Equity Derivatives Strategy

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Identifying Rich and Cheap Implied Volatility

- One of the primary objectives of option market participants is to identify options having relatively high or low implied volatility to identify potential option selling or buying candidates.

- In this study, we present empirical evidence of the mean reverting characteristics of the implied versus realized volatility spread for single-stock options. We also examine two other quantitative metrics: the implied versus sector-weighted-average implied volatility spread and the implied versus S&P 500 implied volatility spread.

- We find that the implied versus sector-weighted-average implied volatility spread has been the single most reliable indicator for predicting a stock's future realized volatility.

- We establish that a screening process combining each of these three indicators in unison improves option traders' ability to profit by identifying options that indeed are truly rich or cheap.

- Although our screening process tends to work across business cycles over the backtest period (1996 – 2005), we observe that identifying rich or cheap options has become more difficult in recent years, particularly for options identified as being "cheap". We believe the largest factor contributing to this phenomenon is the persistent downward trend in market volatility since the beginning of 2003. Another factor could be that the volatility market has become more efficient, with increasing usage of similar quantitative rich/cheap screens by option market participants.

- In addition, we find that, on average, one-month implied volatility spreads tend to more accurately identify overpriced options, whereas three-month implied volatility spreads are generally a more reliable predictor for identifying options that are truly cheap.

- We also find that using a two-year look-back history when analyzing each of these spreads results in a more accurate determination of whether an option is pricing in unreasonably high or low implied volatility.

- Our rich and cheap metrics have been consistent in identifying stocks with excessively high or low risk expectations embedded in their options, regardless of which sector the stocks belonged to.

Introduction

One of the primary objectives of option market participants is to identify options having relatively low/high implied volatility to identify potential option buying/selling candidates. Since the tendency of volatility in equity markets to revert to a longer term mean has been well established, option traders in the long run can profit if they can identify options that have unreasonably high or low implied volatilities that are likely to revert.

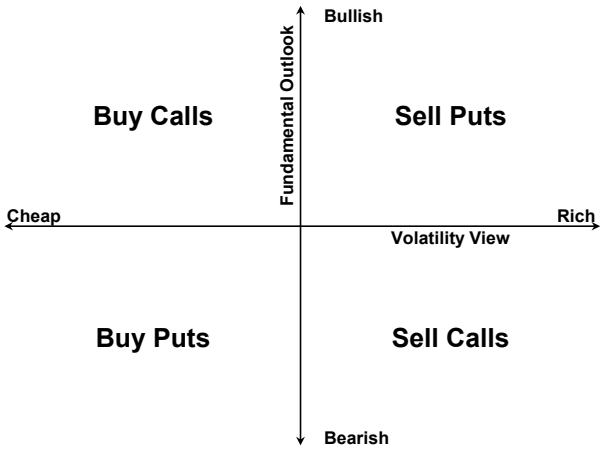
Studies have also demonstrated that implied volatility is a relatively reliable indicator of what the future level of realized volatility is expected to be. Moreover, implied volatility at the market level shows the existence of a volatility risk premium, as evidenced by the tendency of implied volatility to trade at a premium to what the underlying index had recently realized (realized volatility). This is the compensation an option seller demands for taking on volatility risk.

After identifying potential option buying or selling candidates, options traders attempt to capture profits by delta hedging against their long or short option position. That is, an options trader who believes the market is pricing in relatively low/high risk expectations for a stock can take a long/short gamma position and delta-hedge dynamically to lock in the difference between the volatility implied by the market at inception of the trade, and the stock's volatility that is actually realized over the corresponding period. A similar strategy is also available using over-the-counter (OTC) products such as variance or volatility swaps, whereby investors earn a payoff dependent on future return variability and would not need to actively participate in the dynamic hedging process.

In addition, investors can combine a view on future volatility with their directional opinion of the underlying itself to efficiently structure a desired payoff (Figure 1). For instance,

- Investors expecting a stock to rally in the near term might choose to buy calls if they are trading "cheap", but sell puts if they are trading "rich".
- A bearish forecast of the underlying could lead one to sell calls if implied volatility is high and buy puts if it is trading relatively low.

Figure 1: Positioning for Rich/Cheap Volatility



Source: Lehman Brothers

While the total return of an unhedged strategy would likely be affected more by the movement in the underlying than by the level of the option premium, the relative magnitude of implied volatility would be an additional factor driving the yield, particularly over shorter holding periods.

