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PutWrite Strategies and Market Valuation Levels

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After eight years of market recovery, 65% of investment managers now believe that the US equity market is overvalued (Northern Trust Asset Management, 2017). While some investors believe the current state of higher valuations is justified due to the low-interest-rate environment, others have a more bearish view. In this whitepaper, we assess the risk-adjusted performance of a PutWrite strategy on the market for various degrees of market valuation. We find that the PutWrite strategy historically produced consistent alpha under all states of market valuation – undervalued, fairly-valued, as well as overvalued. It is interesting to observe that in richly-valued markets the PutWrite strategy allowed investors to participate in further market upside and, from collecting the volatility risk premium, obtained downside protection in the event of a correction.

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Introduction

Since the S&P 500 hit the bottom during the financial crisis on March 9, 2009, it has rebounded by nearly 260%[1] through price appreciation alone. With this steady market recovery comes a growing concern that the US equity market is now overvalued. According to a recent survey conducted by Northern Trust (2017), nearly two-thirds of professional investors believe that US equities are indeed overvalued. For an investor that believes the market is overvalued, several potential courses of action may include: (a) continue holding US equities while acknowledging that returns may be lower in subsequent periods, (b) hedge out some equity exposure using derivatives, (c) reallocate capital into lower-risk assets, and (d) search for opportunities in other asset classes. The first option requires patience and discipline, with a view of investing over the long term. The next two alternatives aim to provide protection in anticipation of a market correction but they forgo some upside potential before the correction event occurs. The last alternative may allow investors to preserve return potential but one must recognize that they are investing in different risk assets and accessing different risk premia.

One class of strategies that has gained popularity in the search for alternative risk premia is cash-secured put-writing (PutWrite). These strategies typically write short-term near-the-money put options which are fully collateralized with money market securities. PutWrite strategies provide investors with access to the volatility risk premium and over the last 30 years such strategies have achieved equity-like returns with a lower standard deviation. While it is apparent that this risk premium is present and persistent over the long term, an interesting question is whether the volatility risk premium varies with aggregate perceptions of the stock market being overvalued or undervalued. Intuitively, this is possible since such beliefs by market participants translate to asset positioning, views of uncertainty, and the pricing of risk exposures.

In this paper, we wish to shed some light on the performance of PutWrite strategies *conditional on* perceived market valuation levels. In particular, we consider the risk-adjusted performance of the well-established CBOE S&P 500 PutWrite Index (PUT)[2] published by the Chicago Board Options Exchange. At present, of particular interest is the performance of the PUT Index in an overvalued market given that this is a widely held view amongst market participants. Consequently, we assess the performance of the PUT Index relative to some other investment alternatives that might be considered by market participants when they believe the market is overvalued.

[1] As of 6/30/2017.
[2] The PUT Index is a systematic cash-secured put-writing strategy which sells a sequence of one-month, at-the-money S&P 500 put options. See www.cboe.com/PUT for details.

An Indicator of Market Valuation Levels

The Price-to-Earnings (P/E) ratio of the S&P 500 is commonly used to characterize when the stock market is overvalued, fairly-valued or undervalued. Broadly speaking, the P/E ratio is measured by dividing the current level of the S&P 500 by the aggregate earnings of its constituent companies. Intuitively, this is a reasonable measure for the level of market valuation since the price of a stock should reflect the company's long-term future earnings potential; elevated P/E levels are associated with overvalued markets whereas depressed P/E levels with undervalued markets.

