Volatility signals for asset allocation

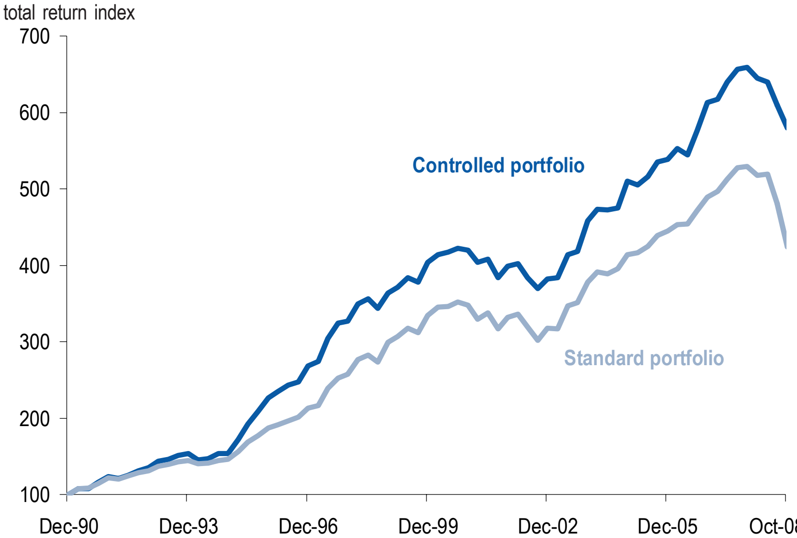
- **Deleveraging in periods of high volatility, and releveraging in periods of low volatility, i.e., risk-budgeting, generates higher risk-adjusted returns with lower tail risk for equities, commodities, and bonds.**
- **Since 1990, risk-budgeting strategies on the S&P 500 and JPMCCI indices beat the underlying indices by 2.7%, and 1.3% per annum, respectively.**
- **Given recent market turmoil, Standard and Poor's has launched a family of vol-controlled equity indices, and J.P. Morgan is launching a vol-capped version of the JPMCCI commodity index.**
- **By reducing vega/gamma risk, vol-controlled indices allow dealers to charge a lower volatility risk premium on options, thus rendering them cheaper.**
- **Call options on vol-controlled indices thus provide investors with a more efficient way of gaining upside exposure to an asset class.**

Volatile volatility

In September 2008, S&P 500 realized volatility came in at 54%, more than three times higher than in September 2007, when volatility was only 17%. Similar volatility spikes were also seen in commodities and bonds. As has become all too clear, volatility can change, often dramatically, over time. This has led many investors to re-evaluate their portfolios and to deleverage. In this note, we show that for equities, commodities, and bonds, deleveraging when recent volatility has been high, and releveraging when recent volatility has been low, i.e., *risk-budgeting* or *vol-controlling*, generates higher risk-adjusted returns with lower tail risk, relative to an allocation based on constant weights. Chart 1 plots the performance of a standard equity, government bond, credit, and commodity portfolio vs. a portfolio of vol-controlled strategies on the underlying asset classes. Both portfolios have similar volatility, but the portfolio of vol-controlled strategies outperformed the passive portfolio by an average of 2% per annum, since 1990.

Chart 1: Standard portfolio of asset classes vs portfolio of vol-controlled strategies

total return index



Source: J.P. Morgan, Bloomberg, Datastream, Barclays. Standard portfolio is 50% S&P 500, 25% Lehman Agg Gov US, 15% Lehman Agg Credit US, 10% JPMCCI Index. Vol-controlled portfolio is a basket of vol-controlled strategies on the underlying indices, each targeting the asset class's long-run historical volatility by deleveraging (releveraging) following periods of high (low) volatility as described in the text.

The certifying analyst is indicated by an AC. See page 11 for analyst certification and important legal and regulatory disclosures.

