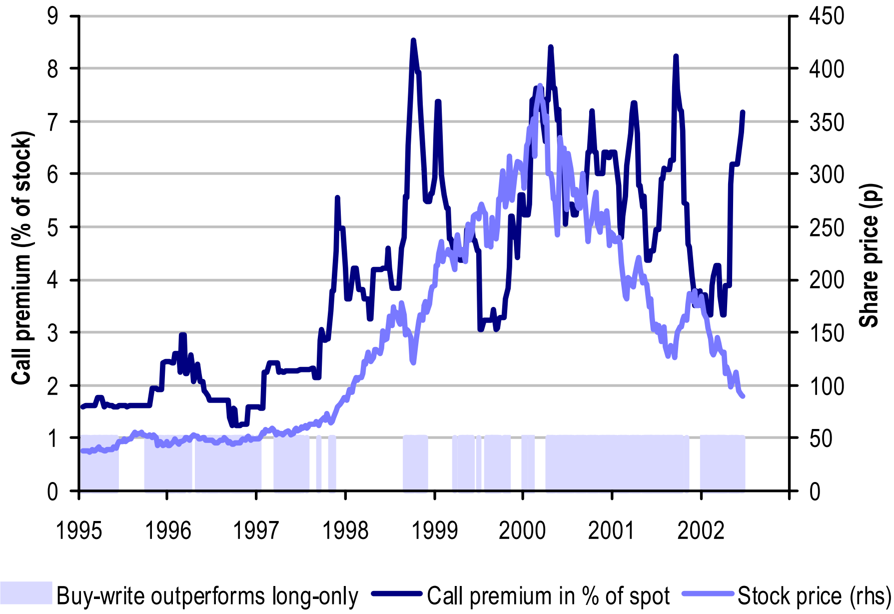
Implied volatility

Does the level of stock option implied volatility matter?

Our equity derivatives research is primarily focused on analysing implied volatility. The question to an investor is: does it matter? Most practitioners selling options seek for high implied volatility as the option premium is higher when implied volatility is high. However, there are also practitioners who seek for low volatility to sell option premium. Their argument is that selling premium in a calm market is more attractive. In an efficient market, there should be no arbitrage opportunity. In other words, options should be priced correctly. The point we raise in this report is that if a manager's view differs from that of the market, he should trade options to more efficiently align his position with his active view on the stock. This could occur, we believe, in regimes of high as well as low implied volatility.

Chart 26 shows the call premium as a percentage of spot at the time of the sale (dark blue line). The light blue line shows the share price (right hand scale) from January 1995 to 21 June 2002. The shaded area indicates that the buy-write strategy has outperformed the long-only strategy.

Chart 26: Call premium versus stock price (Vodafone)



Source: Datastream, UBS Warburg

Buy-write can also outperform long-only strategy when implied volatility is low

Chart 26 allows the amount received from selling the 110% call to be related with whether the buy-write strategy has outperformed the long-only alternative. The graph shows that the buy-write strategy can outperform the cash strategy even when volatility is low. This was the case in the low-volatility periods of 1995 and 1996. A further characteristic of that period was that the stock went more or less sideways. In the period where the bubble burst (post March 2000), the buy-write strategy most often outperformed the long-only alternative. Only in the roaring momentum-market of 1998 does the long-only strategy outperform the buy-write strategy.

Implications

What are the implications? Once a manager has decided to buy the stock, he can consider going outright long or enter the stock through a buy-write strategy. If his idiosyncratic ex-ante return distribution (that is his view on the stock) is at all times equal to that of the market, he should not enter into a buy-write strategy, as systematically selling options does not work. However, if this is the case, he should be running an index fund as his ex-ante information ratio is not higher than zero. However, if his information coefficient[1] is positive, the flexibility to enter the stock through a long-only position or through a buy-write strategy will add value in absolute return space.

[1] The information coefficient (Grinold and Kahn [2000]) measures the skill or the predictive power of the manager. If this information coefficient is zero, the ex-ante alpha or value added of the manager is zero by definition.

