

## CBOE S&P 500<sup>®</sup> 3-Month Volatility Index Description

Introduced in 1993, the CBOE Volatility Index<sup>®</sup>, “VIX<sup>®</sup>”, is widely recognized as the premier benchmark of stock market volatility and investor sentiment, often referred to as the market’s “fear gauge.” In 2003, CBOE updated the VIX methodology, paving the way for exchange-listed products, and establishing volatility as a new, tradable asset class. Today, VIX options and VIX futures are among the most actively traded contracts at CBOE and the CBOE Futures Exchange (CFE<sup>®</sup>), averaging close to 140,000 contracts combined, or about \$15 to \$20 million “vega”<sup>1</sup> per day.

This increased trading activity has coincided with a growing sophistication among volatility traders and a better understanding of the inherent complexity of option implied volatility, behavior that depends on multiple factors such as the volatility “smile” – implied volatility as a function of strike price, and the volatility “term structure” – implied volatility as a function of time to expiration. The CBOE S&P 500 3-Month Volatility Index provides a new benchmark for volatility traders and volatility watchers alike.

Like VIX, the CBOE S&P 500 3-Month Volatility Index measures the market’s expectation of future volatility conveyed by S&P 500 Index (SPX<sup>SM</sup>) option prices. However, this new index reflects 3-month SPX implied volatility rather than the 1-month implied volatility measured by VIX. As such, investors will be able to use VIX and the CBOE S&P 500 3-Month Volatility Index to track the movement of the SPX volatility term structure in the first four listed contract months - options that account for most of SPX trading activity.

On Monday, November 12, 2007, CBOE will begin disseminating real-time values for the CBOE S&P 500 3-Month Volatility Index under the ticker symbol “VXV”.

### *CBOE S&P 500 3-Month Volatility Index Calculation*

The CBOE S&P 500 3-Month Volatility Index measures the market's expectation of 3-month volatility implicit in the prices of S&P 500 Index options with roughly 3 months to expiration. VXV<sup>SM</sup> uses the same methodology and generalized formula used to calculate VIX<sup>2</sup>, but with a different set of SPX options, specifically SPX options with expiration dates that bracket a constant, 93-day maturity.

Generally, CBOE lists SPX option series in three near-term contract months plus at least three additional contracts expiring on the March quarterly cycle; that is, on the third Friday of March, June, September and December. For example, following the September 2007 expiration, the first six SPX contract months were three near-term contracts expiring in October, November & December, plus three quarterly-cycle contracts expiring in March 2008, June 2008 and September 2008.

---

<sup>1</sup> Vega is defined as the amount by which an option price will change if implied volatility moves by 1 point.

<sup>2</sup> Please refer to the VIX White Paper at <http://www.cboe.com/micro/vix/vixwhite.pdf>

As shown in the following table, on Monday, September 17, SPX November (60 days) and December (95 days) options most closely bracket the 93-day maturity. December implied volatility is weighted more heavily (94%) than November implied volatility because December options expire much closer to the 93-day standard.

	Days to Expiration								Option Weight							
	Oct	Nov	Dec	Jan	Feb	Mar	Jun	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Jun	Sep
September 17, 2007		60	95							6%	94%					
September 18, 2007		59	94	<i>Not Available</i>	<i>Not Available</i>					3%	97%	<i>Not Available</i>	<i>Not Available</i>			
September 19, 2007		58	93							0%	100%	<i>Not Available</i>	<i>Not Available</i>			
September 20, 2007			92	<i>Not Available</i>	<i>Not Available</i>	183					99%			1%		
September 21, 2007			91	<i>Not Available</i>	<i>Not Available</i>	182					98%			2%		
September 24, 2007			88			179					95%			5%		

On Wednesday, September 19, December SPX options have exactly 93 days to expiration, and account for 100% of the VXV value on that day.

On September 20, a new set of SPX options is used to calculate VXV, the two contract months that most closely bracket 93 days. Notice, however, that these two expirations are not sequential as before. In the absence of January and February contracts, VXV values are interpolated between December and March options expiring 3 months apart.

On the Monday following October expiration, the first day that January SPX options are listed, VXV is calculated using October and December options.