Identifying "Rich" and "Cheap" Implied Volatility

In this study, we present empirical evidence of the mean reverting characteristic of the implied versus realized volatility spread. We also examine other quantitative metrics, such as the implied versus sector-weighted-average implied volatility spread and the implied versus S&P 500 Index implied volatility spread. We analyze each of these metrics separately, and in unison, in an effort to improve our ability to identify options having unreasonably high/rich or low/cheap implied volatility levels. Options truly have "rich" implied volatilities if their underlying stock's future realized volatility ("ex-post realized volatility") turns out to be lower than what was originally implied by the options market[1]. On the other hand, we say options truly have "cheap" implied volatilities if their underlying stock's ex-post realized volatility is higher than what was originally implied by the options market. Our universe consists of stocks that have been constituents of the S&P 500 or the Nasdaq 100 since January 1996 and have had options trading on them over this period.

We find that an option's implied-realized spread indeed has a tendency to revert to its near-term mean. However, we determine that the implied versus sector-weighted-average implied volatility spread has been the single most reliable indicator for predicting a stock's ex-post realized volatility. We also find that an option's implied versus S&P 500 implied volatility spread is not a very robust indicator for estimating a stock's ex-post realized volatility. However, combining all of these metrics together provides the best results, and has the highest predictive ability for identifying options having unreasonably rich or cheap implied volatilities. Thus, a screening process combining each of these three indicators in unison should improve option traders' ability to profit by identifying options that indeed are truly rich or cheap, and delta hedge against a short or long option position. In addition, the screening methodology can assist in identifying instances when it makes sense to express directional viewpoints in a stock by either buying or selling options. The improvement is found to be consistent across sectors and market cycles over the sample period considered.

We find that using 1-month implied volatility spreads tends to work best when attempting to identify options having rich implied volatilities. On the other hand, 3-month implied volatility spreads tend to be a more reliable indicator when screening for cheap implied volatilities. In addition, comparing current spread levels against their longer-term histories (12 or 24 months) – rather than shorter-term periods (1 or 3 months) – leads to better results for each of the three implied volatility spread metrics analyzed.

However, we also emphasize that each of our "rich" and "cheap" indicators must be analyzed in context with the unique circumstances surrounding each potential volatility trade, since – even though the average performance one would obtain by combining each of our three indicators in unison is the highest – the variability of returns remains at high levels. On the other hand, despite the statistical limitations an empirical screening process inherently has, one should be able to improve their ability to identify potential long or short volatility candidates by using our volatility screening methodology as a starting point for the rich versus cheap volatility selection process.

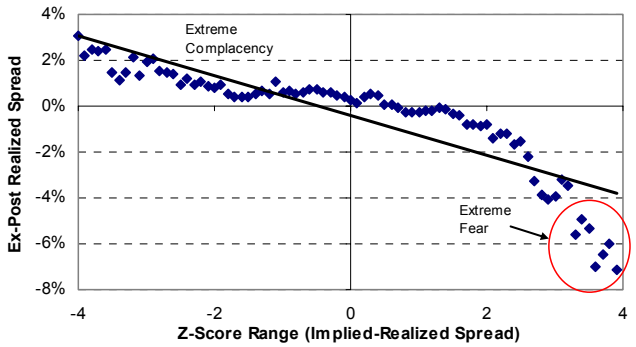
[1] The ex-post realized spread is the difference between the future volatility realized over the term of the option, and that implied at inception of the trade. For a truly cheap option, the ex-post realized spread should by positive. If the implied volatility is truly rich, we would expect the ex-post realized spread to be negative.

Indicators of Rich/Cheap Implied Volatility

Implied – Realized Volatility Spread

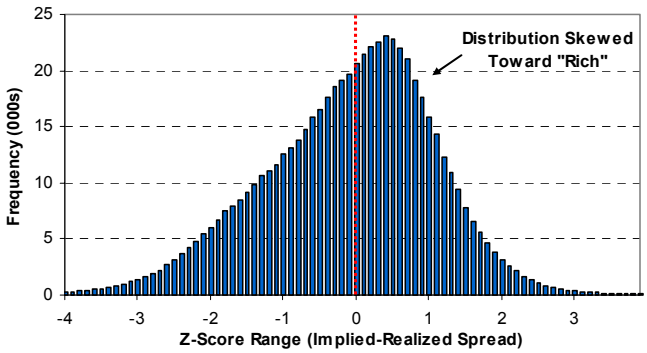
The spread of implied to realized volatility is a popular measure of the volatility risk premium. Since this spread is widely used by option investors to identify the relative richness or cheapness of an option, we first test this spread's power in forecasting ex-post realized volatility.