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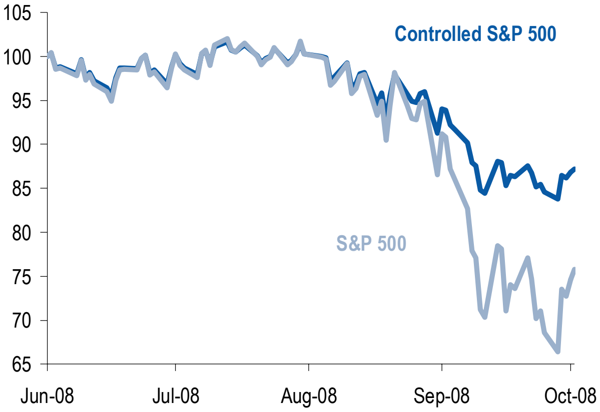
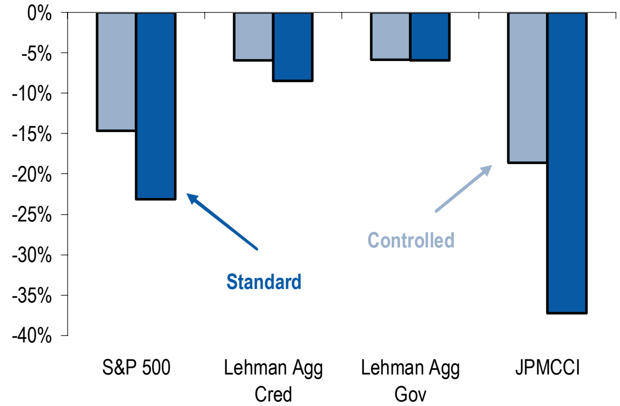
Chart 2: Performance of S&P 500 and vol-controlled S&P 500
excess return index



Source: J.P. Morgan, Bloomberg, S&P.

Chart 3: Worst 3-month return for standard indices and corresponding vol-controlled strategies, 1990-2008.



Source: J.P. Morgan, S&P, Barclays.

While risk-budgeting, also known as vol-controlling, has been known to investors for some time now, the recent financial market crisis provides additional support for the approach.[1] Based on high September realized volatility, a vol-controlled strategy on the S&P 500, designed to target the index's long-run annual volatility, would have only had a 29% exposure to the index, with the remaining 71% invested in cash. While the S&P 500 lost 16.5% in October, the vol-controlled strategy only lost 4.8% (Chart 2).

Historically, vol-controlling has proven to be most beneficial for equities. Since 1990, the S&P 500 generated average annual total returns of 8% per year, some 3% less than a vol-controlled strategy on the index. Vol-controlling also works in commodities. Since 1990, the J.P. Morgan Commodity Curve index (JPMCCI) produced average returns of 3.5%, vs. 4.8% for the corresponding vol-controlled strategy. Benefits were also seen in credit and government bonds, though these were smaller in magnitude.

Volatility controlling also reduces tail risk. Chart 3 shows that the worst 3-month return, using overlapping data from 1990, were significantly worse for the standard indices, except for government bonds, where there was no difference.

The main findings in this note are:
1. Vol-controlling improves risk-adjusted performance for equities, commodities, and bonds.
2. For most asset classes, vol-controlling reduces kurtosis (tail risk) and improves skewness.
3. Reduction in kurtosis increases the value of at-the-money options, but simultaneously reduces their cost as option sellers face less hedging risks, and thus only require a smaller volatility risk premium.

This note is organized as follows. First, we describe the risk-budgeting, or vol-controlling, process. Second, we present an empirical analysis of vol-controlled strategies in equities, commodities, and bonds. A robustness analysis shows results are not sensitive to parameter values. Third, we hypothesize on why vol-controlling improves risk-adjusted performance. Fourth, we highlight the benefits of vol-controlling for option pricing. Finally, we apply the same analysis on thematic (infrastructure) and regional equity indices (BRIC, Latam, SE Asia).

Targeting volatility

Risk-budgeting, or vol-targeting/controlling, consists of allocating a constant volatility exposure to a financial asset. The target exposure is often, though not always, set to a long-run estimate of the asset's historical volatility. When volatility is expected to be high, the strategy deleverages, and when volatility is expected to be low, the strategy releverages. While future volatility can not be known with certainty, it can be forecast with a fair degree of accuracy using simple measures of past volatility.

There are many ways of forecasting volatility. In this note, estimates are computed as the square root of the weighted average of past squared daily log returns, where weights are based on an exponentially decaying function, with a daily decay factor of 0.975. With this factor, approximately 80% of the weight is based on data within the last quarter, 40% within the last month, and 10% within the last week. Daily returns older than 252 business days are assigned a weight of zero. For ease of implementation, we always estimate volatility with a two-day lag.

In the robustness section, we also consider volatility estimates based on alternative decay factors as well as simple 1, 2, and 3-month historical standard deviations.

1 We previously discussed risk-budgeting in *Markowitz in Tactical Asset Allocation*, Ribeiro and Loeys, Sep 2007. Here we provide a more detailed analysis.

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Results in the following section show that even these simple estimates work quite well.

Each day, given a volatility estimate, V_{est}, one invests a fraction V_{target}/V_{est} in the asset, and the remaining $(1-V_{target}/V_{est})$ is invested in cash (1m T-bills).[2] If V_{target}/V_{est} is greater than one, a leveraged exposure is taken by investing borrowed cash in the asset. For example, if one is targeting a 13% volatility, and the current volatility estimate is 10%, one invests 130% in the asset, by borrowing 30% cash. We limit maximum leverage to 200%. Later we also show that related vol-capped strategies, which limit exposure to 100%, also generate superior risk-adjusted returns, with lower tail risk.