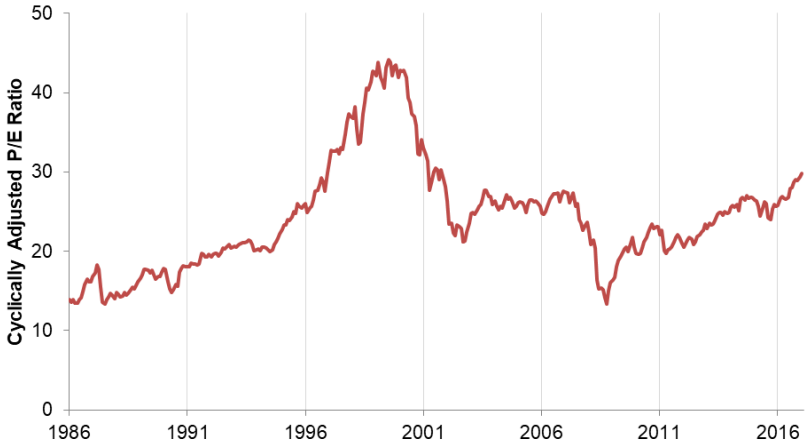
While the P/E ratio is a desirable metric in principal, practical implementation is not straightforward. This stems from difficulties associated with obtaining an appropriate earnings figure. Two commonly quoted P/E ratios in practice are the Trailing 12-month P/E and the Forward P/E. The former uses earnings from the most recent four quarters while the latter uses projected 12-month earnings. The Trailing 12-month P/E has the advantage of being objectively measurable but suffers from being a backward looking measure. The Forward P/E has the advantage of being forward looking but suffers from model risk. The problematic shortcoming of both measures is that they are myopic, hence not reflective of long-term earnings potential, and such short-term earnings figures can vary substantially from year to year.

Campbell and Shiller (1988) address the above concerns by suggesting the use of earnings over an extended period of time adjusted for inflation. In the analysis to follow, we use Shiller's Cyclically Adjusted Price-Earnings Ratio (CAPE) as a proxy for market valuation levels. To be more specific, the CAPE is computed as the ratio of the average S&P 500 price during the month to the average inflation-adjusted constituent company earnings from the most recent 10 years. This valuation metric has the distinct advantage of providing a stabilized earnings figure interpreted as an estimate of steady-state long-term earnings.

For the historical period June 1986[3] – July 2017, the CAPE ranged between 13 and 45 with an average of approximately 24.3. It reached its highest level in the late 1990's before the Dot-Com Bubble burst, and stands at approximately 30 as of 7/31/2017.

[3] Inception date of the CBOE S&P 500 PutWrite Index.

Exhibit 1: Cyclically Adjusted P/E Ratio, 6/1986 – 7/2017[4]



PutWrite and Cyclically Adjusted P/E

If someone says that they believe the market is overvalued, they typically mean that further upside is limited and/or a correction is coming but they don't know when. The latter qualification of "they don't know when" is important because it acknowledges that further upside is possible and a state of overvaluation can persist.

In order to obtain insight into the behavior of the volatility risk premium embedded in PutWrite strategies dependent on market valuation levels (as perceived by market participants using the P/E ratio as an indicator), we compare the total returns on the S&P 500 with the corresponding S&P 500 PutWrite strategy, the PUT Index. More specifically, we compare one-month returns after observing the level of CAPE, which can be interpreted as comparing the performance of the S&P 500 to the PUT Index *conditional on* high, average, and low market valuation levels.

Historical CAPE levels are sorted from lowest to highest and partitioned into four equally-sized buckets. The 1st quartile represents months when the CAPE is low, indicating an undervalued market, whereas the 4th quartile represents months when the CAPE is high, indicating an overvalued market. For each quartile, we consider the risk-return profile based on observed returns over the one-month period following the CAPE observation. To prevent outliers from biasing sample statistics, three-sigma events are excluded. From June 1986 to July 2017, there were three such events: October 1987 (Black Monday), August 1998 (Russian Financial Crisis), and October 2008 (Global Financial Crisis). If these events were included they would have been placed in the 1st quartile, 4th quartile and 2nd quartile, respectively.

[4] Source: Robert Shiller's dataset (refer to http://www.econ.yale.edu/~shiller/data.htm).