Figure 2: Ex-post Realized Spread versus Implied-Realized Spread



Source: Lehman Brothers, OptionMetrics

Figure 3: Distribution of Implied-Realized Spread z-scores



Source: Lehman Brothers, OptionMetrics

For our base case, we group the z-score of the spread of the 3-month implied volatility to 66 trading-day realized volatility, relative to its 12-month history, into bins of 0.1 standard deviations each. The z-score for a given spread over a given time period is simply equal to the number of standard deviations the current spread level is from its mean. It is similar to, and highly correlated with, a percentile ranking. This leads to two key findings.

- Plotting the z-score range against the ex-post realized spread in Figure 2 demonstrates that, on average, options having relatively low implied – realized volatility spreads (lower z-scores) tend to have future realized volatility higher than was originally priced into their options.

- Options having relatively high implied – realized volatility spreads (higher z scores) tend to have future realized volatility that is lower than what was originally priced into their options.

Thus, it appears investors tend to underestimate the expected future realized volatility of a stock when current implied – realized volatility spreads are relatively low relative to the spread's 12-month history and overestimate expected future realized volatility when this spread is relatively high.

Figure 3 illustrates that the z-score of 3-month implied minus 66 trading- day realized volatility tends to trade rich relative to its history more often than its tendency to trade cheap, similar to the distribution of the implied-realized volatility spread itself (negatively skewed). One possible explanation for this is that investors going long volatility are willing to pay a premium, on average, for the possibility of participating spikes in realized volatility, which have a tendency to occur whenever there is an unforeseen market "shock". Alternatively, investors selling volatility will demand a premium for selling potentially unlimited downside risk in the event of a surge in realized volatility ("gap risk").

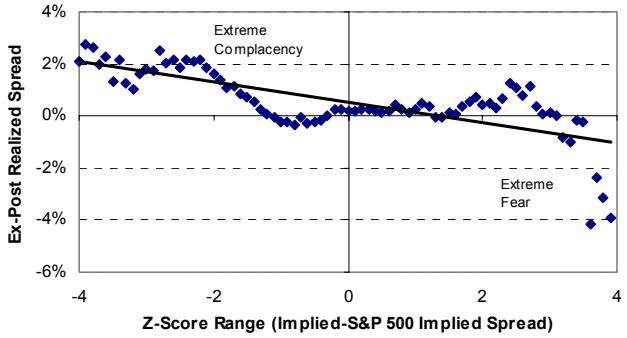
We believe the relatively high frequency of very negative z-scores might be explained by one of the key pitfalls of the realized volatility calculation itself. Specifically, it has been well established that realized volatility, which by definition incorporates historical returns, can be subject to discontinuous jumps if a company's stock price has an unusually large or highly negative return on a given day.

When large moves such as this occur, realized volatility spikes as well and will tend to remain at abnormally high levels until the return that caused the initial spike in realized volatility is no longer included in the realized volatility calculation sample period (in our study, 66 trading days after the initial spike). Implied volatility, on the other hand, would probably rise as well immediately following the event, but may revert lower in the days or weeks following the initial spike if the future risk expectations for the stock decline, and the dramatic move that had recently occurred is not likely to repeat itself in the near future. The combination of these two factors likely understates options' implied – realized volatility spreads during the 66 trading days after such realized volatility spikes occur, which would lead to a disproportionately higher number of highly negative z-scores included in the analysis.

Implied Volatility Relative to the S&P 500 and the GICS Sector

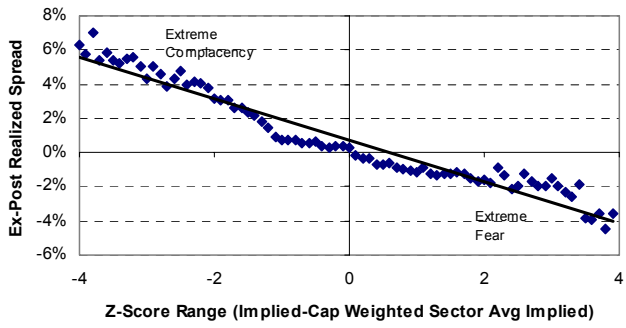
The implied-realized spread, however, is not a perfect measure of risk expectations since it compares a forward-looking consensus estimate of expected future volatility (implied volatility) with a backward-looking standard deviation of returns (realized volatility). In addition, a stock's returns and risk are impacted by factors related to the market (systematic factors) as well as sector factors, apart from its own unique characteristics (idiosyncratic component). We surmise that the spread of an option's implied volatility relative to the S&P 500 implied volatility and the spread relative to the average sector volatility[2] will allow us to more completely isolate the idiosyncratic component of its total risk. We examine the power of each of these spreads in signaling the direction of future realized volatility.