Analyzing volatility-controlled strategies

We analyze vol-controlled strategies in different markets. First, we show that vol-controlled strategies effectively achieve their target volatility, and that their volatilities are much more stable than that of the underlying indices. Second, we show that vol-controlled strategies have lower tail risk (kurtosis), and are more symmetrically distributed (skewness closer to zero).

Data

We consider the S&P 500 index for equities, the Lehman Agg Gov US index for government bonds, the Lehman Agg Credit US index for credit, the JPMCCI index for commodities and 1m T-bills for cash. Later we also consider a thematic index (infrastructure) and regional equity indices (BRIC, Latam, and SE Asia). In each case, we set the target volatility equal to the asset's long-term historical volatility.

Volatility analysis

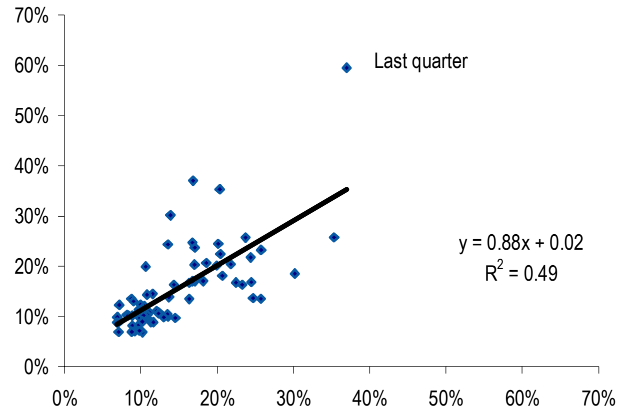
Volatility is persistent. Periods of high volatility tend to be followed by periods of high volatility, and periods of low volatility tend to be followed by periods of low volatility. Chart 4 shows that even simple historical volatility measures can fairly accurately forecast future volatility. Therefore, one can allocate an approximately constant volatility exposure to an asset by deleveraging when past volatility was high, and releveraging when past volatility was low. Indeed, Charts 5 and 6 show that the rolling volatilities of the vol-controlled strategies rarely sway more than a few percent away from their target, unlike the underlying indices, whose volatilities can vary, often drastically, over time.

Table 1 provides summary statistics on the volatility of the vol-controlled strategies. As expected, in each case the vol-controlled strategies have a significantly lower volatility of volatility.

2 This methodology applies to funded assets or total return indices. For the case of excess return indices, one would just invest V_{target}/V_{est} in the index.

Chart 4: Forecasting S&P 500 vol with previous quarter vol

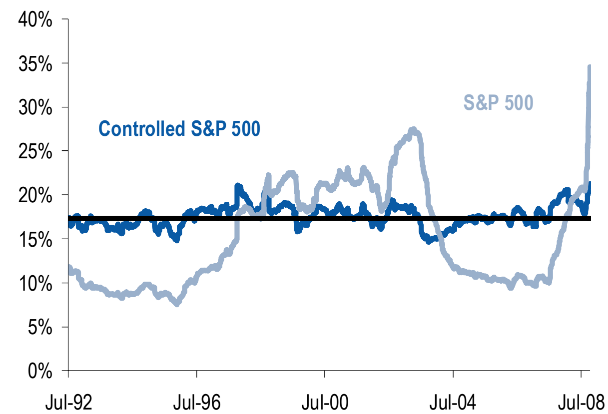
quarterly vol (y-axis) vs. previous quarter vol, using daily returns, annualized



Source: J.P. Morgan. *Last quarter* plots Q4 2008 vol to date vs. Q3 2008 vol.

Chart 5: Volatility of S&P 500 and vol-controlled S&P 500

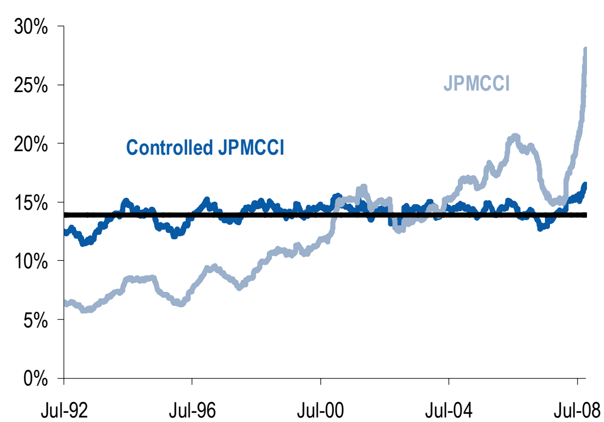
rolling 12-month vol, using daily returns, annualized



Source: J.P. Morgan.