	Days to Expiration								Option Weight							
	Oct	Nov	Dec	Jan	Feb	Mar	Jun	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Jun	Sep
October 17, 2007			65			156					69%			31%		
October 18, 2007			64		<i>Not Available</i>	155					68%		<i>Not Available</i>	32%		
October 19, 2007			63			154					67%		<i>Not Available</i>	33%		
October 22, 2007				88		151						92%	<i>Not Available</i>	8%		
October 23, 2007				87		150						90%	<i>Not Available</i>	10%		
October 24, 2007				86		149						89%	<i>Not Available</i>	11%		

Likewise, on the Monday following November expiration, SPX February series are first listed, prompting another VXV “roll” to February and March options.

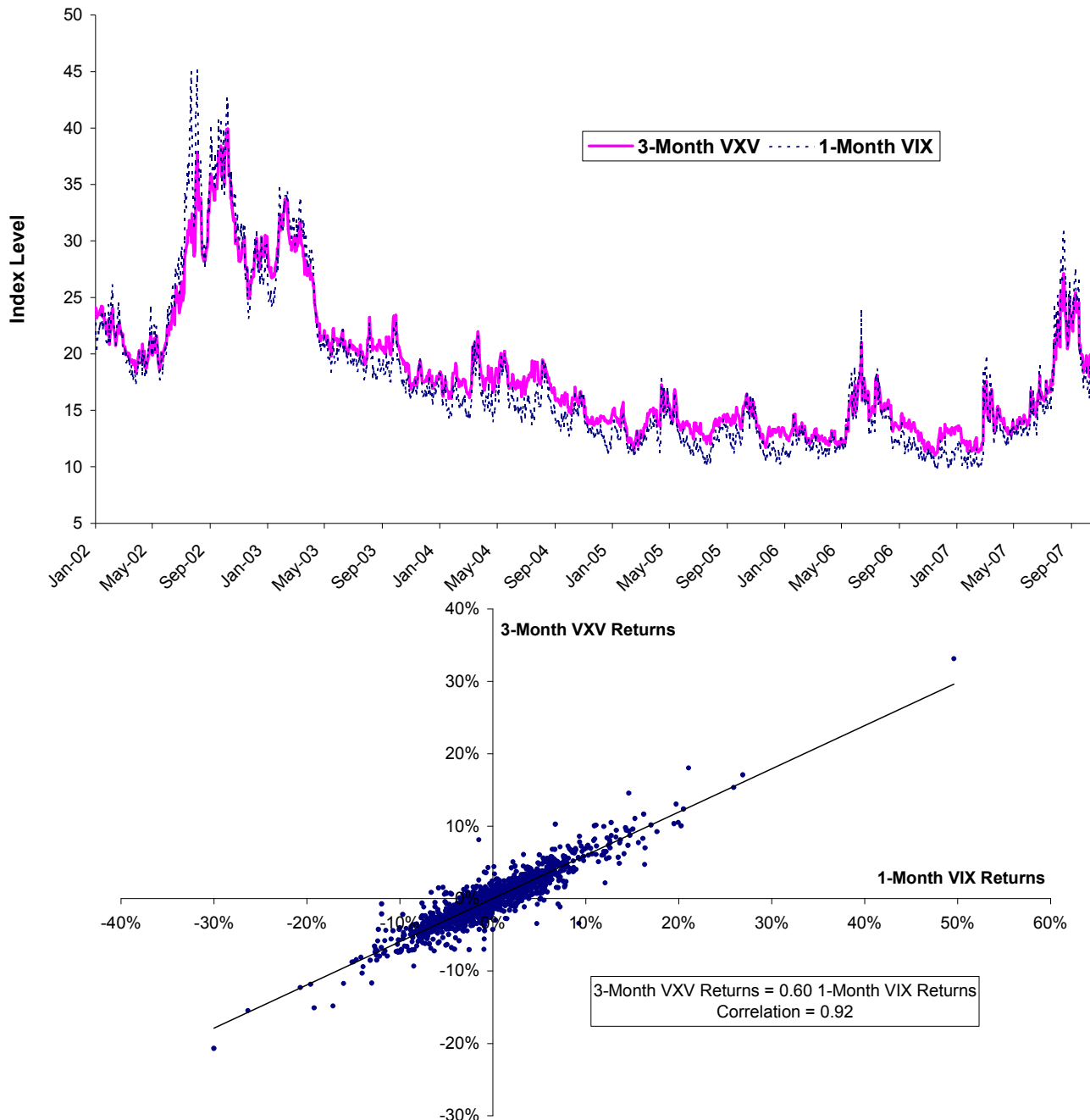
	Days to Expiration								Option Weight							
	Oct	Nov	Dec	Jan	Feb	Mar	Jun	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Jun	Sep
November 14, 2007				65		128						56%		44%		
November 15, 2007				64		127						54%		46%		
November 16, 2007				63		126						52%		48%		
November 19, 2007					88	123							86%	14%		
November 20, 2007					87	122							83%	17%		
November 21, 2007					86	121							80%	20%		