Conclusions

We believe that using stock options can add value to the active manager's overall portfolio performance. Through the use of options, the manager can more effectively translate his view into a transaction than by just holding or not holding the stock. The main strategies are:

- Buy-writes: buy stock, sell call. An alternative entry strategy. Useful if manager wants to enter market at a lower price and/or believes short-term rally is unlikely.
- Covered calls: sell call on existing stock position. Useful if manager believes that a current stock holding is unlikely to exceed a certain level and/or wants to generate some extra income on the position.
- Cash extraction (stock replacement): Sell existing stock, buy call. An alternative exit strategy. Useful if manager wants to lock in profit and still retain some upside potential.
- Short put: An alternative entry strategy similar to the buy-write strategy. Useful if manager is a buyer at a certain (lower) level and/or in times of market panic and implied volatility soars.

In the following section we define and discuss some aspects of volatility. Taking the risk of overdoing our car analogy, one could compare managing portfolio volatility with the interaction between acceleration and deceleration while driving a car. A novice driver will learn early on the functions of the two pedals. The one on the right is for acceleration and the one on the left (or, in manual cars, the one in the middle) is for deceleration. Managing portfolio volatility is analogous to controlling the interaction between investment opportunity and a potential financial loss. Ignorance, lack of knowledge or skill with respect to the functionality of the two pedals might be a sub-optimal way of controlling risk.

Appendix: What exactly is volatility?

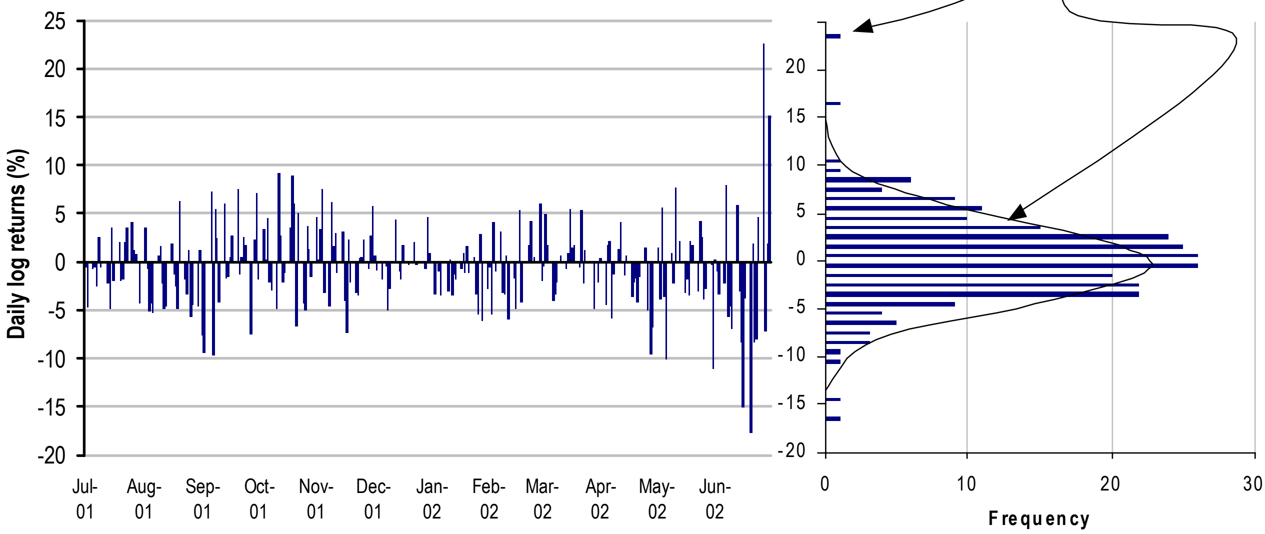
Definition and introduction

Volatility is a measure of uncertainty

Volatility is defined as the annual standard deviation of returns.[1] The standard deviation is a statistical figure that measures the magnitude of dispersion of the returns around their average (arithmetic mean). In financial texts, the terms *volatility*, *standard deviation* and *variance* are often used interchangeably for the (most often) daily variability of prices. In statistical terms, the standard deviation is the square root of the variance and the volatility the annualised standard deviation. A volatility of 20% means that there is a 67% chance that the annual returns should be within a band of plus or minus 20% of the average return. 95% of all annual returns should lie within a band of ±40% and 99% of the returns should lie within ±60% from the mean.[2]