Chart 6: Volatility of JPMCCI and vol-controlled JPMCCI

rolling 12-month vol, using daily returns, annualized



Source: J.P. Morgan.

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Table 1: Volatility statistics of vol-controlled strategies
volatility of non-overlapping quarterly realized volatility, Dec 1990 - Oct 2008

	S&P 500	Lehman Agg Cred	Lehman Agg Gov	JPMCCI
Standard	8.6%	1.4%	1.2%	6.2%
Controlled	3.3%	0.8%	0.6%	1.9%

Source: J.P. Morgan.

Table 2: Higher moments: asset classes and vol-controlled strategies
based on monthly and quarterly returns, Dec 1990 - Oct 2008

	S&P 500	Lehman Agg Cred	Lehman Agg Gov	JPMCCI
	Monthly			
Kurtosis (normal)	1.86	2.82	0.58	4.13
Kurtosis (controlled)	0.07	0.84	0.38	-0.32
Skewness (normal)	-0.77	-0.81	-0.26	-0.70
Skewness (controlled)	-0.23	-0.35	-0.04	0.04
	Quarterly			
Kurtosis (normal)	0.60	0.02	-0.81	2.38
Kurtosis (controlled)	-0.51	-0.69	-0.89	-0.50
Skewness (normal)	-0.35	-0.32	0.19	-0.48
Skewness (controlled)	-0.05	-0.02	0.22	-0.23

Source: J.P. Morgan.

Reducing tail risk

Reducing volatility fluctuations also affects return skewness and return tail risk. Empirically, we find that vol-controlled strategies have lower tail risk than the underlying indices.[3] Chart 3 showed that the worst 3-month return of the volatility-controlled strategies were not as severe as those on the underlying indices. These findings are further reinforced by the results in Table 2, which show that the excess kurtosis (tail risk) of the vol-controlled strategies are lower, and closer to zero. Note that a normal distribution has an excess kurtosis of zero.

We also note improvements in skewness. In each case, the skewness of the vol-controlled strategies are greater than that of the underlying index, and in several cases skewness actually becomes positive, implying that extremes tend to be on the upside, rather than on the downside.

Performance analysis

Table 3 shows that vol-controlled strategies generate higher risk-adjusted returns than the underlying indices. Results are strongest for the S&P 500, where the vol-controlled index outperformed the underlying index by 2.7% per annum, since 1990. Results are also reasonable for commodities, where a

Table 3: Performance of asset classes and vol-controlled strategies
Dec 1990 - Oct 2008, annual statistics

	S&P 500	Lehman Agg Cred	Lehman Agg Gov	JPMCCI
	Standard Indices			
Avg. Exc. Return	4.4%	3.4%	3.8%	3.5%
Standard Deviation	14.2%	5.6%	4.7%	15.0%
Sharpe Ratio	0.31	0.61	0.81	0.23
	Controlled Strategies			
Avg. Exc. Return	7.2%	4.2%	4.4%	4.8%
Standard Deviation	15.5%	5.9%	5.1%	15.0%
Sharpe Ratio	0.46	0.72	0.86	0.32
	Controlled - Standard (beta-adjusted)			
Avg. Exc. Return	3.2%	1.1%	0.9%	1.5%
Standard Deviation	6.0%	1.4%	1.2%	5.8%
Information Ratio	0.53	0.73	0.74	0.26
T-stat (Returns)	2.2	3.1	3.1	1.1

Source: J.P. Morgan. Controlled-Standard is an active strategy that is long the vol-controlled strategy and short the corresponding standard index, beta-adjusted.

Table 4: Recent performance: asset classes, vol-controlled strategies
Dec 31, 2007 - Oct 31, 2008, annualized

	S&P 500	Lehman Agg Cred	Lehman Agg Gov	JPMCCI
	Standard Indices			
Excess Return	-39.2%	-17.0%	2.8%	-27.9%
Standard Deviation	22.2%	10.0%	4.0%	39.6%
	Controlled Strategies			
Excess Return	-27.7%	-12.5%	3.4%	-6.7%
Standard Deviation	13.7%	7.5%	3.4%	21.9%

Source: J.P. Morgan.

vol-controlled strategy on the JPMCCI index outperformed the JPMCCI by 1.3% per annum.[4] Table 4 shows that vol-controlling would have significantly limited losses over the past year. Indeed, volatility has become much more unstable in 2008, and it is therefore not surprising that the benefits of vol-controlling were most apparent during this period.

