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FIRST QUADRANT

Using Options in a TAA Process

FQ Perspective

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TAA Review

To date we have written numerous monographs and papers exploring the attributes of a quantitative tactical asset allocation process. Throughout these publications, we have identified a disciplined approach to asset allocation, which rests on four basic assumptions:

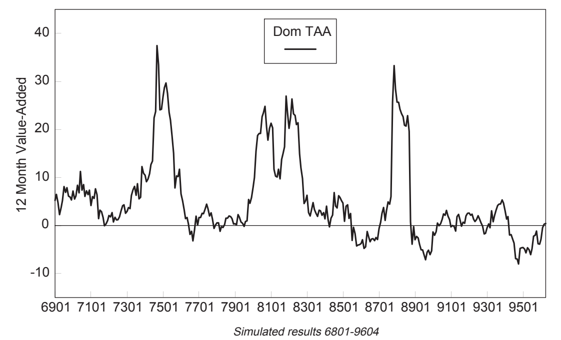
- Long-term returns for various asset classes are directly observable in the markets.
- These returns reflect the consensus view of all market participants on the relative attractiveness of asset classes.
- These returns tend to exhibit a normal or "equilibrium" level, relative to one another.
- As future returns stray from this normal equilibrium, when measured against investment alternatives, eventually capital flows into the out-of-favor market, and thereby market forces pull the markets back into line.

These four assumptions provide the foundation for our quantitative modeling of world financial markets in our tactical asset allocation process, and allow us to respond opportunistically to the changing patterns of reward in the markets. It does so by shifting the asset mix toward the market priced to offer superior near-term rewards. Tactical asset allocation strategies sell after a market rally and buy after a decline. Therefore, it is inherently contrarian and affords one the confidence to invest more aggressively in an out of favor asset class. In short, tactical asset allocation:

- Objectively measures prospective returns.
- Has a disciplined framework to provide confidence to invest in out-of-favor, hence contrarian assets.
- Takes advantage of the liquidity and opportunity provided by investors favoring the comfortable asset class.

We have long made a point of bringing to light the episodic nature of value added associated with tactical asset allocation. Exhibit 1 will show that TAA's value added tends to arrive in episodic bursts. Why should this occur? Should we expect TAA to add value evenly and consistently as we expect the best equity managers to do, for example?

Exhibit 1
U.S. TAA Value-Added 70/30 Benchmark
Rolling 12 Month Value-Added



To understand why such episodic results are derived from TAA, it may be useful to think more precisely about what TAA attempts to do. Principally, tactical asset allocation aims to tilt the asset mix towards those asset classes which are likely to provide unusually favorable near-term returns and away from those which are likely to significantly underperform in the near-term. We know that stocks, on average, have tended to outperform bonds by a few hundred basis points per annum (e.g., 330 basis points per annum in the US over the last 33 years). This fact, however, has already been taken into account in the formation of the long-term policy mix, so the aim of TAA is not to tilt the policy mix towards stocks to merely take advantage of the long-term superior performance of stocks over bonds. In fact, a TAA strategy tends to leave the average asset mix unchanged relative to the long-term policy mix over the course of a typical market cycle.

So, if it is not the average differential return between asset classes which rewards TAA, then what does? It is the impressive variance in these relative returns which motivates the tactical asset mix shifts. Stock and bond prices move together more than they diverge, but when they diverge, the relative performance has often been dramatic. In 1980, for instance, US equities outperformed US bonds by 36%, while we witnessed bonds outperforming stocks in 1974 by 32%! Such return differentials dwarf the 3-4% long-term average differential, and it is exactly these episodes of divergence where TAA plays its most significant role in the overall fund program.

Importantly, these episodes of significant divergence between stock and bond returns have historically been the result of either relative valuations which differed noticeably from historical norms (e.g., stock yields very low relative to bond yields), or measurable market forces which worked to push fairly valued assets away from fair value (e.g., sharp changes in short-term rates). TAA models, therefore, seek to determine when relative value deviates from its norm, while simultaneously taking into account the market forces which will either drive fairly valued assets away from fair value, or over/undervalued assets back towards fair value. Ultimately this translates into a recommended mix which favors the more promising asset classes.

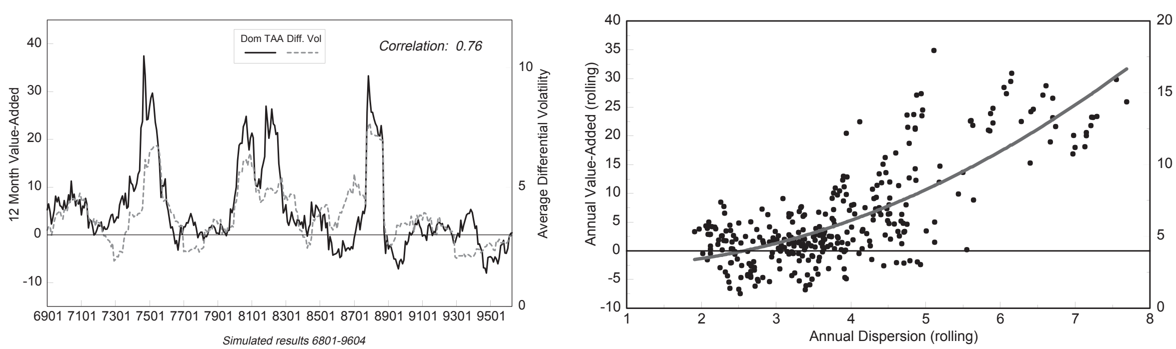
To state the obvious, TAA can only provide large profits when three conditions are met:

- There must be substantial divergence among asset class returns. *One cannot add value from asset allocation when asset classes offer similar returns.*
- The TAA discipline must suggest (in advance of this divergence) that markets are sufficiently mispriced relative to one another to merit a large “bet”, favoring one market over another.
- The TAA discipline must, of course, be correct!