Note that when SPX contract months are sequential; that is, expiring one month apart, the “roll” is a smooth transition from one set of options to the next. Yet, when the expiration dates of the

SPX options used to calculate VXV are two or three months apart, there is a “jump” in the option weights by as much as 35%. CBOE has filed a proposed rule change with the SEC to allow CBOE to list four consecutive SPX contract months at any given time, which should eliminate this type of discontinuity in the future.

### *Analysis of CBOE S&P 500 3-Month Volatility Index*

CBOE has calculated historical prices for the CBOE S&P 500 3-Month Volatility Index (VXV) from January 2002. Since that time, VXV has ranged from a high of 39.91 on October 9, 2002, to a low of 11.05 on November 16, 2006. As shown in the charts below, the movement of VXV and 1-month VIX appears to be closely related, but there are important differences.

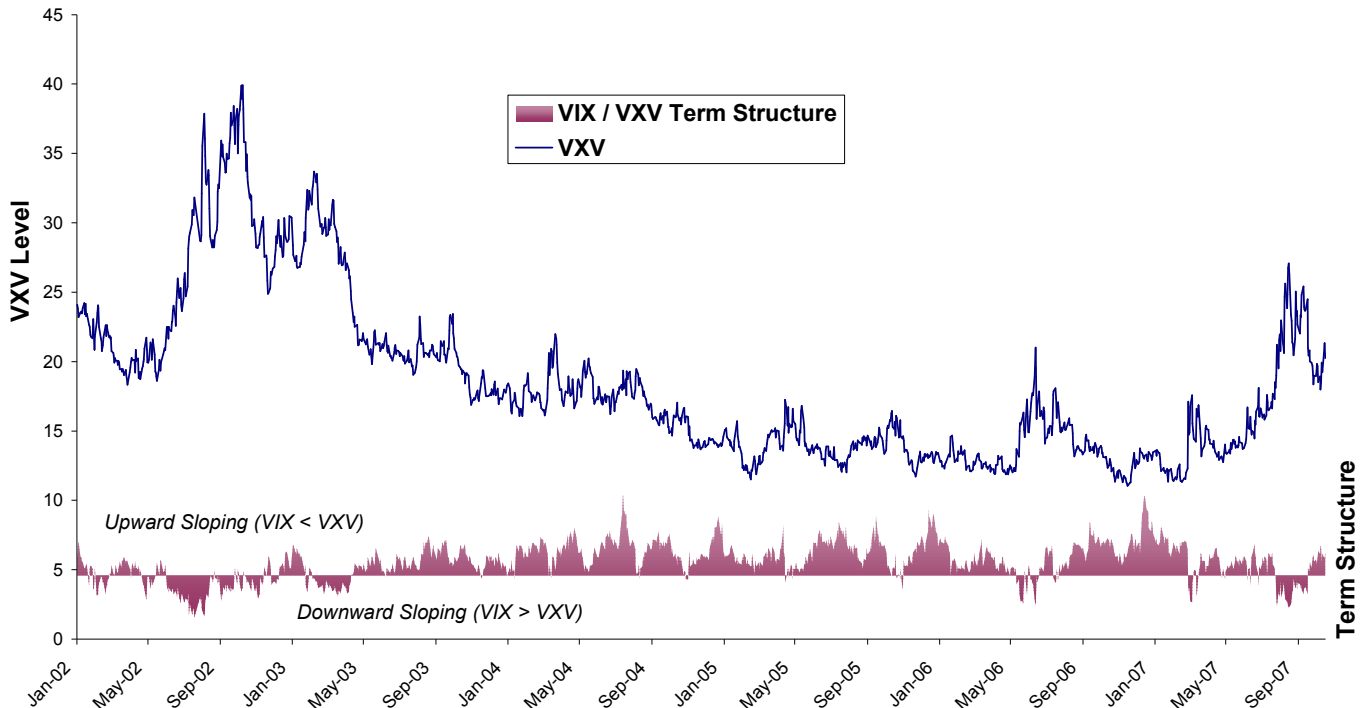


**CBOE Proprietary Information**

Copyright (c) 2007, Chicago Board Options Exchange, Incorporated. All rights reserved.