We also considered a portfolio of vol-controlled strategies. Specifically, we compared the performance of a 50-25-15-10 equity-gov bond-credit-commodity portfolio, with the performance of a 50-25-15-10 portfolio of vol-controlled strategies on the same asset classes. Table 5 shows that the vol-controlled portfolio has higher returns, with similar volatility, higher skewness, and lower tail risk (kurtosis). That the benefits of lower tail risk are preserved at the portfolio level suggests that the co-skewness of the vol-controlled strategies is not an issue.

3 This is consistent with theoretical predictions that constant volatility processes have lower kurtosis than stochastic volatility processes.

4 This alpha is not statistically significant (t-stat = 1.1). Though not reported, we did obtain statistically significant alpha when using different parameters.

Table 5: Performance of portfolio of asset classes and portfolio of vol-controlled strategies

Dec1990 - Oct 2008, annual statistics

	Standard Indices	Controlled Strategies
	Monthly portfolio rebalancing	
Avg. Exc. Return	4.4%	6.2%
Standard Deviation	8.0%	8.6%
Sharpe Ratio	0.55	0.72
Skewness	-1.01	-0.16
Kurtosis	3.76	0.24
	Quarterly portfolio rebalancing	
Avg. Exc. Return	4.4%	6.3%
Standard Deviation	7.9%	8.1%
Sharpe Ratio	0.56	0.77
Skewness	-0.61	0.12
Kurtosis	1.20	-0.33

Source: J.P.Morgan, Bloomberg, Datastream, Barclays. Constant weight portfolio is 50% S&P 500, 25% Lehman Agg Gov US, 15% Lehman Agg Credit US, 10% JPMCCI Index. Risk-budgeting portfolio is a basket of risk-budgeting strategies on the underlying indices, each targeting the asset class's long-run historical volatility by deleveraging (releveraging) following periods of high (low) volatility as described in the text. Standard and vol-controlled strategies are rebalanced to the target portfolio weights monthly/quarterly.

Robustness

Table 6 shows that the vol-controlled strategies are robust to different parameters. First, we consider two alternative exponential-decay factors for the volatility estimation procedure. Second, we compute past volatility as the simple standard deviation of past 21, 42 and 63 day log returns. All variations generated similar, and occasionally better, performance. Although not reported, these variations also yielded lower tail risk and better skewness than the underlying indices.[5]

Why does vol-controlling improve risk-adjusted returns?

Theoretically, one would expect that when future expected volatility increases, prices drop to the point where IRRs are sufficiently high to compensate for the increased risk going forward. This is the time-series equivalent of the more familiar cross-sectional notion that riskier assets should earn higher returns, on average. But empirically, there is little to no relation between past volatility and near-term future returns.[6] Therefore, when risk is high (low), risk-adjusted returns tend to be lower (higher). In some sense, risk-budgeting improves risk-adjusted returns by exploiting the lack of an empirical (positive) relation between past risk and (near-term) future returns.

Table 6: Vol-controlled strategies with different parameters

Dec 1990 - Oct 2008, annual statistics

	S&P 500	Lehman Agg Cred	Lehman Agg Gov	JPMCCI
	Standard			
Avg. Exc. Return	4.4%	3.4%	3.8%	3.5%
Standard Deviation	14.2%	5.6%	4.7%	15.0%
Sharpe Ratio	0.31	0.61	0.81	0.23
	Exponential decay (0.99)			
Avg. Exc. Return	7.7%	3.9%	4.1%	4.6%
Standard Deviation	15.4%	5.8%	4.9%	14.9%
Sharpe Ratio	0.50	0.68	0.83	0.31
	Exponential decay (0.95)			
Avg. Exc. Return	6.5%	4.5%	4.7%	4.9%
Standard Deviation	15.8%	6.0%	5.3%	15.1%
Sharpe Ratio	0.41	0.75	0.89	0.32
	21-day			
Avg. Exc. Return	6.2%	4.8%	5.0%	5.0%
Standard Deviation	16.4%	6.3%	5.5%	15.5%
Sharpe Ratio	0.38	0.76	0.92	0.32
	42-day			
Avg. Exc. Return	6.8%	4.4%	4.6%	4.9%
Standard Deviation	15.9%	6.1%	5.3%	15.1%
Sharpe Ratio	0.43	0.72	0.87	0.32
	63-day			
Avg. Exc. Return	7.1%	4.3%	4.5%	4.7%
Standard Deviation	15.8%	6.0%	5.1%	15.1%
Sharpe Ratio	0.45	0.71	0.87	0.31

Source: J.P. Morgan.

