“The true investor welcomes volatility” – Warren Buffet

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US Volatility Research

Low Volatility Environment

The recent period of low volatility has attracted a lot of attention – We examine volatility levels in a historical context to see where they rank.

A lot of Attention

The recent period of low volatility has attracted a lot of attention – for example, sub-10 readings in the VIX as the market makes new all-time highs. Although volatility levels over the past 5 years have been well under median levels, current readings seem especially low. We examine volatility levels in a historical context to see where they stack up: How do current levels compare across all available data and across the most recent low volatility period (2006) from the previous market cycle?

The three metrics we examine are:

1. **Realized Volatility:** What the market realized in terms of movements. Calculated from historical closing prices and affects short-term implied volatility.
2. **Implied Volatility:** The market’s expectation of volatility. Calculated from listed option prices.
3. **Option Percentage Premiums:** Option prices expressed as a percentage of the prevailing market level.

1. Realized Volatility

3-month (“3M”) realized volatility – second lowest in four decades
Realized volatility over a 3-month period reached a low of 6.48% in 4/2017: second lowest in four decades. The last time it was below this level was in 10/1995 when it touched 6%.

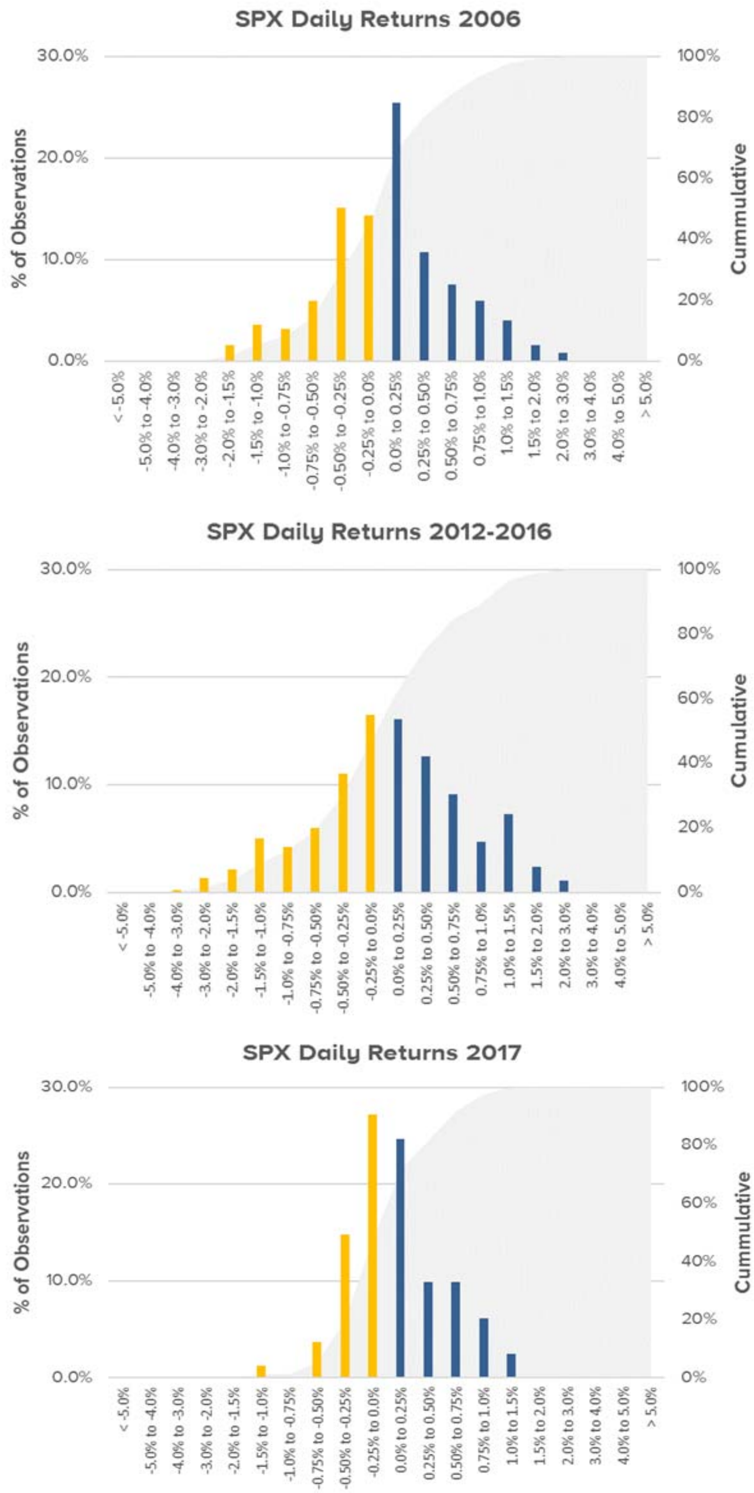
S&P 500 Index (“SPX”) daily moves
Shown in Exhibit 1 is a distribution of daily SPX returns for various years: 2006 (low volatility period of the last cycle); 2012-2016 (recent era of low volatility); and 2017. The specific years were chosen to represent arguably similar late cycle equity returns and low volatility periods in calendar years.