First, VXV has tended to be less volatile than 1-month VIX. Since January 2002, the volatility of VXV daily returns has been 58.4% compared to 90.1% for VIX. The correlation between VXV and 1-month VIX during that time was 0.92, indicating a strong tendency to move together, but far from moving in lockstep.

Using VXV and VIX together provides useful insight into the term structure of SPX option implied volatility. The following chart shows VXV price movement along with a measure of the difference between the 3-month VXV and 1-month VIX. Since January 2002, VXV has been higher than VIX – reflecting an upward sloping term structure – 79% of the time. However, 21% of the time, especially when volatility spikes, VIX is greater than VXV – reflecting a downward sloping term structure.



### *VXV / VIX Term Structure*

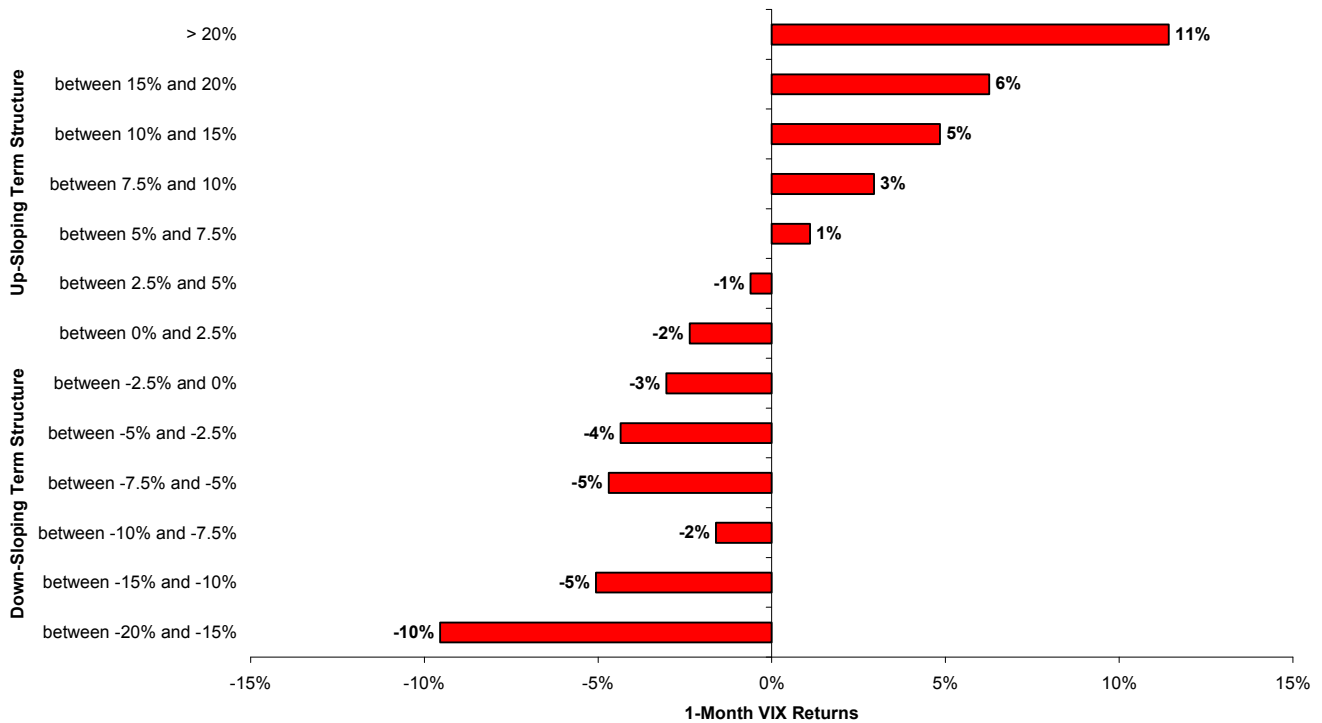
The behavior of VXV relative to VIX illustrates the mean-reverting properties of volatility and suggests that the slope of the 1- to 3-month SPX implied volatility term structure could be used to predict future levels of near-term (1-month) implied volatility. The following chart summarizes the results of a study measuring the average closing VIX level for a 1-month period