But why do IRRs not rise (drop) sufficiently when volatility rises (falls)? One hypothesis is that investors underreact to volatility shocks. Perhaps they believe these shocks will be short-lived and, therefore, will not react to them fully when adjusting IRRs. Instead, the IRRs are only adjusted gradually as the volatility shock proves to be longer lasting. For example, S&P 500 realized volatility was 54% this September. But going into October, the VIX index, a measure of expected volatility, was only 40%. Apparently, investors believed the volatility shock would be temporary, and that volatility would quickly mean-revert towards lower historical levels. Instead, realized volatility in October was 80%, and the S&P 500 fell 16.5%.

Another reason vol-controlled indices might generate higher Sharpe ratios is momentum. The term momentum refers to the

5 We also considered the forward looking VIX volatility index, rather than past volatility, as an estimate of future S&P 500 volatility, and obtained similar results.

6 See, for example, *Measuring and Modeling Variation in the Risk-Return Tradeoff*, 2007, Lettau and Ludvigson, Handbook of Financial Econometrics, edited by Yacine Ait-Sahalia and Lars P. Hansen.

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Box 1. Risk-budgeting: an active passive strategy

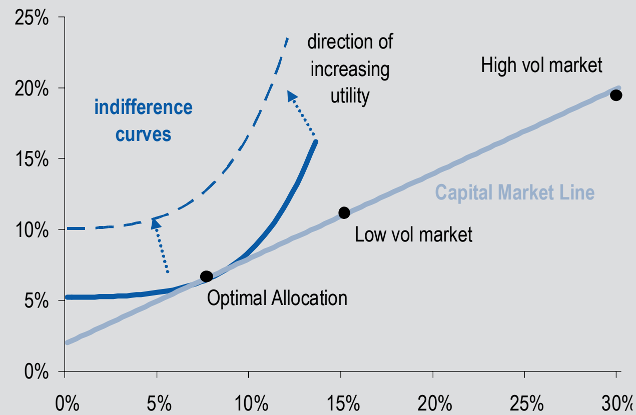
The empirical section of this note shows that vol-controlled strategies generate higher Sharpe ratios than the underlying indices. Here, we explain how vol-controlled strategies can benefit investors, even if they did not yield higher Sharpe ratios.

One of the most celebrated theories in modern finance is the portfolio separation theorem implied by the CAPM. Under certain assumptions (homogeneous expectations, mean-variance preferences and/or normal return distributions), all investors choose to hold the same risky portfolio, namely the theoretical "market portfolio". According to the theory, no other combination of assets can provide a higher risk-return tradeoff, i.e., a higher Sharpe ratio. Investors thus maximize their utility functions by deciding how much of their wealth to allocate to the risky market portfolio and how much to allocate to the risk free asset. Graphically, investors select the point on the Capital Market Line tangent to their indifference curves (Chart 7).

The decision depends on investors' level of risk aversion. For example, a very risk averse investor might only invest 20% of his wealth in the risky market portfolio, and the remaining 80% in cash. Another may be less risk averse, and decide to invest 50% in the market portfolio. Both portfolios have the same Sharpe ratio, but provide different utilities to different investors.

Chart 7: Selecting a portfolio on the Capital Market Line

x-axis is risk, y-axis is expected return



Source: J.P. Morgan

Of course, many of the assumptions underlying the traditional CAPM do not hold in reality. The CAPM is a static model, and the world is dynamic. Specifically, the volatility of the market portfolio varies over time. In Chart 7, we consider a low and high vol market environment. We assume the Sharpe ratio of the market, and the risk free rate, remain constant, and, therefore, the Capital Market Line remains the same in both cases. In the low vol environment, the investor optimally allocates 50% of his wealth to the market portfolio. But in the high vol environment, he only allocates 25%. In each case, the investor is optimizing his utility function according to his preferences. Indeed, the investor is effectively following a vol-controlled strategy.

fact that, for many asset classes, high returns tend to be followed by high returns, and low returns tend to be followed by low returns. (See, for example, *Exploiting Cross-Market Momentum*, Feb 2006, Ribeiro and Loeys, and the references therein.) Because realized volatility tends to be higher when prices have declined, a vol-controlled strategy will naturally tend to deleverage when past returns were poor, and to releverage when past returns were high. Therefore, given the evidence for momentum in asset price returns, it is perhaps not surprising that vol-controlled strategies produce higher risk-adjusted returns.

The ideas discussed above are geared towards understanding the benefits of vol-controlled strategies for equities, and do not necessarily apply to other asset classes, such as commodities or government bonds. Indeed, perhaps this is why the strongest benefits for vol-controlling are in equity markets.

While our results show that vol-controlled strategies can generate higher risk adjusted returns, Box 1 explains how these strategies would add value, from a utility perspective, even if they did not produce higher risk-adjusted returns.