So, what should we expect when the returns to stocks and bonds are similar? Virtually by definition, no meaningful value will be added through tactical shifts in a market where little or no differential return exists between asset classes.

Thus, when assets are fairly valued and no significant market forces promise to disturb this equilibrium, then tactical shifts will yield neither significant gains nor losses. Exhibit 2 shows that this has been, in fact, the experience of our own tactical programs. During periods of undifferentiated asset returns (as indicated on the right axis where the monthly average absolute differential is measured), tactical asset allocation has, on average, yielded a smaller alpha. It has been the periods characterized by large differential returns where TAA has captured the greatest added value. Such a period has not existed ***in the US market*** since the late

Exhibit 2
TAA Value-Added vs. Asset Return Differentials



Simulated Results 1/68-3/96

1980's. But, outside of the US, such opportunities have arisen and have been rewarded.

So what can an investment manager do? The episodic nature of TAA is typified by short bursts of value added, followed by longer periods of flat performance. Is there anything that can be done in order to improve the prospects of adding value during these flat periods? We think so.

Enhancing a Base Investment Strategy

When designing a methodology which has the intent of enhancing a base investment program, there are two key objectives to keep in mind:

1. The enhancement program must provide value-added when the base strategy does not, so as to produce a more stable composite value-added.

2. The enhancement program must not restrict the base strategy's ability to profit.

For a TAA based investment strategy, the objective would be to design a program which would consistently add value during the calm market periods, while not detracting from TAA's ability to add value during the turbulent market environments. This means that the enhancement program must not lose much during the market turbulence that typically leads to TAA profits.

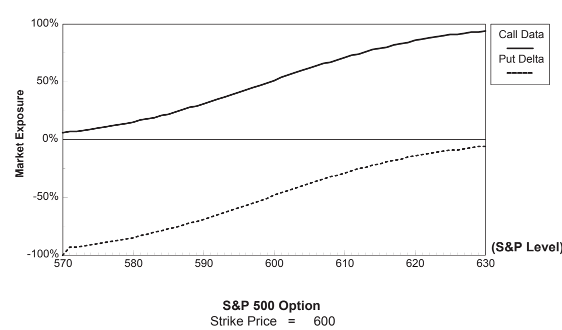
By using the natural properties of option contracts, we are able to structure various option positions in a portfolio whose characteristics should achieve these desired objectives. By layering put and call option positions, both long and short, we create a market neutral portfolio which is designed to profit during the trendless periods of the market cycle, which are typically difficult market environments for TAA.

Option Characteristics - A Short Tutorial

A basic understanding of option characteristics and price sensitivities is required in order to understand the structure of an option portfolio constructed with the objective of profiting during specific market conditions. A description of these characteristics and sensitivities are commonly referred to by the Greek terms: "Delta", "Gamma", "Theta", "Kappa", and "Rho". Each of these terms will explain how an options value will change based on changes in the underlying market conditions such as: price, volatility, time to expiration (of the specific option) and interest rates. Listed below is an introduction to each term and its affect on the options value.

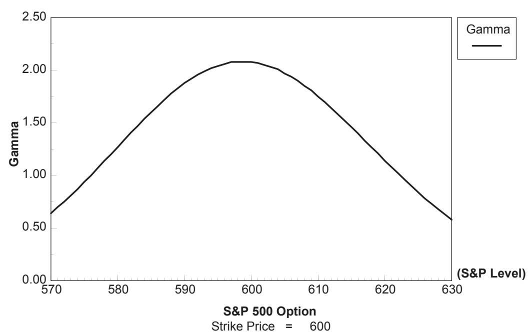
Delta - The delta of an option reflects the expected change in the price of an option given a change in price of the underlying asset. As delta increases, the price sensitivity of the option will increase. Because of this price relationship, delta can also be viewed as an options market exposure. Exhibit 3 illustrates this relationship for call and put options. Delta ranges from 0 to 100, with a call option delta representing long market exposure and put options delta representing short market exposure. In general, an at the money option has a market exposure of 50%. The delta of an option which is out-of-the-money will also be lower than that of an option which is in-the-money and reflects the lessened influence changes in the underlying market price will have on the price of an out-of-the-money option.