Chart 27 is an attempt to visualise the daily returns of a stock. The left part of the graph shows the daily (log) returns of France Telecom over an (admittedly turbulent) one-year period. The bars on the right hand side of Chart 27 measure the frequency of each one-percentage point gap. For example 25 of the 252 daily returns were between zero and one percent whereas only one observation was between nine and ten percent. The line shows the normal distribution of the daily (log) returns. The shape of the realised distribution when compared with the normal distribution can best be described as leptokurtotic, that is, it has a high peak, a thin midrange, and fat tails.

Chart 27: Daily returns of France Telecom (5 July 2001-4 July 2002)



Source: Datastream, UBS Warburg

In modern portfolio theory (MPT) volatility is often used synonymously with risk. The reason volatility is used as a proxy for risk is because, to some extent, volatility

[1] See also glossary on page 49.

[2] This is slightly simplified as log-returns are normally distributed, whereas simple returns are log-normally distributed.

is a measure for uncertainty and to some extent there is no better alternative. If two diversified portfolios have an expected return of 10% and portfolio A has a volatility of 20% and portfolio B has a volatility of 5%, the latter is superior to the former.

The common denominator of investors' preferences

Markowitz (1959) points out that different investors have different objectives and considerations. However, two objectives are common to all investors:

> 1. *They [the investors] want 'return' to be high. The appropriate definition of 'return' may vary from investor to investor. But, in whatever sense is appropriate, they prefer more of it to less of it.*
> 2. *They want this return to be dependable, stable, not subject to uncertainty. No doubt there are security purchasers who prefer uncertainty, like bettors at a horse race who pay to take chances. The techniques in this monograph [Portfolio Selection] are not for such speculators. The techniques are for the investor who, other things being equal, prefers certainty to uncertainty.*[1]

In other words, if volatility were equal to uncertainty and synonymous with risk, portfolio A may be eliminated from consideration, since it yields the same return with greater uncertainty than does portfolio B.

How uncertain are equity returns?

To some degree, the dispersion of returns is a measure for how horribly wrong a forecast can be

Chart 28 below is based on 308 annual returns for UK stocks from 1694 to 2001. The graph illustrates that the returns can essentially be all over the place. 272 or 88.3% of the returns lie between an annual loss of –20% and a gain of 20%. 295 or 95.8% were within ±30%. Being bullish or bearish for the forthcoming 12-month stock market performance is important with respect to conversation at social occasions (as is fundamental knowledge on the weather or results from major sporting events). Being aware of the dispersion, however, is important with respect to controlling and managing risk in absolute return space.

[1] Markowitz (1959), p. 6.

Chart 28: Annual returns for UK stock market (1694-2001)