Exhibit 2: Performance Statistics of S&P 500 and PUT Index by CAPE Quartile[5]

Cyclically Adjusted Price-Earnings Ratio (CAPE) is a proxy for market valuation levels. It is computed as the ratio of the average S&P 500 price during the month to the average inflation-adjusted constituent company earnings from the most recent 10 years. Elevated CAPE levels are associated with overvalued markets whereas depressed CAPE levels with undervalued markets.

Full Sample: Average CAPE = 24.25

	Average Return	Standard Deviation	Realized Sharpe Ratio
S&P 500	12.59%	13.83%	0.672
PUT	11.68%	8.69%	0.965

1st Quartile: Average CAPE = 16.53

	Average Return	Standard Deviation	Realized Sharpe Ratio
S&P 500	19.10%	16.93%	0.821
PUT	17.91%	9.89%	1.285

2nd Quartile: Average CAPE = 21.50

	Average Return	Standard Deviation	Realized Sharpe Ratio
S&P 500	12.25%	11.81%	0.883
PUT	9.63%	7.68%	1.016

3rd Quartile: Average CAPE = 25.56

	Average Return	Standard Deviation	Realized Sharpe Ratio
S&P 500	11.21%	11.36%	0.789
PUT	8.42%	7.50%	0.822

4th Quartile: Average CAPE = 33.43

	Average Return	Standard Deviation	Realized Sharpe Ratio
S&P 500	7.81%	14.57%	0.268
PUT	10.84%	9.36%	0.740

For each market valuation quartile, an investment in the PUT Index yielded superior risk-adjusted performance relative to the S&P 500 total return, as evidenced by the Realized Sharpe Ratio. What is of particular interest is the performance comparison for the overvalued market partition – the 4th quartile. An investment in the PUT Index returned on average 10.84% annually, outperforming the S&P 500's annualized total return of 7.81%. Further, this was achieved with the PUT Index realizing a substantially lower volatility of 9.36% compared to 14.57% for the S&P 500 total return.

To further understand the risk/return characteristics at different market valuation levels, as proxied by Shiller's CAPE, we examine the beta and alpha of the PUT Index for each CAPE quartile. The monthly excess return series of the PUT Index ($r_{PUT} - r_f$) is regressed onto the monthly excess S&P 500 total return series ($r_{SPXTR} - r_f$). To prevent outliers from biasing estimates of beta, and other second-moment measures such as volatility and covariance, the previously mentioned three-sigma events are excluded from their calculation. One might argue that any apparent excess return captured by alpha may actually be fair compensation for such risk events. Consequently, these events are *not* excluded in the following alpha estimates.

[5] Source: Robert Shiller's dataset, Bloomberg and RJA analysis. Statistics are annualized. The Realized Sharpe Ratio is calculated using the realized average return and realized standard deviation, based on the 3-month Treasury yield corresponding to the return period.

Exhibit 3: Risk Characteristics of the PUT Index by CAPE Quartile[6]

	Average CAPE	Correlation w/ S&P 500	Volatility Ratio	Beta to S&P 500	Annualized Alpha
1st Quartile	16.53	0.818	0.584	0.483***	5.19%***
2nd Quartile	21.50	0.812	0.650	0.525***	1.17%**
3rd Quartile	25.56	0.829	0.661	0.546***	1.27%***
4th Quartile	33.43	0.775	0.643	0.495***	4.52%***
Full Sample	24.25	0.805	0.629	0.505***	3.10%***

*** - significant at 1% level; ** - significant at 5% level; * - significant at 10% level.

Despite the incorporation of large negative outlier events, the annualized alpha of the PUT Index is positive for each CAPE quartile, ranging from 1.17% to 5.19% per year. Of particular interest is that alpha is most prominent in the extreme quartiles, i.e. market undervaluation and market overvaluation. For both groups, alpha averages over 37 bps per month and is statistically significant at the 1% level. From a risk perspective all quartiles are similar in nature. Beta exposure to the S&P 500 does not vary substantially across quartiles: each is in the order of 0.5. The volatility ratio, which measures the amount of proportional total risk, also does not vary greatly and is in the order of 0.63, except the 1st quartile where the PUT Index exhibited slightly lower relative volatility.