Exhibit 3
Delta vs. Price



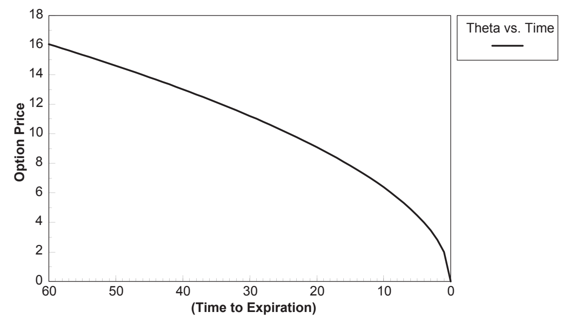
Gamma - Gamma is the term used to explain the anticipated change in delta, for a given change in the underlying market price. Defined as the "rate of change", as gamma increases, the delta of the option becomes more sensitive to underlying price movements. The "bell" shape of gamma (Exhibit 4) explains why an options delta is more sensitive when the option is "at-the-money". Options which have very low or very high deltas are not as sensitive to incremental underlying price changes, whereas an option with a delta of 50 will be more susceptible to changes in the underlying price movement.

Exhibit 4
Gamma vs. Price



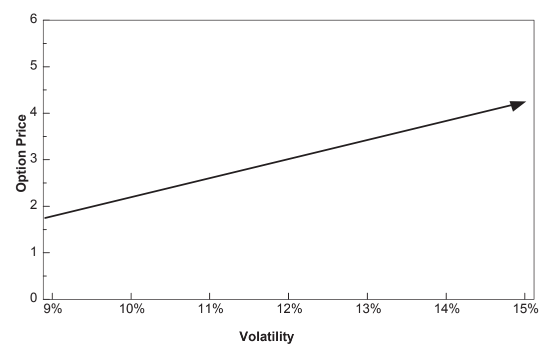
Theta - Options are known as "wasting assets", this is due to the high degree of "time premium" which is included in the pricing of an option: once an option expires, it is worth either its "intrinsic value" (market level less striking price) or nothing, ***and that value can no longer change***. The decay of value over the life of the option due solely to the passage of time, is known as theta. The rate of time premium decay for an option is not constant, with the decay rate accelerating as the option approaches expiration. When comparing theta to the options delta, the result is also "bell shaped". The time decay of a 50 delta option is higher than the time decay of a 10 delta or a 90 delta option. With a 10 delta option, there is less option premium to decay vs. a 50 delta option. The premium on a 90 delta option is composed primarily of intrinsic value due to the in-the-money status of the option. Consequently, there is less "time premium" to decay vs. the 50 delta option.

Exhibit 5
Theta of an Option



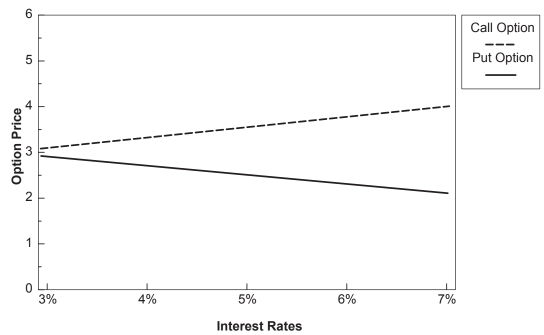
Kappa - The kappa of an option reflects the sensitivity of an options price given a change in the volatility of the underlying asset. As volatility increases, the price of an option will increase. Volatility will have more affect on an option with a longer term to expiration than options with a short term to expiration, due to the increasing effect of theta on options as they approach expiration.

Exhibit 6
Kappa of an Option



Rho - The rho of an option is the rate of change in the price of the option with respect to changes in interest rates. Changes in interest rates will influence put and call options differently due to the effect interest rates have in the pricing of derivative securities. As interest rates increase, the cost of carry element in the pricing of derivative securities increases, thus the increase in the value of call options and the decrease in value of put options.

Exhibit 7
Rho of an Option



Each of these characteristics can be summed across a portfolio of options, in order to calculate the "net option characteristic" for the entire portfolio. By taking the weighted sum for each option in the portfolio, the investment manager is able to calculate the net delta, gamma, theta, kappa, and rho exposures for the entire portfolio. By actively monitoring these portfolio exposures, the manager is then able to construct option positions to reach a desired objective. Further, these exposures are used to identify and manage the risks of the portfolio, given changes in the underlying market conditions.

What Is Market Neutral?

We define the portfolio characteristic which results from our combined option positions as "market neutral". This is because the market exposures of each option position in the portfolio will offset the other to the degree that the net market exposure of the total portfolio is near zero. Since the profitability of this program is reduced when markets are turbulent, it is then important to have an established definition of "market neutral" in order to meet our objectives:

- Consistent profits during calm market periods cannot be achieved in a directionally based option portfolio.
- A directionally based option portfolio is more susceptible to adverse market moves than a market neutral option structure.

The following Exhibits (8 and 9) are designed to help illustrate the concept of market neutral within this option based program. In the table below each option position in the portfolio is listed along with the corresponding delta and market exposure. In this example, the delta exposure of the short call and put options offset each other, as do the delta exposure of the long option positions. By adding the delta exposures of each option position together we can compute the net market exposure of the portfolio as 0%, or market neutral. This would represent a "perfect world" scenario - the strike prices of the put and call options sold are equidistant from the actual market level of 600.

Exhibit 8
What is Market Neutral?