Figure 4: Ex-post Realized Spread Based on Implied vs S&P 500



Source: Lehman Brothers, OptionMetrics

Figure 5: Ex-post Realized Spread Based on Implied vs Sector



Source: Lehman Brothers, OptionMetrics

Figure 4 and Figure 5 display the z-scores of implied volatility spreads relative to S&P 500 implied volatility and each company's weighted average sector implied volatility, plotted against the stocks' ex-post future realized volatility spread relative to what had been originally implied. We find that options' implied volatility relative to S&P 500 implied volatility has relatively low predictive power in estimating their future realized volatility. On the other hand, options' implied versus average sector volatility spreads have the highest explanatory power for estimating future realized volatility.

Apart from the three spreads above, we also consider if an option's current absolute level of implied volatility relative to its history can be a reliable indicator of richness or cheapness. We define an option as having "rich" absolute implied volatility if its current implied volatility level is at least 1 standard deviation above its average implied volatility level for the past year. An option is deemed to have "cheap" absolute implied volatility if its current implied volatility is at least 1 standard deviation below its average implied volatility level for the past year. As Figure 6 on the following page

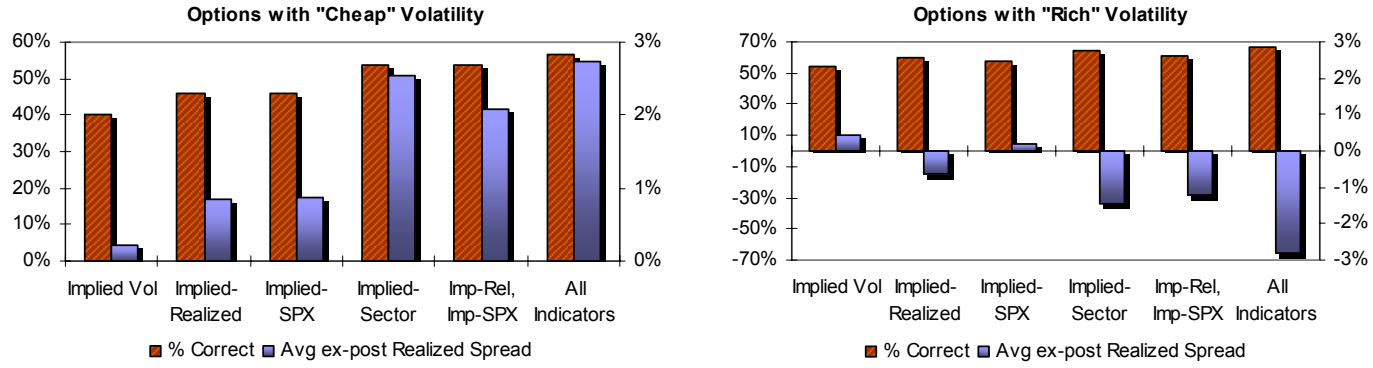
[2]The average sector volatility is the market capitalization-weighted average implied volatility of all stocks in our universe that belong to the same GICS sector. This differs from the implied volatility of a hypothetical ETF or sector index containing the same stocks, which contains an additional implied correlation component.

illustrates, using an option's absolute implied volatility level by itself is a poor indicator for correctly forecasting a stock's ex-post realized volatility. Thus, we will not consider this metric when attempting to identify options having rich or cheap implied volatilities.

Incorporating All Three Implied Volatility Spreads

Figure 6 also demonstrates that the predictability of the ex-post realized volatility is improved as we successively incorporate additional volatility spread screening criteria[3]. That is, the ex-post realized spread for options deemed to be "cheap" is highest and tends to increase more frequently when the z-scores for implied minus realized, implied minus sector and implied minus S&P 500 volatility spreads are all less than -1. Likewise, the ex-post realized spread for options labeled as "rich" is lowest and tends to decrease more frequently when the z-score for each of these spreads is greater than 1. We also find that "rich" signals are usually more reliable than "cheap" signals, possibly indicating the tendency of the market to overprice downside risk expectations.

Figure 6: Better Predictability of Future Realized Volatility Using All Indicators



Source: Lehman Brothers, OptionMetrics

However, the impact of outlier returns is relatively large for each of these indicators, particularly when used to identify options having rich implied volatilities. That is, the standard deviation of ex-post realized spreads itself (far right column in Figure 7 on the following page) tends to be much larger than both the average and median ex-post realized – current implied volatility spreads for each of the indicators in isolation or together. Thus, an option identified as "cheap" or "rich" could actually have much higher or lower future realized volatility than what was originally implied, and a single long or short volatility position could make or lose substantially more money than what is made, on average, for a large number of similar positions across a wide range of options in the long run.