(i.e.,  $\sum_{i=1}^{20} VIX_i / 20$ ) following an observation of the direction and slope of the VXV / VIX term

structure. The term structure is quantified by taking the percent difference of VIX and VXV ( $\{VXV - VIX\}/VIX$ ). Positive values ( $VXV > VIX$ ) reflect an upward sloping term structure, negative values ( $VXV < VIX$ ) reflect downward sloping. The magnitude of these values reflects the slope of the term structure with higher positive, or lower negative, values indicating steeper slopes.

When the VXV / VIX term structure was sharply upward sloping; that is, 3-month VXV was higher than 1-month VIX by more than 10%, the average closing VIX level over the following 20 trading days was, on average, higher by at least 5%. Moreover, this effect became more pronounced as the slope of the term structure steepened.

**Average 1-Month Change in VIX by  
Direction & Slope of VXV / VIX Term Structure**



Conversely, when the slope of the VXV / VIX term structure was relatively flat (less than 5%) or downward sloping (VXV lower than VIX), VIX levels over the next month tended to be lower, on average.

As shown in the following table, since January 2002, the slope of the VXV / VIX term structure has been greater than 20% on 8 separate occasions covering 31 daily observations.

Event Date	Length (Days)	Max	Min	Average	Median
Dec-06	10	10.7%	2.5%	6.3%	6.3%
Jul-04	7	20.0%	7.6%	14.6%	13.3%
Dec-05	6	15.9%	4.5%	9.2%	7.2%
Dec-04	4	17.7%	12.0%	14.9%	14.9%
Apr-05	1	32.8%			
Jul-05	1	12.3%			
Sep-05	1	23.3%			
Sep-06	1	5.8%			

The longest period spanned 10 days in December 2006. There were four periods lasting just one day. The average closing VIX level for the following month for each observation was greater in every instance, ranging from a high of 32.8% to a low of 2.5%.

### *Conclusion*

The CBOE S&P 500 3-Month Volatility Index provides a valuable tool for investors to identify changes in the term structure of S&P 500 option implied volatility and, more importantly, make informed trading decisions based on a more complete understanding of a critical driver of option prices. This new indicator demonstrates that a single value for SPX option implied volatility is simply not enough; the term structure of implied volatility conveys significant insight on how the market views, and prices, the risks of buying and selling options of different maturities.

CBOE®, Chicago Board Options Exchange®, CFE®, CBOE Volatility Index® and VIX® are registered trademarks, and SPX<sup>SM</sup>, BXM<sup>SM</sup>, VPI<sup>SM</sup>, VXV<sup>SM</sup> and VARB-X<sup>SM</sup> are servicemarks of Chicago Board Options Exchange, Incorporated (CBOE). The methodologies of the CBOE volatility indexes and variance derivatives are owned by CBOE and may be covered by one or more patents or pending patent applications. Standard & Poor's®, S&P®, and S&P 500® are registered trademarks of The McGraw-Hill Companies, Inc. and are licensed for use by CBOE. All other trademarks and servicemarks are the property of their respective owners.

Options involve risk and are not suitable for all investors. Prior to buying or selling an option, a person must receive a copy of Characteristics and Risks of Standardized Options (ODD). Copies of the ODD are available from your broker, by calling 1-888-OPTIONS, or from The Options Clearing Corporation, One North Wacker Drive, Suite 500, Chicago, Illinois 60606. Past performance does not guarantee future results. The information in this document is provided solely for educational and informational purposes.