The low volatility period of the last equity market cycle (i.e. 2006) still showed a return distribution similar to that of 2012-2016.

Even compared with the low volatility periods of 2006 and 2012-2016, 2017 shows especially muted downside volatility.

Exhibit 1: Distribution of Daily SPX Returns in Various Years

Realized Volatility Conclusion



Source: Bloomberg. Data through May 1, 2017. Notes: This information is not intended as a recommendation to invest in any particular asset class or strategy or as a promise of future performance. Indexes are unmanaged and used for illustrative purposes only. They are not intended to be indicative of any fund or strategy's performance.

The levels recent implied volatility are comparable with the lowest we have seen in the entire history of S&P 500 implied volatility.

2. Implied Volatility

- **The VIX 9.77 low on 05/08/17: lowest since December 1993**
- **The SPX 3M implied volatility of 9.88: all-time low on 4/25/17**
- **SPX 3M 100% implied volatility average: 18.58 from 2000, 12.27 for 2006, 11.39 for Jan-Apr 2017**

The historical data for the VIX goes back to 1990 and the recent reading of 9.77 on 5/08/17 is the lowest since the 12/22/93 reading of 9.31. The third lowest close was on 1/24/2007 when the VIX reached 9.89.

As for the 3M implied volatility, the historical data does not go as far back as the VIX and are reliable since about 2000.

Implied Volatility Conclusion

The levels of the recent period are comparable with the lowest we have seen in the entire history of S&P 500 implied volatility.

3. Option Premiums

Exhibit 2 is an examination of percentage premium levels of the SPX 90-110 strangles (i.e. Price of a put struck at 90% of market level along with a call struck at 110% of market level) and 95-105 strangles expiring in 3 months since 2001. This shows that current levels are among the lowest encountered. Further, Exhibit 3 shows the rolling 3-month average of the 3-month 95-105 and 90-110 option premiums showcasing a longer term visual representation from April 2001 through April 2017.

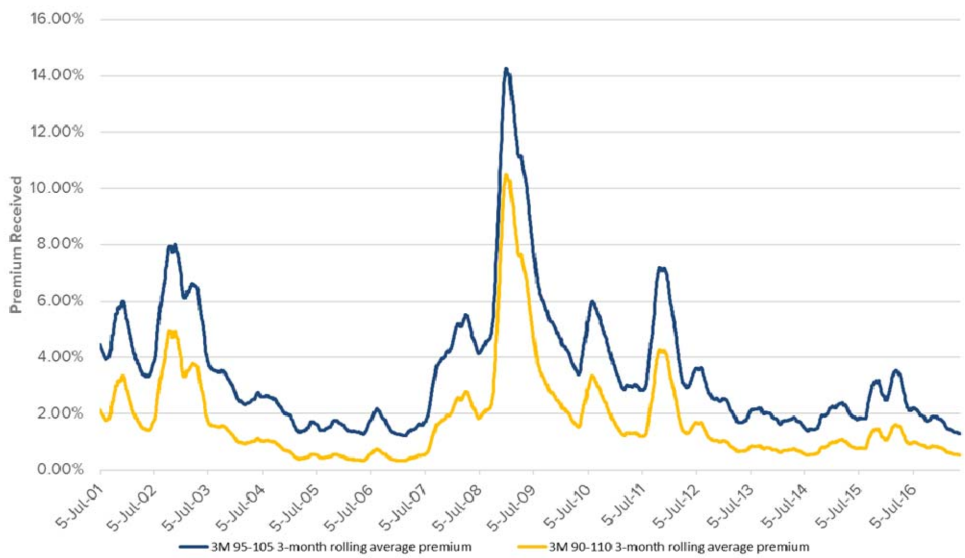
Exhibit 2: Average Option Premium Received, Various Time Frames