[3]In Figure 6, "% Correct" is defined as the proportion of cases where realized volatility moved in the direction predicted. The average ex-post realized spread is the average difference between future realized volatility and current implied volatility for stocks that clear each screen. Rich stocks are expected to have lower future realized volatility and a successful indicator should result in more negative ex-post realized spreads. For cheap stocks, ex-post realized spread should be higher if the indicator is meaningful.

Figure 7: Performance of Screen for Rich and Cheap Implied Volatility

Z-score Screen	Total	# Correct	% Correct	Avg Ex-post Realized - Current Implied	Median Ex-post Realized - Current Implied	Std Dev of Realized Spread
Spread More Than One Std Deviation Less Than One Year Mean (Cheap Volatility)						
Absolute Implied Volatility	165,596	66,431	40%	0.21%	-1.56%	9.08%
Implied-Realized	127,986	58,984	46%	0.84%	-0.71%	11.14%
Implied-SPX	148,426	68,306	46%	0.87%	-0.73%	9.81%
Implied-Sector	132,184	70,705	53%	2.55%	0.67%	10.59%
Implied-Realized, Implied-SPX	27,500	14,812	54%	2.08%	0.67%	9.46%
Implied-Realized, Implied-SPX, Implied-Sector	17,940	10,174	57%	2.73%	1.26%	9.75%
Spread More Than One Std Deviation Greater Than One Year Mean (Rich Volatility)						
Absolute Implied Volatility	129,867	70,447	54%	0.42%	-1.01%	13.75%
Implied-Realized	108,117	64,958	60%	-0.61%	-2.22%	12.22%
Implied-SPX	126,447	72,355	57%	0.20%	-1.58%	13.87%
Implied-Sector	122,848	79,520	65%	-1.46%	-2.94%	13.32%
Implied-Realized, Implied-SPX	30,041	18,196	61%	-1.22%	-2.58%	15.39%
Implied-Realized, Implied-SPX, Implied-Sector	22,259	14,806	67%	-2.81%	-3.89%	16.11%

Source: Lehman Brothers, OptionMetrics

However, it is worthwhile to note that the percentage of correct rich and cheap signals does tend to improve as we successively incorporate additional volatility spread screening criteria. In addition, the average and median ex-post realized – current implied volatility spreads tend to move "in the right direction" as we include additional screening criteria.

Moreover, we do not alter our universe to exclude special situations such as M&A or unique event risks, which investors would certainly take into account prior to initiating a single-stock volatility position, even if a quantitative screening process signals that the stock's options are rich or cheap relative to historical spread metrics. In other words, an option could be "cheap" or "rich" for a reason, and the expected risk-adjusted return of initiating a long or short volatility trade might not make sense given the unique risks associated with a stock. Finally, as noted earlier, the discontinuous nature of realized (and implied) volatility likely biases the ex-post realized – current implied volatility spreads' standard deviation higher.

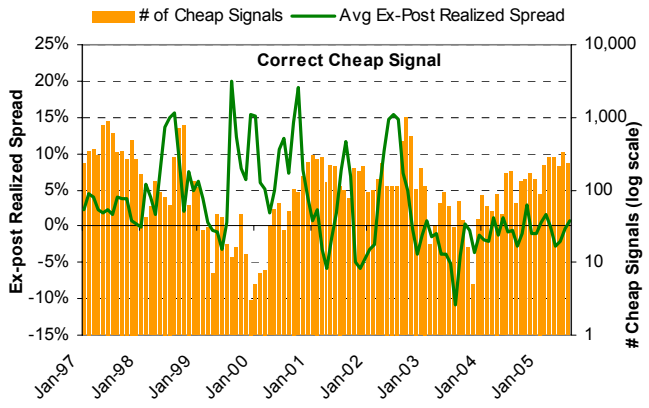
These factors indicate that our analysis likely errs on the side of conservatism and – despite the statistical limitations an empirical screening process inherently has – investors should be able to improve their ability to identify potential long or short volatility candidates by using our volatility screening methodology as a starting point for the rich versus cheap selection process.

Rich and Cheap Volatility Signals Across Business Cycles

Next, we examine whether these rich or cheap signals have been a reliable predictor of future realized volatility across business cycles (1997 – 2005). Figure 8 and Figure 9 show that ex-post realized volatility for "rich" options has tended to be lower than what was originally estimated by options market participants (implied volatility) throughout most of the sample period. In addition, ex-post realized volatility for "cheap" options tended to be higher than what was originally forecast throughout most of the period analyzed.