The Option Portfolio (perfect world)

	Delta	Market Exposure
Long 625 Call Option (+)	20	+20%
Short 620 Call Option (-)	25	-25%
Short 580 Put Option (-)	25	+25%
Long 575 Put Option (+)	20	-20%
Net Market Exposure =		*0%*
S&P 500 Level =		*600*

- This portfolio has 0% market exposure, or is "Market Neutral."

Exhibit 9
The Option Portfolio

The Option Portfolio (more typical situation)

	Delta	Market Exposure
Long 625 Call Option (+)	26	+26%
Short 620 Call Option (-)	33	-33%
Short 580 Put Option (-)	18	+18%
Long 575 Put Option (+)	15	-15%
Net Market Exposure =		*-5%*
S&P 500 Level =		*610*

- This portfolio has -5% market exposure, acceptably close to "Market Neutral."

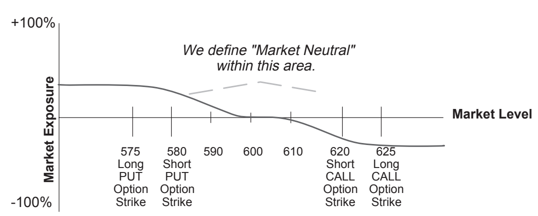
This next table is designed to show the changes in market exposure as the underlying market moves, in this case from 600 to 610. Note how the delta (and market exposure) of the call options increases as the market level increases. The delta of the put options also changes, decreasing as the market level increases. The net market exposure of the portfolio changes with negative market exposure entering the portfolio as the underlying market increases. This change in net market exposure is due to the different gamma relationships of the options in the portfolio. Consequently, as the underlying market levels increase, negative market exposures will appear in the portfolio. As the underlying market decreases, positive market exposure will enter the portfolio.

So what is market neutral? Exhibit 10 is designed to show how the market exposure of the option portfolio will change given changes in the underlying market levels. Note how market exposures remain relatively flat as the underlying market oscillates between the strike prices sold. As the underlying market approaches these strike prices, market exposure begins to accelerate. This increase in exposure levels is a direct result of the changing gamma relationships of the options in the portfolio. Market exposure in this program equals risk, and increasing exposure levels counter to directional moves of the underlying can result in periods of underperformance. At some stage, of course, one must readjust option positions to re-establish the market neutral band when these threshold levels are exceeded.

Exhibit 10
Monthly Returns within +/- 5%

Market Exposure of Option Strategy

Long 575 Put Option (+) Long Call 625 Option (+)
Short 580 Put Option (-) Short Call 620 Option (-)

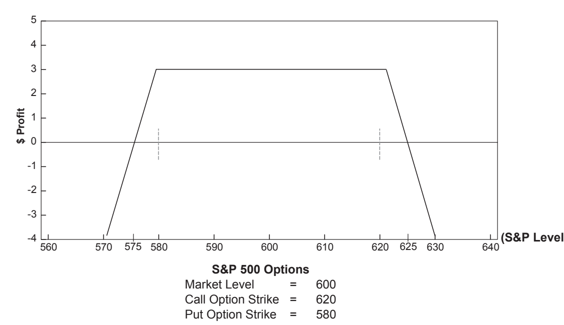


Options and Tactical Asset Allocation

In designing an option based strategy which would complement a TAA program, we focused on improving the typically flat performance periods for TAA. This leads to an approach which would tend to profit during the periods in the market which are characterized by low volatility, or by oscillating, non-trending price movements. Not surprisingly, we would not seek a program that would appreciably undermine the ability of the base TAA program to add value during the turbulent or divergent periods in the market.

By selling short dated (30 - 45 days to expiration) put and call options which are set with strike prices equal distant from the underlying market levels, we can create a portfolio which begins to offer the desired characteristic of adding value during calm market periods. As a whole, the two options will provide a delta neutral structure (market exposure of the put offsets the market exposure of the call), and would profit from the rapid time decay ("theta") associated with short dated options.

Exhibit 11
Profit Profile: Sell Put and Call Options



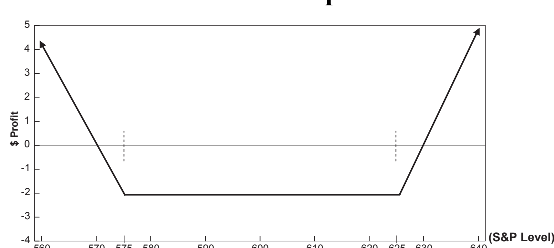
The risk with this portfolio is centered on the unlimited potential for loss from short option positions. Defined as "gamma risk", the risk from short option positions becomes evident in this structure as the underlying market price approaches one of the short option strike levels. As this occurs, the market exposure of the option approaching in-the-money status increases, while the market exposure of the other option decreases. The result is an increasing market exposure which is counter to the movement in the underlying market. Left unprotected, this position can generate losses which are limited only by the movement of the market.

As the above profit profile suggests, this option portfolio will profit when the underlying market trades within the range defined by the strike price of the put and call options. These profits are a result of the decay in option premiums received from the sale of the put and call options. As the market extends beyond the strike prices, losses can be incurred as the cost in closing out the short option positions can exceed the premiums received. This particular approach would satisfy the first objective, namely the ability to add value during the calm market periods, but would fail at the second objective, the desire to not appreciably affect the TAA performance.