Return	Year																					Frequency	Percentage
130 - 140	1975																					1	0.3%
120 - 130																							
110 - 120																							
100 - 110																							
90 - 100	1824																					1	0.3%
80 - 90																							
70 - 80																							
60 - 70																							
50 - 60																							
40 - 50	1959																						
	1968																					4	1.3%
	1971																						
	1977																						
30 - 40	1817																						
	1954																					4	1.3%
	1958																						
	1989																						
20 - 30	1697	1933	1983																				
	1707	1941	1984																				
	1762	1967	1986																			15	4.9%
	1785	1980	1993																				
	1896	1982	1999																				
10 - 20	1698	1717	1771	1804	1850	1879	1936	1963	1995														
	1702	1720	1795	1809	1860	1889	1942	1972	1996														
	1709	1723	1798	1833	1862	1895	1944	1985	1997													44	14.3%
	1712	1727	1799	1843	1863	1918	1946	1991	1998														
	1716	1765	1801	1844	1871	1922	1953	1992															
0 - 10	1699	1713	1729	1738	1748	1757	1775	1787	1802	1814	1823	1836	1858	1869	1885	1894	1908	1923	1928	1943	1978		
	1700	1714	1730	1741	1749	1764	1779	1789	1805	1818	1827	1840	1861	1870	1886	1897	1909	1924	1932	1950	1979		
	1703	1718	1734	1742	1750	1766	1782	1791	1806	1820	1829	1842	1864	1872	1888	1898	1911	1925	1934	1951	1981	105	34.1%
	1706	1724	1735	1743	1751	1767	1784	1793	1807	1821	1832	1852	1865	1873	1891	1904	1916	1926	1935	1955	1987		
	1711	1725	1736	1746	1752	1774	1786	1800	1808	1822	1835	1856	1868	1880	1893	1905	1919	1927	1939	1965	1988		
-10 - 0	1695	1719	1737	1753	1760	1777	1790	1813	1838	1851	1859	1877	1887	1901	1912	1929	1956	1966					
	1704	1722	1739	1754	1763	1780	1792	1815	1841	1853	1867	1881	1890	1902	1913	1945	1957	1970					
	1708	1728	1740	1756	1768	1781	1794	1819	1845	1854	1874	1882	1892	1903	1914	1947	1960	1976				90	29.7%
	1710	1731	1744	1758	1773	1783	1810	1834	1846	1855	1875	1883	1899	1906	1915	1948	1961	1994					
	1715	1732	1747	1759	1776	1788	1812	1837	1849	1857	1876	1884	1900	1910	1921	1952	1962	2000					
-20 - 10	1701	1761	1796	1830	1878	1937	1969																
	1726	1769	1797	1831	1907	1938	1990																
	1733	1770	1811	1839	1917	1940	2001															33	10.9%
	1745	1772	1816	1847	1920	1949																	
	1755	1778	1828	1848	1930	1964																	
-30 - 20	1694	1826																					
	1696	1866																					
	1705	1931																				8	2.6%
	1803																						
	1825																						
-40 - 30	1721																					2	0.7%
	1973																						
-50 - 40																							
-60 - 50	1974																					1	0.3%

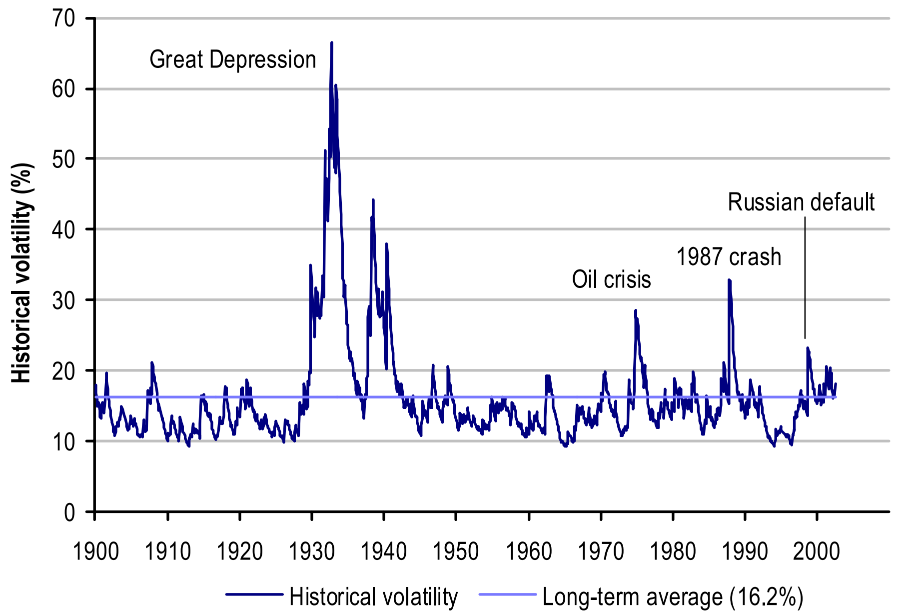
Source: Global Financial Data, UBS Warburg, illustration adopted from Markowitz (1959)

Measurement

Different approaches to measuring uncertainty

There are different ways of measuring volatility. The standard approach is to calculate the annual standard deviation of returns, that is, the volatility, over time. Chart 29 shows historical volatility for the US stock market from 1900 to July 2002.

Chart 29: Historical volatility of US stock market (1900 – 2002)



Source: UBS Warburg
Based on monthly returns until July 2002.