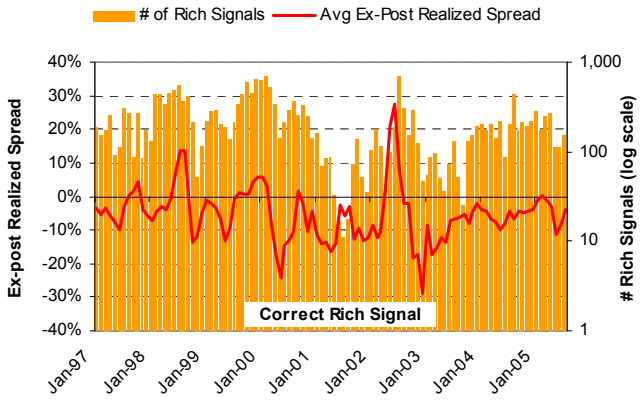
However, we also observe that identifying rich or cheap options has become more difficult in recent years, particularly for options having "cheap" implied volatilities. That is, future realized volatility for options originally identified as having cheap implied volatility did not tend to exhibit significantly higher ex-post realized volatility than what had initially been implied (realized volatility tended to drift lower throughout 2004 and 2005). We believe the largest factor contributing to this phenomenon relates to the persistent downward trend in market volatility since the beginning of 2003, which made it difficult to identify options that were truly trading "cheap". On the other hand, the recent declining volatility regime likely made it easier to identify options that were truly "rich". Another factor contributing to this result could be that the volatility market has become much more efficient, with increasing usage of similar quantitative rich/cheap screens incorporated by option market participants.

Figure 8: Monthly Performance of "Cheap" Signal



Source: Lehman Brothers, OptionMetrics

Figure 9: Monthly Performance of "Rich" Signal



Source: Lehman Brothers, OptionMetrics

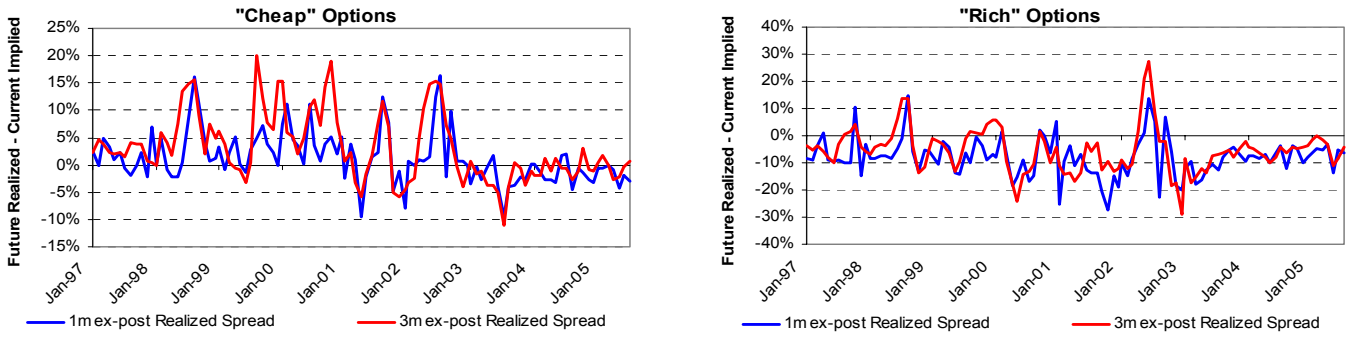
Are Near-Term Implied Volatility Spreads Better Indicators?

In this section, we test the predictive power of forecasting future realized volatility (ex-post realized) using z-scores based on 1-month and 3-month implied volatilities. Similar to the term structure of interest rates, near-term implied volatility responds more to short-term catalysts and tends to be subject to wilder swings than longer dated implied volatility. For example, 1-month implied volatility can change drastically, depending on whether or not a material catalyst, such as an earnings announcement, FDA drug approval or shareholder vote, is expected to occur prior to option expiration. If there is a catalyst forthcoming, 1-month implied volatility should reflect it and trade relatively high; if not, implied volatility should trade low. On the other hand, 3-month implied volatility – which always includes at least one earnings period – tends to be much more stable.

1-Month vs. 3-Month Implied Volatility Spreads

The first chart in Figure 10 compares the implied minus ex-post realized volatility spread for options having "cheap" 1-month volatility versus options having "cheap" 3-month implied volatilities. An option is considered to have cheap 1-month implied volatility if its 1-month implied volatility spread versus 22 trading-day realized, its 1-month sector weighted-average volatility spread and 1-month S&P 500 implied volatility spread are at least 1 standard deviation below the average of where each of these spreads had traded during the prior year (z-scores < -1). The same criteria apply for 3-month implied volatilities, except the realized volatility spread encompasses 66 trading days and the average sector implied volatility and the S&P 500 implied volatility correspond to 3 month terms. 3-month implied volatility appears to be a better metric for identifying stocks with relatively low risk expectations. This is also apparent in Figure 11, which shows the average difference between future realized volatility and the volatility originally implied is higher using 3-month volatility, while the standard deviation of the metric is lower.