To offset this risk, we can modify the base option portfolio by adding the purchase of long-dated (45 - 90 days to expiration) put and call options. The profit profile (Exhibit 12) that results from the purchase of the call and put option is opposite of the base option structure. Losses from this long option position will be incurred as the underlying market levels stay within the strike prices of the options bought, due to the decay of option premiums. As the market levels extend beyond these strike prices, this position can realize gains as the net premiums of the option positions exceed the cost of the options.

Exhibit 12

Profit Profile: Buy "Out of the Money" Put and Call Options

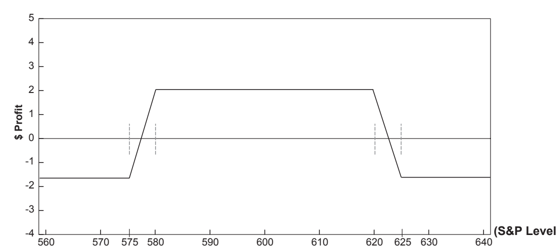


S&P 500 Options
Market Level = 600
Call Option Strike = 625
Put Option Strike = 575

By combining the two positions - the short option positions with the long option positions - we create a portfolio which is better suited to reaching our stated objectives. The profile of the combined portfolio (Exhibit 13) will reflect an ability to profit from the short option position as these premiums will decay at a faster rate than the long option positions, in addition there is an improved ability to manage any loss potential by "capping" the downside risk associated with the short option positions.

Exhibit 13

Profit Profile: Total Portfolio

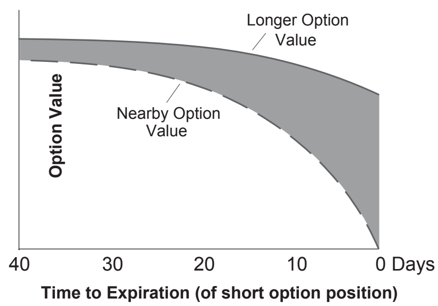


S&P 500 Options
Market Level = 600
Buy Call Option = 625 Strike
Sell Call Option = 620 Strike
Sell Put Option = 580 Strike
Buy Put Option = 575 Strike

This graph represents the typical profile of the option strategy over a wide range of market prices.

The layering of long option positions with short option positions extends the market neutral characteristics of the option portfolio. The market exposure (delta) of the short put and call option positions are offset by the market exposures of the long put and call option positions. The portfolio maintains this market neutral outlook over a wide range of underlying price movements, because the layering of option positions will also neutralize the effects of each options gamma exposure. The portfolios ability to profit within this defined range of price movement is due to the "net short theta" position of the portfolio - the short dated options will decay faster than the longer dated options (see Exhibit 14). Losses can be incurred in the portfolio as the underlying market price approaches or exceeds the short option strike price. This is due to the growing market exposure of the portfolio as net gamma exposure starts to increase.

Exhibit 14
Decay Rate Difference Short vs. Long Options



- The graph represents an option's time value to expiration. The strategy is designed to profit from the difference in time decay between the long dated and the short dated option positions.

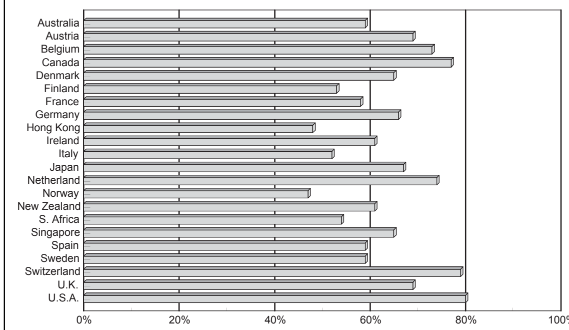
Option Markets

This sort of program need not be limited to the US. It can be designed to use options on all global fixed income and equity markets covered by our TAA process. This does not mean however, that all markets are used in the program. A market selection process is incorporated in order to identify those option markets which will offer the most consistent profit opportunity. All option markets are analyzed for the following characteristics:

- Moderate levels of volatility.
- Liquid option markets.
- Implied volatility consistently above historic volatility.

An analysis of monthly global equity returns covering all countries in our GTAA program shows that the majority of these returns fall within a fairly narrow band. Exhibit 15 shows the percentage of time each global equity market fell within a band of + or- 5% on the month. The U.S. equity market has proven to be the most subdued, with roughly 80% of the months falling between these return levels. Norway and Hong Kong have proven to be the more volatile markets, with returns exceeding a 5% band over 50% of the time.