Unpredictable shocks to the system

Chart 29 shows that the major spikes in volatility are shocks to the system. A shock to the system, by definition, is not predictable; otherwise it would not be a shock. One therefore could argue that the major determinants influencing investors' wealth are unforecastable. Portfolio diversification is the answer to dealing with uncertainty. If we knew that equities outperformed bonds in the long-term we could accept the advice of Thaler and Williamson (1994), or Swank et al (2002) and invest 100% in equities, or Lamm's (1999) advice and invest 100% in hedge funds.

Social systems are complex, not deterministic

Until a couple of decades ago, scientists viewed the world as an orderly place governed by immutable laws of nature. Once uncovered, it was believed, these laws would enable scientists to determine the future by extrapolating from historical patterns and cycles. This approach worked well for Sir Isaac Newton. Once he discovered the mathematics of gravity, he was able to predict the motions of our planets. This line of thinking, called determinism, is based on the belief that future events unfold following rules and patterns that determine their course. Current science is proving this deterministic view of the world to be naïve. The theories of chaos and complexity are revealing the future as fundamentally unpredictable. This applies to our economy, the stock market, commodity prices, the weather, animal populations, and many other phenomena.

In social sciences, not only facts but also beliefs and perceptions matter

One of the main reasons for any social system (such as for example financial markets) being difficult to predict is that they involve thinking participants. Planets are held in orbit by laws of the natural sciences. And, equally important, the planets moving around a centre do not influence the laws which are holding them in orbit. In other words, social phenomena have thinking participants whereas natural phenomena do not. The participants' thinking creates problems that have no counterpart in the natural sciences. The closest analogy to the natural sciences is in quantum physics, where scientific observation gives rise to Heisenberg's uncertainty principle. Heisenberg's uncertainty principle establishes a limit to the ability to attain knowledge because the observation of the phenomenon interferes with the observed phenomenon. When events have thinking and adapting participants, the subject is not only confined to facts but also includes the participants' perceptions and beliefs. The chain of causation does not lead directly from fact to fact but from fact to perception and from perception to fact.[1] In other words, in the case of thinking participants, their own thoughts form part of the subject to which they relate, whereas in quantum physics it is only the act of observation which interferes with the subject.

Gizzard squeezers still lack consistency in forecasting the future

Behaviourists argue that we have a hard time discerning probabilities of events and cannot distinguish a long-shot prediction from something that is likely to occur by pure chance. Or as Warren Waver, author of the book *Lady Luck*, observed, 'The best way to lose your shirt is to think that you have discovered a pattern in a game of chance.'[2] Peter Lynch was quoted as saying, 'I don't believe in predicting markets,' and that market timers 'can't predict markets with any useful consistency, any more than the gizzard squeezers could tell the Roman emperors when the Huns would attack.'[3]

Wide sector dispersion is risk as well as opportunity

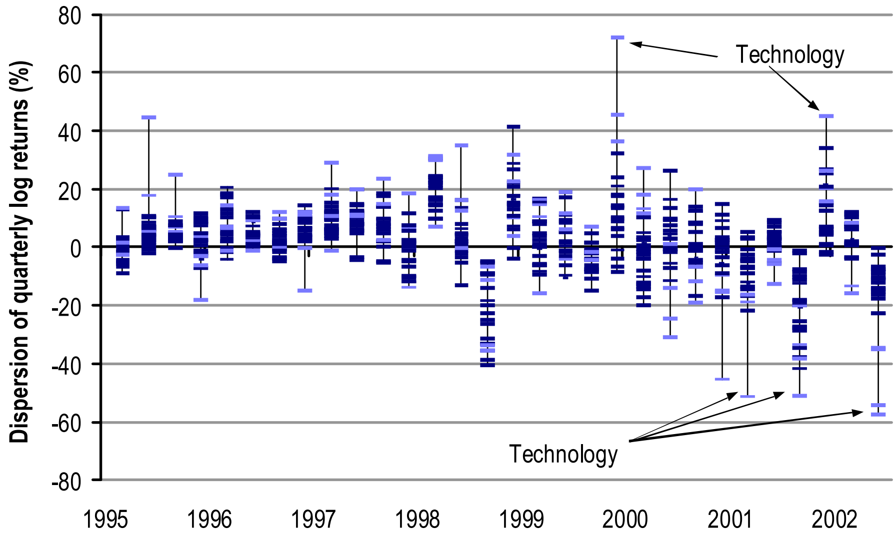
There are alternative ways of expressing volatility. One alternative which was the focus of attention in the late 1990s was the increase in the dispersion of sector returns. A widening of sector returns has implications both for relative as well as absolute return managers. A wide dispersion is a risk to the investor. However, to the active manager with an analytical edge it is an opportunity.