To summarize the above findings, the PUT Index has historically provided superior risk-adjusted performance and generated alpha relative to the S&P 500. In particular, during times of market overvaluation, not only was alpha significant, the PUT Index exhibited both higher returns and notably lower volatility than the S&P 500 total returns.

A Closer Look: PutWrite in Two Overvalued Markets

In this section, we examine the PUT Index in greater depth by studying its performance during two historically overvalued markets: from the beginning of the Dot-Com Bubble to its crash, and from the start of the Housing Bubble through to the crash of the Global Financial Crisis. It is worth noting that these two periods have distinctively different shape characteristics in the path of the S&P 500 total returns over time. The Dot-Com Bubble is marked by a rapid rise in the stock market followed by an extended period of steady decline whereas the Housing Bubble exhibited a gradually rising market followed by a sharp dive.

[6] Source: Robert Shiller's dataset, Bloomberg and RJA analysis. Excess returns are calculated based on the 3-month Treasury yield.

(1) Dot-Com Bubble Inception to Crash (January 1997 – October 2002)

The Dot-Com Bubble started in the late 1990's as investors aggressively invested in commercialized internet companies. The S&P 500 doubled from the end of 1996 to the end of 1999, with the CAPE consistently above 27.5 while trending upward. Although some economists called the market overvalued in late 1996 (Grant, 1996), the Dot-Com Bubble did not burst until mid-2000. The market then fell steadily for an extended period before it bottomed out in October 2002.

(2) Housing Bubble Start through to the Global Financial Crisis (January 2005 – March 2009)

The housing market became highly leveraged in the early 2000's as interest rates remained low with easy access to credit. The CAPE hovered around 26.5 from 2005 to 2007. Similar to the Dot-Com Bubble, economists warned of an overvalued market in the second half of 2004 (Casscells & Asness, 2004) but the market downturn did not start until 2007. The S&P 500 subsequently plummeted by more than 55% before it hit the bottom on March 9, 2009.

For both of the above historical periods, we compare the risk-return profiles of four portfolios motivated by what an investor might consider if they believe the market to be overvalued: investment in

(a) S&P 500 total return index;
(b) S&P 500 total return index plus a monthly 5% out-of-the-money put, represented by the CBOE S&P 500 - 5% Put Protection Index (PPUT)[7];
(c) 50% invested in the S&P 500 with dividend reinvestment and 50% invested in 3-month T-bills; and
(d) CBOE S&P 500 PutWrite Index (PUT).

Similar to the previous analysis, outlier events (August 1998 and October 2008) are excluded from the beta calculation and included in the alpha calculation.

[7] The PPUT Index tracks the performance of a hypothetical portfolio that invests in the S&P 500 total return and buys a monthly 5% out-of-the-money S&P 500 put option. See www.cboe.com/PPUT for details.

Exhibit 4[8]: Historical Performance Statistics for Two Overvalued Market Periods

(1) Dot-Com Bubble Inception to Crash (January 1997 – October 2002)

Investment Strategy	Average Return	Standard Deviation	Realized Sharpe Ratio	Beta to S&P 500	Alpha (Annualized)
(a) S&P 500	4.58%	18.54%	0.003	1.000***	0.00%
(b) S&P 500 + Put Protection	2.06%	14.71%	-0.168	0.735***	-2.62%***
(c) 50% SPX + 50% 3-mo T-bills	5.00%	9.30%	0.051	0.500***	0.00%
(d) PUT Index	8.50%	12.66%	0.314	0.538***	3.61%***

*** - significant at 1% level; ** - significant at 5% level; * - significant at 10% level.

(2) Housing Bubble Start through to the Global Financial Crisis (January 2005 – March 2009)