Exhibit 15
Monthly Returns within ± 5%



Identifying markets which trade in manageable ranges is one aspect in the market selection process. By selecting those markets which carry a higher probability of being contained within a narrow price range, we are able to greatly improve the consistency of the program. Typically, these markets will be characterized with moderate volatility levels (Exhibit 16). Trading markets which exhibit moderate levels of volatility is important in managing this market neutral strategy because of the risk control mechanisms of the program. Financial markets which exhibit very low volatility do not offer much opportunity because of the resulting low option premium levels; conversely markets with excessive volatility are difficult to manage in a market neutral environment due to the constant need to readjust positions. Transaction costs alone will

Exhibit 16
Equity Markets with Moderate Levels of Volatility

	Mean	**Standard Deviation**	**Volatility Range**
U.S.	11.67%	1.97%	7.93% - 17.92%
Japan	22.87%	7.20%	11.69% - 45.74%
U.K.	16.04%	3.52%	10.47% - 30.37%
France	21.82%	4.33%	15.68% - 41.62%
Germany	17.35%	3.24%	10.79% - 30.98%

Average implied volatility levels of ATM options - 1/91 to 12/94 eat away any profit associated with the normally high option premium levels. Markets which exhibit a moderate level of volatility, generally between 10.0% - 25.0% on an annual basis, offer a desirable balance between premium levels and the ability to maintain a market neutral option portfolio.

We also analyze global option markets for their "depth" and liquidity. It is important to identify specific option markets which exhibit a consistent level of liquidity in a variety of market conditions. Exhibit 17 shows how liquidity has entered the markets as option volume has increased. The consistency of a markets liquidity is best judged by the bid/ask spread and the "normal" market size. The most desirable markets will exhibit bid/ask spreads which are consistently narrow, along with sufficient market size to absorb institutional sized trades without creating market impact. The liquidity of a market is analyzed over a variety of market conditions in order to gauge consistency between calm and turbulent market conditions.

An options price is a function of the underlying security price, time to expiration, exercise price of the option, risk-free interest rate and the underlying security's price volatility. All factors in the pricing of an option are observable except the price volatility of the security. Using the Black-Scholes option pricing model, if the price of an option is known, then price volatility can be "implied" based on the other model inputs. The implied volatility of the option is the markets "best-guess" at what the actual price volatility of the security will be over the length of the option. Historic volatility is the actual volatility of the security, usually quoted in annual terms. The difference between the two, implied minus historic volatility, represents the "premium" an option seller will receive over the historic risk of owning the security. The spread between the implied and historic volatility will fluctuate based on changing supply and demand conditions in the market.

Linking Options Into TAA

By identifying option markets which are characterized by a consistent level of premium between implied and historic volatility, we are able to improve our opportunity to profit. Typically, the world equity markets will trade with a healthy premium of implied over historic volatility. As Exhibit 18 reflects, this spread can fluctuate between markets, with a spread of 2.00% or higher being desirable. Over time, this premium works to the advantage of the program as volatility that is sold (implied) is consistently higher, ***across all of these markets*** than actual volatility experienced (historic).

Exhibit 17
Listed Options Volume
Average Daily Number of Contracts

		1994 M.V. ($ Billion)	**1994**	**1993**	**% Change**
U.S.	S&P 500	$35.5	309.0	170.0	81.7%
	S&P 100	14.2	825.0	640.0	28.9%
Japan	Nikkei 225	2.6	28.5	34.5	-17.4%
U.K.	FT-SE 100	1.1	23.5	17.0	38.2%
France	CAC-40	2.2	30.0	20.5	46.3%
Germany	DAX	1.7	117.0	107.0	9.3%

Number of contracts (000's)

Exhibit 18
Implied vs. Subsequent Volatility

	Implied	Subsequent	Spread
U.S.	11.67%	9.13%	2.54%
Japan	22.87%	18.79%	4.08%
U.K.	16.04%	12.16%	3.88%
France	21.82%	17.23%	4.59%
Germany	17.35%	15.01%	2.35%

1/91 to 12/94

The ability to systematically profit from this spread relationship is the determining factor in the programs long term success. During the periods when actual market volatility exceeds the implied levels of volatility sold, the program will underperform. Typically, these are the periods when markets are most volatile, with excessive directional moves occurring. These are the periods that TAA was designed to identify and add value to the underlying portfolio.

Market periods which are characterized by relatively subdued market returns are typically the periods when implied volatility is greater than historical. It is difficult to add value in a TAA program during these "calm" periods of market activity - and explain why the process tends to be episodic in nature.

If price implied volatility and subsequent actual volatility converge, then this kind of options strategy should no longer exhibit the kinds of profits we have seen historically (both in simulation and on live assets). In other words, the principal source of profits comes from "selling volatility" and "selling theta." If this long-standing tendency in options markets to overestimate volatility stops (which we think unlikely), and options suddenly became fairly priced, the profits for this program would vanish. ***But, the greatest attraction is that this kind of program adds value when TAA does not; that crucial advantage remains unaltered***.

Tactical Option Program - An Analysis

First Quadrant uses two methods to simulate these option strategies historically. The first is a daily simulation of option prices based on market conditions over the past 10 years. The second method is a Monte Carlo simulation based on the market characteristics of our database.

Daily Simulation

Using the Black-Scholes option pricing model, we have constructed an extensive simulation model which generates a daily recommended option portfolio and theoretic prices. With this model, we are able to construct a simulation to illustrate the impact historic market conditions would have had on the program. By using the option program that we have described, along with estimates for transaction costs and slippage, we can calculate the return characteristics of the program under various market conditions.

The simulation was generated using a constant allocation between the U.S. fixed income and equity markets, U.K., German, French and Japanese equity markets. An allocation of 30% U.S. fixed income, 30% U.S. equity, 10% U.K. equity, 10% German equity, 10% French equity, and 10% Japanese equity.