Chart 30 below shows the dispersion of quarterly sector log returns for the European MSCI stock universe from first quarter 1995 to second quarter 2002. Every horizontal tick measures a quarterly absolute log return. The four sectors in light blue measure the quarterly returns of the TMT related sectors (technology, media, telecommunications, and software).

---

[1] From Soros (1987), p. 12
[2] From Sherden (1998), p. 121
[3] ibid (1998), p. 106

Chart 30: Dispersion of sector returns



Source: Datastream, UBS Warburg
Based on quarterly log returns. Q1 95 until Q2 02.

Dispersion of sector returns has widened in the recent past

Due to the rise and fall of TMT, the dispersion of sector returns has widened. An alternative way of measuring the same effect would be by comparing a basket of value stocks versus growth stocks. Whether this increase in sector dispersion is cyclical or structural is yet uncertain.

Table 4: Average daily price changes

	DJ Industrial Average			Nikkei 225		
	Daily mean Return (%)	Volatility (%)	Average daily price change (%)	Daily mean Return (%)	Volatility (%)	Average daily price change (%)
1955-59	0.04	11.32	0.53	0.07	11.59	0.53
1960-64	0.02	10.84	0.49	0.03	15.87	0.75
1965-69	-0.01	**9.91**	**0.49**	0.05	14.04	0.66
1970-74	**-0.02**	16.00	0.74	0.04	18.77	0.80
1975-79	0.02	13.38	0.66	0.04	**10.07**	**0.46**
1980-84	0.03	15.25	0.74	0.05	10.87	0.49
1985-89	0.07	**21.04**	**0.76**	**0.10**	16.05	0.63
1990-94	0.03	12.53	0.58	**-0.06**	**25.09**	**1.13**
1995-99	**0.09**	15.68	0.72	0.00	23.21	1.08
2000-*	-0.03	20.52	0.98	-0.10	25.91	1.24

Source: Datastream, UBS Warburg
* until 20 June 2002.
Figures in bold measure high and low for the nine five-year periods from 1955 to 1999. The averages are based on trading days only.

Table 4 illustrates a further way of measuring volatility: average daily price changes. Volatility (annual standard deviation of returns) and average daily price changes are strongly correlated as they measure essentially the same thing. However, non-investment people unfamiliar with the terms volatility and variance, can associate average daily price changes with volatility in the market. Note that the average daily price change from January 2000 to June 2002 has been high by historical standards.