Option pricing benefits

In this section, we highlight the benefits of vol-controlled strategies for option pricing. In short, by reducing volatility risk, also known as vega/gamma risk, vol-controlled strategies allow dealers to charge a lower volatility risk premium when selling options. This renders the options cheaper for investors. In other words, options on vol-controlled indices are a more efficient way of gaining upside exposure to an asset class.

To understand why, consider a dealer who sells a call option. Generally, the dealer delta hedges his directional risk by dynamically trading the underlying index. Delta hedging, however, does not eliminate vega/gamma risk. If implied volatilities increase, the dealer incurs a mark-to-market loss. If, over the life of the option, realized volatility turns out to be higher than the implied volatility initially used to price the option, the dealer realizes an actual loss. Because of this volatility uncertainty, dealers will generally only sell options if they are priced with an implied volatility higher than their best estimate of future realized volatility.

The magnitude of the premium charged depends on the degree of uncertainty surrounding future vol. If volatility uncertainty is low, there is less volatility risk and a lower volatility risk premium need be charged. Conversely, if future realized volatility is highly uncertain, a higher risk premium is required to compensate the dealer for the volatility risk.

Are fat tails good or bad for options?

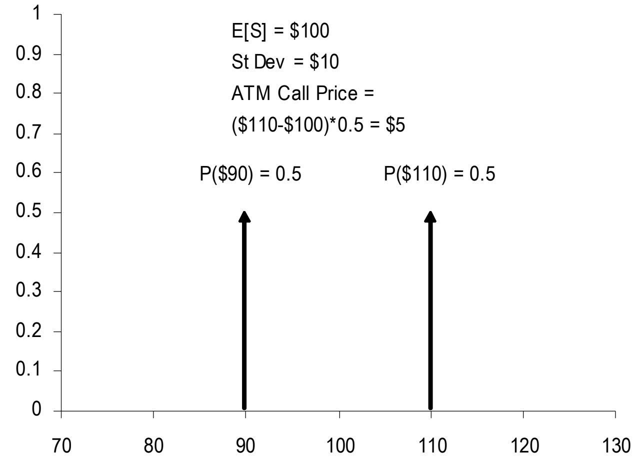
We previously showed that vol-controlled indices have thinner tails than the underlying indices. In this section we examine the implication of fat/thin tails on option pricing. We explain why, holding volatility constant, *at-the-money* options are actually more valuable, or have a higher expected payoffs, when tails are thin. Consequently, at-the-money options on vol-controlled strategies are more valuable than those on the underlying indices.

Intuitively, one might think fatter tails make options more valuable. Indeed, this is the case for out-of-the-money options. But for at-the-money options, increasing the probability of extreme events, while holding standard deviation constant, actually decreases value.

This relationship is most easily understood through a simple example. Charts 8 and 9 plot the (risk-neutral) probability distribution of two stocks. Both have a mean and standard deviation of $100 and $10, respectively. The distribution in Chart 9, however, has fatter tails. Clearly, the fatter tailed distribution increases the value of an out-of-the money call option, with strike price $115 (from $0 to (120-115)×0.125 = $0.625). But, the fatter tailed distribution decreases the value of an at-the-money option (from $5 to $2.5, see Chart 9).

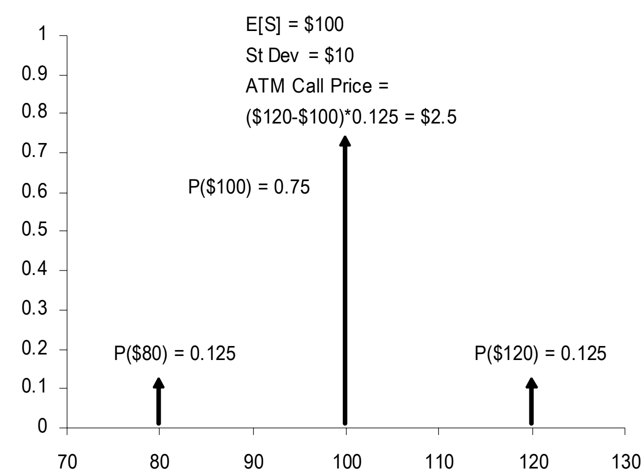
Loosely speaking, because the standard deviation function is non-linear, in order to increase the probability of extreme events without changing the standard deviation, more weight needs to be shifted in towards the mean, than is pushed out towards the tails. This makes at-the-money options on thin-tailed distributions more valuable than at-the-money options on fat tailed distributions. But the opposite is true for sufficiently deep out-of-the-money options.[7]

Chart 8: Stock price distribution: thin tails
x-axis is stock price at maturity, y-axis is probability of outcome



Source: J.P. Morgan.