Figure 10: Relative Performance of Rich/Cheap Metrics Using One-Month and Three-Month Implied Volatility Maturities



Source: Lehman Brothers, OptionMetrics

However, as the second chart in Figure 10 illustrates, 1-month implied volatility predicted future realized volatility for options classified as "rich" more accurately (although the standard deviation is higher). One possible explanation for this could be that heightened risk expectations often coincide with earnings announcements or other short-term events, and investors tend to express these concerns using the front month contract. Thus, short-term volatility would be more likely to revert sharply once the catalyst has passed. Investors purchasing unhedged options with the front month maturity close to a catalyst such as earnings would also tend to be willing to pay a larger premium to compensate for the larger expected swings in the underlying. On average, this "uncertainty premium" tends to dissipate once the event has passed.

Figure 11: Dependence on Maturity of Implied Volatility

Implied Volatility Maturity	Total	# Correct	% Correct	Avg Ex-post Realized - Current Implied	Median Ex-post Realized - Current Implied	Std Dev of Realized Spread
"Cheap" Options						
1-Month Implied	15,246	7,611	50%	1.95%	-0.02%	11.35%
3-Month Implied	17,940	10,174	57%	2.73%	1.26%	9.75%
"Rich" Options						
1-Month Implied	21,544	16,318	76%	-6.53%	-7.65%	20.13%
3-Month Implied	22,259	14,806	67%	-2.81%	-3.89%	16.11%

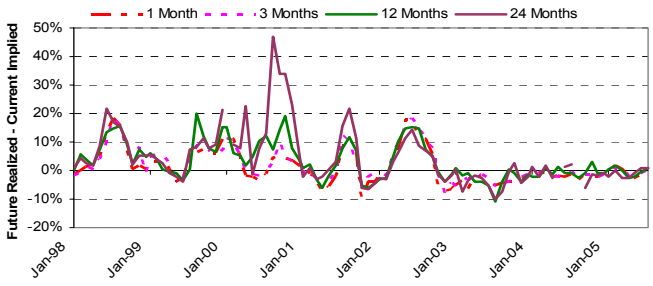
Source: Lehman Brothers, OptionMetrics

Optimal Look-Back Window for Calculating Average Spreads

Until this point, we have compared each of the implied volatility spreads to their respective 12-month histories and calculated the z-scores based on the deviation from their mean over that period. Is this the best look-back window over which to calculate the long-term average of each spread or can we empirically demonstrate better prediction of future realized volatility using a different time period?

Shorter periods are more likely to capture short-term momentum effects while longer periods tend to smooth out the impact of random spikes in the implied volatility history. We compare the accuracy of our metrics using 24-month, 12-month, 3-month and 1-month look-back histories for each of the three implied volatility spreads analyzed (using 3-month constant maturity implied volatilities).

Figure 12: Dependence of Predictability on Look-back History for "Cheap" Implied Volatilities

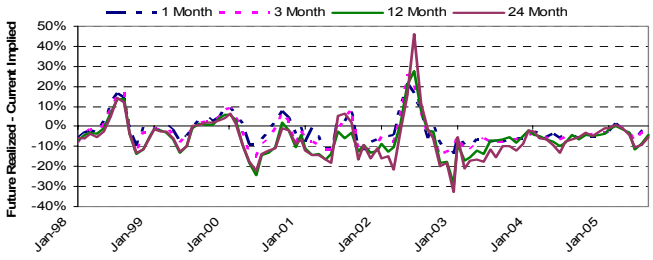


Look-back Window	Total	# Correct	% Correct	Avg Ex-post Realized - Current Implied	Median Ex-post Realized - Current Implied	Std Dev of Realized Spread
24 months	9,157	5,266	58%	3.5%	1.6%	11.4%
12 months	12,755	6,835	54%	2.8%	0.7%	11.0%
3 months	28,321	13,816	49%	1.7%	-0.2%	11.4%
1 month	43,023	19,196	45%	1.0%	-1.0%	12.0%

Source: Lehman Brothers, OptionMetrics

Figure 12 displays the impact of changing the time period used for calculating the history of z-scores for each of the spreads, for instances when the three metrics signaled volatility was "cheap". It is clear that the predictability of realized volatility increased as the look-back window against which the spreads were compared was increased. In addition, there were progressively fewer instances when implied volatility was considered cheap when measured against longer histories, and when using a two-year look-back period, future realized volatility exceeded implied volatility about 58% of the time. In addition, the average ex-post realized – implied spread was, on average, the highest when incorporating a 2-year look-back history.