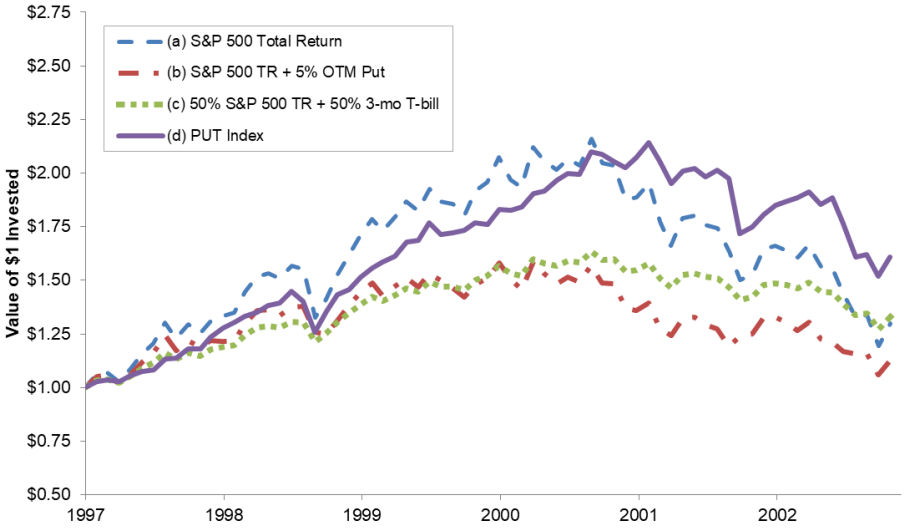
Investment Strategy	Average Return	Standard Deviation	Realized Sharpe Ratio	Beta to S&P 500	Alpha (Annualized)
(a) S&P 500	-7.47%	15.49%	-0.698	1.000***	0.00%
(b) S&P 500 + Put Protection	-5.62%	11.30%	-0.792	0.770***	-0.88%
(c) 50% SPX + 50% 3-mo T-bills	-1.90%	7.84%	-0.668	0.500***	0.00%
(d) PUT Index	-0.10%	12.71%	-0.271	0.581***	3.14%***

*** - significant at 1% level; ** - significant at 5% level; * - significant at 10% level.

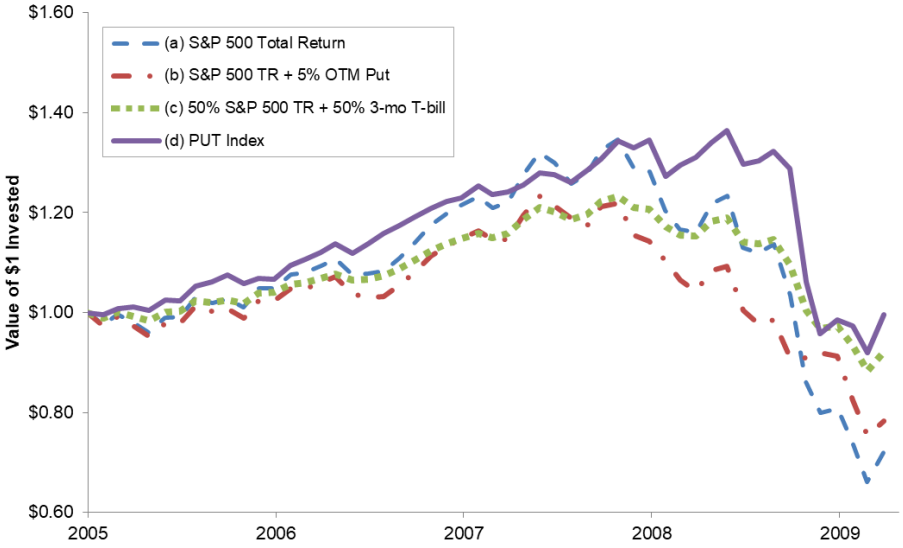
[8] Source: Bloomberg and RJA analysis. Statistics are annualized. The Realized Sharpe ratio is calculated based on the 3-month Treasury yield corresponding to the return period. Past results do not guarantee future performance.