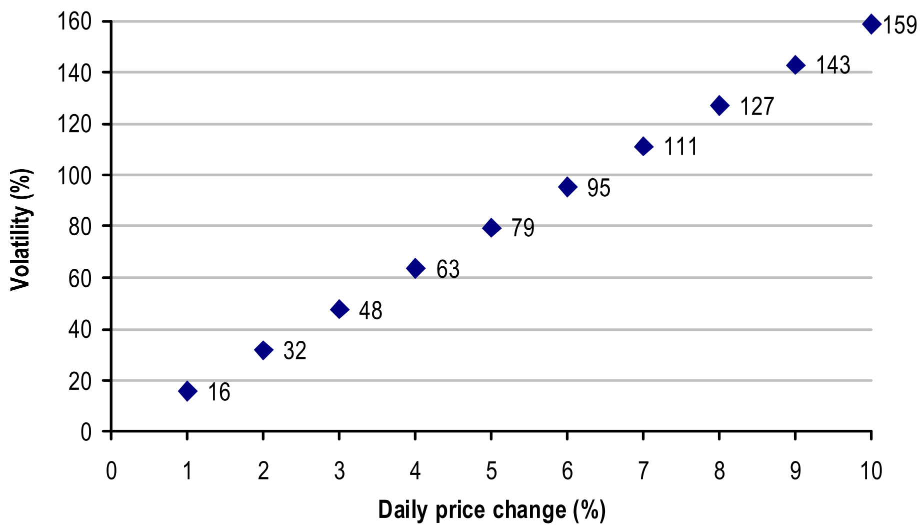
Average daily price change has risen

The average price change for the DJ Industrial Average and the Nikkei 225 for the 1955-1999 period was 0.63% and 0.73% respectively. In other words, the average price change in the US was only slightly above the norm in the second half of the 1990s whereas the 1990s were substantially above the norm in Japan. The average daily price change in the new millennium was substantially above average in both markets.

Rule of thumb to calculate volatility

When volatility is calculated based on daily returns, the standard deviation is normally annualised by multiplying the standard deviation of daily (log) returns by the square root of 252, as there are normally around 252 trading days in one calendar year. The square root of 252 is 15.9%. A rule of thumb to assess volatility during the day is multiplying the change of the index by 16. In other words, if the price change today is 2%, volatility is around 32% (two times the square root of 252 is 31.75). Put differently, a daily move of 6.3% implies a volatility of 100% (6.3 times 15.9 is 100). Chart 31 shows the linear function between volatility and daily returns.

Chart 31: Rule of thumb to calculate volatility on the day



Source: UBS Warburg
Figures are rounded

Glossary

Actual volatility	Same as realised volatility.
Excess kurtosis	For a normal distribution kurtosis is 3. Excess kurtosis, therefore, is kurtosis minus 3.
Future volatility	The volatility a financial instrument will experience in the future. Implied volatility is the market's view on future volatility.
Higher moment risk	Skewness and kurtosis are often used in econometrics to characterise forecast errors and nonnormality of the distributions of such errors. Skewness is referred to as the third moment of a distrbution while kurtosis is the fourth moment. The mean and standard deviation are the first and second moment of the distribution.
Historical implied volatility	Historical implied volatility is the past implied volatility.
Historical volatility	Same as realised volatility.
Implied volatility	Implied volatility is the volatility that is implied in option prices in the options market. It is the market's view on the future volatility of a financial instrument.
Kurtosis	Kurtosis measures the fourth moment of a return distribution. Kurtosis is an indication of 'fat tails', that is kurtosis measures whether the observed data fall near the center of a distribution or in the tails. Kurtosis characterises the relative peakedness or flatness of a distribution compared with the normal distribution. A kurtosis value less than that of a normal distribution indicates a distribution with a fat midrange on either side of the mean and a low peak. This is called a platykurtotic distribution. A kurtosis value greater than that of a normal distribution indicates a high peak, a thin midrange, and fat tails. This is called a leptokurtotic distribution and is very often observed in time series of price return data.
Realised volatility	The volatility a financial instrument experienced in the past. The realised volatility is normally measured by calculating the standard deviation of returns and multiplying with the square root of time. Realised volatility is also called historical volatility or actual volatility.
Skewness (or: skew)	Skewness measures the third moment of a return distribution. Skewness characterises the degree of asymmetry of a distribution around its mean. Positive skewness indicates a distribution with an asymmetric tail extending toward more positive values. Negative skewness indicates a distribution with an asymmetric tail extending toward more negative values.
Standard deviation	The standard deviation measures the second moment of a return distribution - the first moment being the mean return. The standard deviation is a statistical measure of how widely values are dispersed from the average value (the mean). Standard deviation and volatility (the annualised standard deviation) are the most often used proxies for risk. Statistically speaking, the standard deviation is the square root of the mean of the squared deviations of the members of a population from their mean, that is, the square root of the variance.
Variance	The mean of the squared deviations of each member of a population from the mean. The variance is the square of the standard deviation.
Volatility	Volatility is defined as the annualised standard deviation of returns. Often the terms volatility and variance are used interchangeably, albeit not entirely correct.

References

Arnott, Robert D., and Peter L. Bernstein (2002) 'What Risk Premium Is Normal?' *Financial Analyst Journal*, Vol. 58, No. 2 (March April), pp. 64-85.