Figure 13: Dependence of Predictability on Look-back History for "Rich" Implied Volatilities



Look-back Window	Total	# Correct	% Correct	Avg Ex-post Realized - Current Implied	Median Ex-post Realized - Current Implied	Std Dev of Realized Spread
24 months	17,353	11,478	66%	-3.3%	-4.1%	17.6%
12 months	20,117	13,359	66%	-2.8%	-4.0%	16.6%
3 months	31,870	21,108	66%	-1.9%	-3.8%	15.5%
1 month	42,728	27,670	65%	-1.4%	-3.3%	14.3%

Source: Lehman Brothers, OptionMetrics

Figure 13 illustrates that there is no significant difference in predictability for options signaled as having "rich" implied volatilities as the comparison history is increased. While the longer history allows for more accurate identification of the long-term mean of the volatility spread, it results in a weaker signal when volatility has been driven up in the near past because of upcoming catalysts. However, the average ex-post realized – current implied spread was, on average, the most negative when incorporating a 2-year look-back history.

Volatility Mean Reversion Across GICS Sectors

An option's implied volatility, which measures the total risk expectation in the underlying stock, is naturally impacted by factors specific to a company's sector. Figure 14 shows our rich and cheap metrics have, for the most part, been very successful in identifying stocks which have excessively high or low risk expectations embedded in their options, regardless of which sector the stocks belonged to. Over a nine year history, options in the Consumer Staples sector that had originally been characterized by our screen as having cheap volatility tended to have higher-than-originally-anticipated realized volatility over the next three months in two-thirds of the cases. In addition, options in the Industrials and Consumer Discretionary sectors originally identified as having relatively rich implied volatility tended to have lower-than-originally-anticipated realized volatility over the following three months on more than 7 out of 10 occasions.

Figure 14: Dependence of Indicators on GICS Sector

	Cheap Implied Volatility					Rich Implied Volatility				
Sector	Total	# Correct	% Correct	Avg Ex-post Realized - Current Implied	Std Dev of Ex-post Realized - Implied	Total	# Correct	% Correct	Avg Ex-post Realized - Current Implied	Std Dev of Ex-post Realized - Implied
Energy	924	536	58%	1.18%	5.79%	1,065	672	63%	1.93%	30.99%
Materials	2,235	1,293	58%	2.83%	8.33%	2,370	1,638	69%	-4.15%	12.84%
Industrials	2,743	1,537	56%	1.94%	7.44%	3,398	2,393	70%	-4.59%	12.41%
Consumer Discretionary	3,530	1,962	56%	3.22%	10.26%	4,803	3,360	70%	-4.74%	14.72%
Consumer Staples	1,611	1,068	66%	2.80%	7.00%	2,048	1,372	67%	-4.38%	13.60%
Health Care	2,071	1,028	50%	2.93%	16.32%	2,065	1,448	70%	-3.79%	16.23%
Financials	1,852	1,177	64%	3.55%	7.92%	2,371	1,523	64%	-0.50%	15.24%
Information Technology	1,751	953	54%	3.13%	9.53%	2,437	1,332	55%	1.46%	18.00%
Telecommunication Services	302	128	42%	1.91%	7.79%	521	294	56%	-1.22%	9.97%
Utilities	921	492	53%	1.88%	8.37%	1,181	774	66%	-1.16%	17.48%

Source: Lehman Brothers, OptionMetrics

Conclusion

We have proposed three metrics: z-scores of the spread of 1) implied volatility to realized 2) implied volatility relative to the S&P 500 implied and 3) implied volatility relative to sector weighted-average implied volatility (GICS sector) for identifying options having rich or cheap volatility. We have demonstrated that, on average, using a screening criterion of 1 z-score for each of these spreads results in more accurate prediction of future realized volatility than any single spread in isolation, although the standard deviation of the future realized – current implied volatility spread remains very high. We also found that, on average, one-month implied volatility spreads tend to more accurately identify overpriced options, whereas three-month implied volatility spreads are generally a more reliable predictor for cheap options. In addition, we found that using a two year look-back history when analyzing each of these spreads results in a more accurate determination of whether an option is pricing in unreasonably high or low implied volatility.

We believe – despite the statistical limitations an empirical screening process inherently has – one should be able to improve their ability to identify potential long or short volatility candidates by using our volatility screening methodology as a starting point in the rich/cheap volatility selection process.

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