	3M 95-105 Put-Call	3M 90-110 Put-Call
Average (from 4/2001)	3.52%	1.76%
Current (5/19/17)	1.13%	0.49%
2017 average	1.31%	0.54%
2006 average	1.54%	0.46%
2012-2016 average	2.30%	0.98%

Source: Bloomberg and internal data. Data from April 2001 – April 2017. Notes: This information is not intended as a recommendation to invest in any particular asset class or strategy or as a promise of future performance. Indexes are unmanaged and used for illustrative purposes only. They are not intended to be indicative of any fund or strategy's performance.

The 3M 95-105 and 3M 90-110 rolling 3-month option premiums are currently amongst the lowest encountered.

Exhibit 3: Average Option Premium Received



Source: Bloomberg and internal data. Data from July 2001 – April 2017. Notes: This information is not intended as a recommendation to invest in any particular asset class or strategy or as a promise of future performance. Indexes are unmanaged and used for illustrative purposes only. They are not intended to be indicative of any fund or strategy's performance.

Option Premium Conclusion

Not surprisingly, recent premium levels compare favorably with the lowest seen in about 2 decades.

Comparison with Calendar Year 2006

Although some of the players and products of today's market have changed, the current volatility environment is not dissimilar to that seen in calendar year 2006. This low volatility period ended early in 2007, not long after the VIX put in its lowest print for that market cycle.

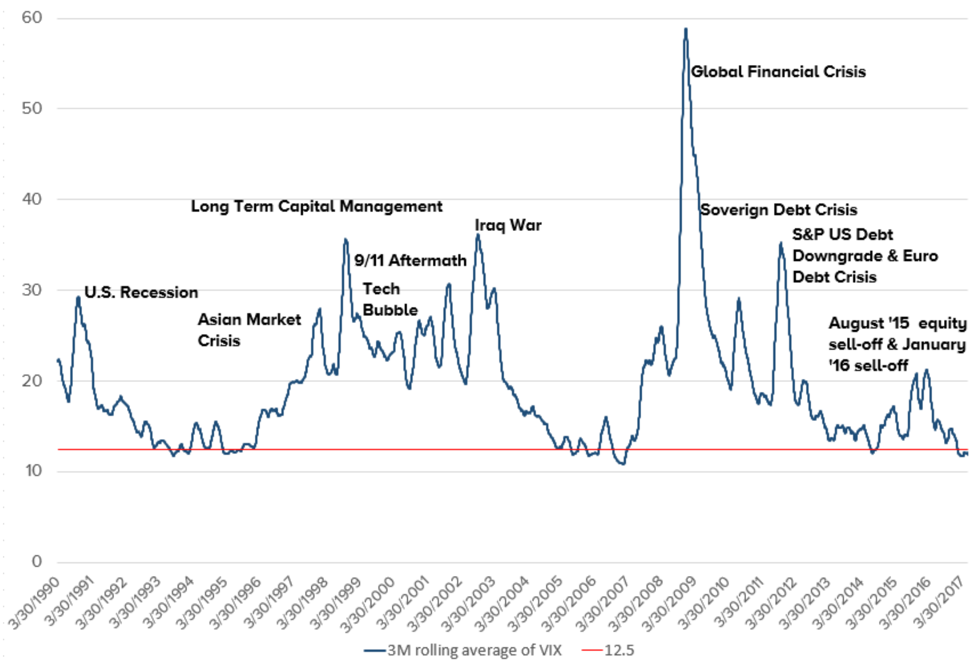
The most important new products in the tradeable landscape have been VIX futures and options. They were introduced in the 2006-07 volatility era, but did not see wide adoption till after the Global Financial Crisis. Currently, activity in the VIX, in terms of volatility exposure or 'vega', rivals that of the most widely used and liquid equity derivatives in the world – the S&P 500 Index options. Additionally, a large number of strategies are position-sized to trailing realized volatility levels.