Chart 9: Stock price distribution: fat tails
x-axis is stock price at maturity, y-axis is probability of outcome



Source: J.P. Morgan.

7 For a more rigorous analysis, see Hull and White, *The pricing of options on assets with stochastic volatilities*, Journal of Finance, 42, 1987.

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Volatility-capped strategies

Vol-controlled strategies imply leverage whenever past volatility was below the target level. As many investors are not able to use leverage, we also analyze the performance of vol-capped strategies, which can deleverage, but can not leverage. In other words, the maximum allocation to the asset is limited to 100%. Table 8 shows that most of the benefits for vol-capped strategies come from reducing risk, rather than increasing returns. The exception is commodities, where the vol-capped strategy significantly improves returns as well.

Other indices

Tables 8, 9 and 10 show results for other thematic (infrastructure) and regional indices (BRIC, Latam, and SE Asia). Results are based on data since 2003. In all cases, we find strong outperformance of the vol-controlled strategies with thinner tails and better skewness. Standard and Poor's has launched a family of vol-controlled indices on these asset classes, though they follow slightly different rules.

Conclusion and caveats

This note showed that vol-controlled strategies generate higher risk adjusted returns with lower tail risk for equities, commodities, and bonds. Vol-controlled strategies can also improve investors' utility functions by targeting a constant volatility exposure. Finally, because of lower vega/gamma risk, options on vol-controlled indices can provide investors with an efficient way of gaining upside exposure to an asset class. A few caveats, however, are in order.

Volatility signals were particularly beneficial during the market crisis of the past year. But, historically, we have witnessed long periods with only small outperformance. Also, the portfolio of volatility-controlled indices has a relatively small information ratio (0.55). It is, however, statistically significant, with a t-stat of 2.3 for the alpha.

Finally, a vol-controlled strategy will underperform standard indices whenever there are losses in low volatility environments. Therefore, drawdowns in low volatility periods are generally higher for the vol-controlled strategies.

Table 7: Vol-capped strategies
Dec 1990 - Oct 2008, annual statistics

	S&P 500	Lehman Agg Cred	Lehman Agg Gov	JPMCCI
	Standard indices			
Avg. Exc. Return	4.4%	3.4%	3.8%	3.5%
Standard Deviation	14.2%	5.6%	4.7%	15.0%
Sharpe Ratio	0.31	0.61	0.81	0.23
Skewness	-0.77	-0.81	-0.26	-0.70
Kurtosis	1.86	2.82	0.58	4.13
	Vol-capped strategies			
Avg. Exc. Return	4.4%	3.6%	3.8%	4.7%
Standard Deviation	12.4%	5.2%	4.5%	12.5%
Sharpe Ratio	0.36	0.69	0.84	0.38
Skewness	-0.23	-0.35	-0.04	0.04
Kurtosis	0.07	0.84	0.38	-0.32

Source: J.P. Morgan.

Table 8: Volatility statistics of vol-controlled strategies
volatility of non-overlapping quarterly realized volatility, Dec 2003 - Oct 2008

	Infrast.	Latam	SE Asia	BRIC
Standard	9.3%	21.7%	7.9%	20.5%
Controlled	5.4%	9.1%	2.9%	8.6%

Source: J.P. Morgan.

Table 9: Higher moments for normal and controlled indices
based on monthly and quarterly returns, Dec 2003 - Oct 2008

	Infrast.	Latam	S. East	BRIC
	Monthly			
Kurtosis (normal)	7.99	3.88	2.36	1.40
Kurtosis (controlled)	0.70	0.05	-0.53	-0.14
Skewness (normal)	-1.95	-1.33	-1.03	-0.87
Skewness (controlled)	-0.35	0.02	-0.24	0.01
	Quarterly			
Kurtosis (normal)	2.37	1.69	-0.25	0.42
Kurtosis (controlled)	0.13	0.39	-0.93	0.39
Skewness (normal)	-1.48	-1.13	-0.38	-0.75
Skewness (controlled)	-0.58	0.29	-0.22	0.35

Source: J.P. Morgan.

Table 10: Performance statistics for normal and controlled indices
Dec 2003 - Oct 2008, annual statistics

	Infrast.	Latam	SE Asia	BRIC
	Standard Indices			
Avg. Exc. Return	2.5%	16.7%	-2.8%	10.7%
Standard Deviation	21.7%	28.4%	27.0%	29.7%
Sharpe Ratio	0.12	0.59	-0.10	0.36
	Controlled Strategies			
Avg. Exc. Return	10.6%	32.3%	2.8%	26.8%
Standard Deviation	24.1%	32.8%	21.8%	36.8%
Sharpe Ratio	0.44	0.98	0.13	0.73

Source: J.P. Morgan.

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