The results of this simulation are incorporated with our reported GTAA performance figures in order to provide an approximation of how the two programs may have performed together. The results of this simulation are shown in Exhibit 19.

A review of the results will highlight the benefits of adding the option program to a base GTAA strategy. Note the annualized returns and standard deviation of the benchmark returns, GTAA program, option program and combined results. Analysis of these figures will show how the option program can complement a TAA program by increasing the overall alpha of the base program while reducing the standard deviation of those returns.

Exhibit 19
A TAA and Option Based Approach

	Global Benchmark Return	Global TAA-Live Value Added	Tactical Option Program Value Added	Combined TAA/Option Value Added
1989	2.42%	1.78%	1.37%	3.18%
1990	-4.73%	12.99%	0.22%	13.25%
1991	19.24%	3.30%	0.72%	4.04%
1992	5.70%	-6.55%	2.36%	-4.33%
1993	12.52%	1.71%	0.54%	2.27%
1994	-1.22%	1.73%	1.27%	3.02%
1995	17.22%	0.53%	0.12%	0.65%
Annual	6.97%	2.08%	0.94%	3.04%
Standard Deviation	9.69%	4.55%	0.66%	4.39%

Benchmark: 50% EAFE
50% Solomon
World Bond

A closer look at the two programs is illustrated on the next page. Exhibit 20 represents the plotting of monthly TAA alpha over the past 7 years. Note the upward slope of the regression line which suggests that as the benchmark returns become more turbulent, TAA tends to add more value. Exhibit 21 is a plot of a tactical option program. In this instance the regression line is downward sloping, indicating that as the benchmark returns become more turbulent, the option program will tend to lose value. Exhibit 22 shows simulated returns for of the combined programs. Note how the slope of the regression line is flatter, along with a slightly higher intercept. This is a result of the non-correlation in alpha generation between the two programs and translates into a higher and more consistent stream of returns over the base TAA program.

It is also worth noting the effect that the October, 1987 U.S. stock market crash would have had on a combined program. Using a U.S. based portfolio, with a benchmark objective of 50% stock / 50% bond, we can simulate the effect October would have had on a TAA program. With a recommended shift of assets into bonds and cash, our simulations project a value added of 1240 bps for the month. As expected during a turbulent market period, the Tactical Option Program would have underperformed by 230 bps. The combination of the two programs would have still resulted in a solid gain of 1010 bps. An 8 standard deviation event, the October, 1987 period, highlights the importance that this kind of risk-controlled option program does not undermine TAA's ability to add value during the most turbulent periods in the market cycle. When compared with the increased ability to add value to the base program, the 18% drop in alpha which would have resulted by overlaying the tactical option program in October, 1987 to the TAA program is more than offset by the programs consistent ability to add value during the majority of market environments in a typical market cycle.

Exhibit 20
TAA vs. Benchmark

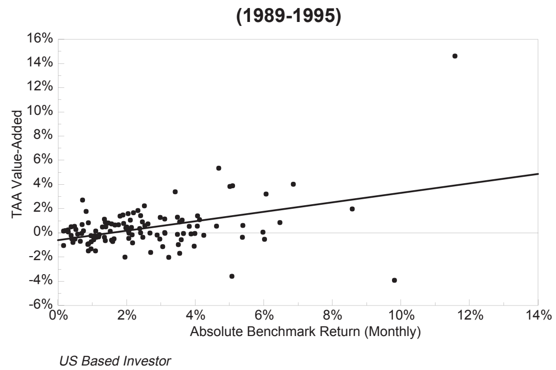


Exhibit 21
Options vs. Benchmark

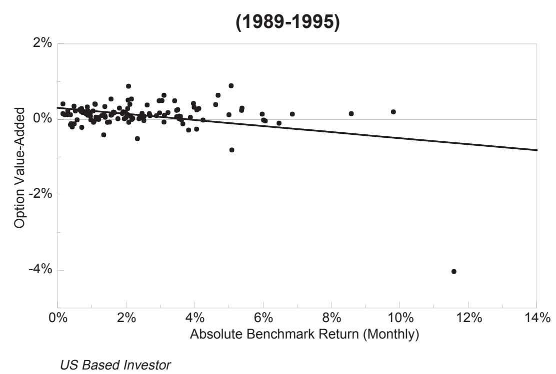
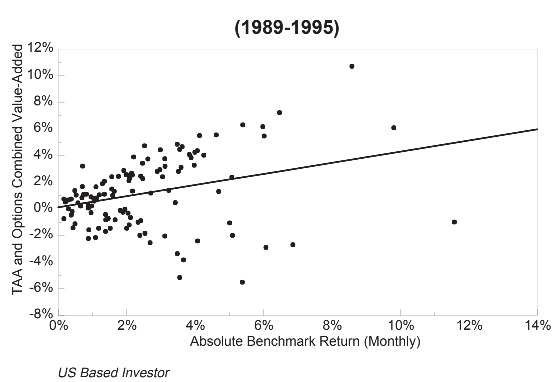


Exhibit 22
TAA, with Options, vs. Benchmark



Monte Carlo Simulation

Monte Carlo simulations are used in order to help identify the probabilistic characteristics of a specific investment strategy. By constructing a model incorporating the attributes of our database, we are able to simulate the characteristics of the Tactical Option Program over a large set of market conditions. To test the program, a simulation covering 5,000 monthly periods was generated based on our database characteristics of monthly return, implied volatility and interest rate data.