While history may not repeat, it does rhyme. The current period of low volatility is similar to prior periods and history shows us the experience does not last forever.

Low Volatility Periods Do Not Last Forever

Exhibit 4 smooths the VIX into a 3-month rolling average and analyzes similar periods where the smoothed average trades below 12.5. What history tells us is that low volatility periods do not last forever. And in fact, today's low volatility regime is very similar to previous periods of low volatility.

Exhibit 4: VIX 3M Rolling Average



Source: Bloomberg. Data from March 1990 – May 2017. Notes: This information is not intended as a recommendation to invest in any particular asset class or strategy or as a promise of future performance. Indexes are unmanaged and used for illustrative purposes only. They are not intended to be indicative of any fund or strategy's performance.

Exhibit 5 shows the duration of prior instances of 3-month S&P 500 realized volatility below 10 and a 3-month rolling VIX average below 12.5. The higher threshold of the implied volatility (12.5) relative to the realized volatility (10) reflects the historical premium of the latter due to supply and demand. The 3-month realized volatility data goes back to 1972 and have a mean (median) period of 6.4 (4.6) months below 10 volatility. The VIX data start in 1990 and the 3-month average has a mean (median) period of 3.9 (3.6) months below 12.5 volatility. The longer data set for realized volatility illustrates that low volatility periods have not been confined to the post-1990 markets when options have been actively trading. Currently, 3-month realized volatility has been below 10 for 5.8 months (as of 5/19/17) and the 3-month VIX average has been below 12.5 for 3.8 months (as of 5/19/17).

Current month count of low volatility is currently inline with mean and median levels where a turning point occurred.

Exhibit 5: Mean-Median Months of Low Volatility Historically

3M SPX realized below 10			VIX 3M rolling average below 12.5		
Start	**End**	**Months**	**Start**	**End**	**Months**
2/16/1972	2/28/1973	12.6	-		
1/31/1977	11/14/1977	9.6	-		
6/14/1979	10/2/1979	3.7	-		
4/19/1985	10/1/1985	5.5	-		
10/23/1992	3/8/1993	4.5	-		
7/1/1993	4/4/1994	9.2	8/3/1993	11/15/1993	3.5
7/5/1994	10/28/1994	3.8	12/29/1993	3/14/1994	2.5
1/9/1995	1/10/1996	12.2	3/6/1995	10/2/1995	7.0
7/20/2005	10/20/2005	3.1	7/27/2005	10/10/2005	2.5
1/24/2006	5/30/2006	4.2	1/10/2006	5/26/2006	4.5
10/9/2006	2/27/2007	4.7	10/25/2006	3/30/2007	5.2
6/6/2014	10/3/2014	4.0	7/9/2014	9/5/2014	1.9
12/8/2016	**6/1/2017**	**5.8**	**2/8/2017**	**6/1/2017**	**3.8**
	Mean	6.4		**Mean**	3.9
	Median	4.6		**Median**	3.6

Source: Bloomberg. VIX data January 1990 – May 2017 and S&P 500 data from January 1972 -May 2017. Notes: This information is not intended as a recommendation to invest in any particular asset class or strategy or as a promise of future performance. Indexes are unmanaged and used for illustrative purposes only. They are not intended to be indicative of any fund or strategy's performance.

Conclusion

Premiums for various S&P 500 Index option strategies are comparable to the lowest levels (which occurred in 2006) of the past two decades. Notwithstanding some extreme readings, the 2017 low volatility period is comparable to that of the previous cycle which occurred in 2006, a year that was followed by a rise in volatility and a richer opportunity set. Although the future course of volatility cannot be predicted, history shows that volatility regimes do not last forever. Today's experience is similar to prior experiences and, if history is any guide, will not persist indefinitely.

ABOUT GLADIUS CAPITAL MANAGEMENT LP

Gladius Capital Management is an investment firm specializing in the global derivative markets. Investment strategies are managed by a team of highly experienced individuals with the singular goal of maximizing benefits for the firm's clients. Gladius strives to employ its cornerstone principles of excellence and intellectual integrity in all aspects of its professional culture.

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