Brinson, Gary P., L. Randolph Hood, and Gilbert L. Beebower (1986) 'Determinants of Portfolio Performance.' *Financial Analysts Journal*, Vol. 42, No. 4 (July/August), pp. 39–44.

Chandler, Beverly (1998) 'Investing with the Hedge Fund Giants – Profit Whether Markets Rise or Fall,' Financial Times Pitman Publishing: London.

Grinold, Richard C. (1989) 'The Fundamental Law of Active Management,' *Journal of Portfolio Management*, Vol. 15, No. 3 (Spring), pp. 30-37.

Grinold, Richard C., and Ronald N. Kahn (2000) 'Active Portfolio Management – A Quantitative Approach for Producing Superior Returns and Controlling Risk,' 2nd edition, McGraw-Hill: New York.

Ineichen, Alexander M. (2000) 'Systematic Stock Option Writing Does Not Work,' *Derivatives Quarterly*, Vol. 6, No. 3 (Spring), pp. 50-59.

Ineichen, Alexander M. (2002a) 'Investment philosophy of absolute return managers,' in Claire Evans ed. The Euromoney Derivatives & Risk Management Handbook, 2002/2003, pp. 1-10.

Ineichen, Alexander M. (2002b) 'Absolute Returns – Risk and Opportunities of Hedge Fund Investing,' forthcoming, John Wiley: New York.

Kahneman, Daniel, and Amos Tversky (1979) 'Prospect theory: An analysis of decision under risk,' *Econometrica*, Vol. 47, pp. 263-291.

Lamm, McFall R. (1999) 'Portfolios of Alternative Assets: Why Not 100% Hedge Funds?' *Journal of Investing* (Winter), pp. 87-97.

Lo, Andrew W. (2001) 'Risk Management For Hedge Funds: Introduction and Overview,' *Financial Analyst Journal*, Vol. 57, No. 6 (November/December), pp. 16-33.

Loomes, Graham C. and Robert Sugden (1982) 'Regret theory: An alternative theory of rational choice under uncertainty,' Economic Journal, Vol. 92, pp. 805-824.

Markowitz, Harry M. (1959) 'Portfolio Selection – Efficient Diversification of Investments,' Cowles Foundation, Monograph 16, Yale University Press: New Haven.

Rogers, Jim (2000) 'Investment Biker – around the world with Jim Rogers,' first published 1994 by Beeland Interest, Inc., John Wiley: Chichester.

Sherden, William A. (1998), 'The Fortune Sellers – The Big Business of Buying and Selling Predictions,' John Wiley, New York.

Soros, George (1987) 'The Alchemy of Finance – Reading the Mind of the Market,' John Wiley: New York.

Swank, Peter B., Michael A. Rosen, and James W. Goebel (2002) 'The Next Step: 100% Equity Allocation for Pension Plans,' *Journal of Investing*, Vol. 11, No. 1 (Spring), pp. 37-44.

Thaler, Richard H., and J. Peter Williamson (1994) 'College and University Endowment Funds: Why Not 100% Equities?' *Journal of Portfolio Management*, Vol. 21, No. 1 (Fall), pp. 27-37.

UBS Warburg (1999) '20th Century Volatility – A review of the stock and derivatives markets in the 20th Century,' Warburg Dillon Read Global Equity Research, December.

UBS Warburg (2000) 'In Search of Alpha – Investing in Hedge Funds,' UBS Warburg Global Equity Research, October.

UBS Warburg (2001) 'The Search for Alpha Continues – Do Fund of Hedge Fund Managers Add Value?,' UBS Warburg Global Equity Research, September.

UBS Warburg (2002a) 'Return expectations,' UBS Warburg Global Equity Research, 24 May.

UBS Warburg (2002b) 'Food for Thought,' UBS Warburg Global Equity Research, 24 May.

Yale Endowment (2001) Endowment Update, Fiscal Year 2001.

This report was produced by:
UBS Warburg

+44-20-7567 8000

Head office:
1 Finsbury Avenue
London
EC2M 2PP
UK

UBS Warburg, 1 Finsbury Avenue, London, EC2M 2PP, UK Phone: +44-20-7567 8000