Individual simulations were run for each market in the program and based on an allocation of: 30% U.S. fixed income, 30% U.S. equity, 10% U.K. equity, 10% German equity, 10% French equity, and 10% Japanese equity. A portfolio simulation was calculated by combining the individual market results of each period tested to generate a total program return for that period. The results of these simulations are listed in Exhibit 23.

Exhibit 24 displays the monthly simulated profit/loss results on the total option portfolio. The simulated mean return for the portfolio is estimated at 18 bps per month or 216 bps per annum., with 80% of the distribution falling between -35 bps and +66 bps per month. It is calculated that 68% of the months would be profitable. This is not unlike the live-asset experience.

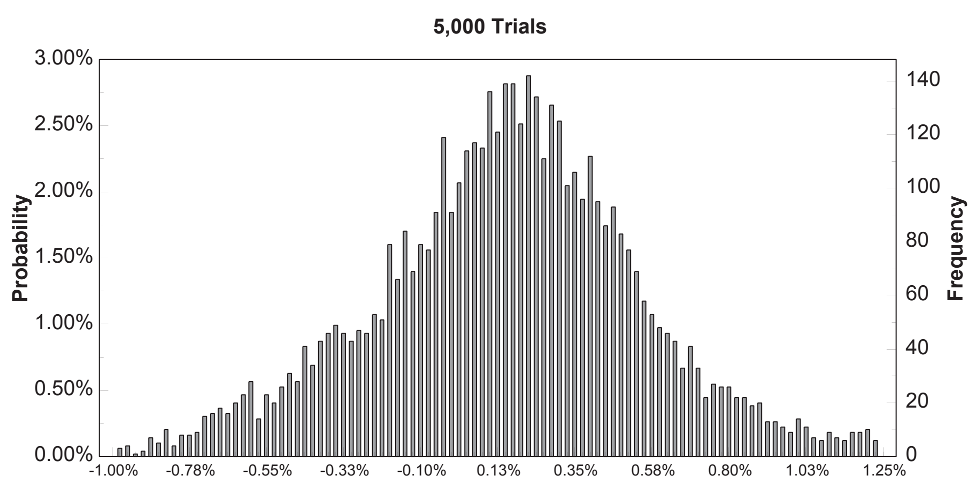
A closer look a the simulation shows that the largest variable to influence the return stream of the program is underlying market return, with roughly 2/3 of the program returns being attributed to the market returns of the underlying market. Fluctuations in volatility also affect the program, with roughly 1/3 of the programs returns being attributed to changes in underlying markets implied volatilities.

Exhibit 23
Monte Carlo Results

	Total Portfolio	U.S. Equity	U.S. Fixed Income	Japan Equity	U.K. Equity	Germany Equity	France Equity
Mean Return	0.17%	0.23%	0.20%	0.35%	0.24%	-0.11%	0.01%
Median	0.18%	0.22%	0.16%	0.23%	0.26%	0.15%	0.08%
Mode	0.17%	0.17%	0.08%	0.35%	0.31%	0.05%	-0.06%
Std. Deviation	0.41%	1.16%	0.18%	1.49%	0.58%	0.99%	0.85%
Variance	0.00%	0.01%	0.00%	0.02%	0.00%	0.01%	0.01%
Skewness	0.29	0.50	-0.21	0.69	-0.96	-1.67	-1.91
Kurtosis	4.56	6.01	6.52	5.08	6.08	5.75	9.05
Coeff. of Variab.	2.36	5.14	0.94	4.26	2.44	-8.77	145.47
Range Min.	-1.18%	-3.43%	-1.34%	-4.98%	-2.57%	-4.67%	-4.77%
Range Max.	3.24%	10.15%	0.96%	8.85%	2.35%	2.54%	3.28%
Mean Std. Error	0.01%	0.02%	0.00%	0.02%	0.01%	0.01%	0.01%

based on 5,000 trials

Exhibit 24
Portfolio Return
Frequency Chart



SUMMARY

The combination of an option based process, which seeks profits by "selling" volatility and theta (thereby, betting on quiet markets), with a base tactical asset allocation program enables a portfolio manager to enhance returns while reducing the risk of a given portfolio. Because the investment objectives of these two programs differ, they tend to complement each other very well:

- TAA most typically adds value during the volatile periods of the market cycle, when assets diverge from their historic norms.
- A tactical options program will add value during the trendless periods of the market cycle.
- The two programs are highly complementary and give us a mechanism to add value during the inevitable quiet, hence unprofitable, spans for TAA.

Additional benefits that result by combining the two programs include the ease and flexibility of implementation. By using only those options markets which are used in the TAA process, we limit our position to markets already familiar to the portfolio. Net exposures and risk is managed as a whole. The market selection process is flexible to allow allocations based on fund investment objectives, risk parameters or benchmark settings.

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