Exhibit 5[9]: Growth of $1 for Two Overvalued Market Periods

(1) Dot-Com Bubble Inception to Crash (January 1997 – October 2002)



(2) Housing Bubble Start through to the Global Financial Crisis (January 2005 – March 2009)



[9] Source: Bloomberg and RJA analysis. Statistics are annualized. Past results do not guarantee future performance.

From the start of market overvaluation commentary through to the ensuing crash, both periods had an initial phase where the market continued to rise. The Dot-Com Bubble period had a more pronounced initial rise, so by the end, the market returned approximately the same as an investment in risk-free bonds over the entire period. This is not the case for the Housing Bubble / Financial Crisis period which experienced an exaggerated market decline at the end, resulting in notable underperformance relative to risk-free bonds. What is illustrated by the above examples is that it is very difficult (if not impossible) to call the top of the market and it is difficult to foresee the extent of a future downturn.

Strategy (b) may be viewed as purchasing tail protection by a cautious investor who believes the market is overvalued. This can turn out to be costly. Both periods above have been selected with an ending crash event and yet on a risk-adjusted basis, Strategy (b) underperforms, as can be seen from the Realized Sharpe Ratio and negative alpha, which in part reflects the embedded cost of put option purchases. Factors contributing to underperformance of this type include an inability to time the market top, along with efficiency considerations in the design of downside risk protection.

A cautious investor may simply wish to take money off the table via Strategy (c). Clearly this reduces market exposure, and hence volatility, which ultimately (after the fact) provided a benefit over both of the above selected periods. However, since the timing of market peaks and troughs is illusive, this type of strategy does little, if anything at all, toward improving investment performance on a risk-adjusted basis and does not add alpha.

The CBOE S&P 500 PutWrite Index yielded the best performance across all four alternatives on both an absolute and a risk-adjusted basis. Over the Dot-Com Bubble period, the PUT Index returned on average 8.50% annually, compared with 4.58% for the S&P 500, 2.06% for the Put-Protected S&P 500, and 5.00% for the 50/50 Risk Reduction Portfolio. The PUT Index achieved this outperformance with the second lowest annualized standard deviation amongst the investment alternatives of 12.66%, making it the most efficient with a Realized Sharpe Ratio of 0.314. Exhibit 5 further illustrates that the PUT Index also accomplished decent returns in the years leading up to the peak of the bubble, in contrast to the slower growth of the Put-Protected S&P 500 and the 50/50 Risk-Reduction investment alternatives.

Over the Housing Bubble / Financial Crisis period, the PUT Index lost only 10 bps on an annualized basis whereas the S&P 500, Put-Protected S&P 500, and 50/50 Risk-Reduction portfolios respectively lost 7.47%, 5.62% and 1.90% per year. During the Global Financial Crisis the market took a steeper downturn relative to the Dot-Com Crash. As a consequence, the PUT Index, which has a concave payoff profile in each expiration cycle, empirically resulted in a higher beta of 0.581. Despite this, the alpha-generating capability of the PUT Index was not

hindered, achieving an annualized alpha of 3.14%. Once again, Exhibit 5 illustrates that the PUT Index generated superior performance during the pre-crisis period allowing investors to participate in the market upside.

It is clear that during both periods, the volatility risk premium collected by the S&P 500 PutWrite Index generated alpha which allowed investors to achieve equity-like returns with lower volatility. In addition to reducing market exposure (beta) and reducing total risk (volatility), the PUT Index, through the continued collection of the volatility risk premium, also contributes to the downside protection as market valuations revert to a fair-valued or undervalued state.

Conclusion

In this whitepaper, the performance of the CBOE S&P 500 PutWrite Index (PUT) is examined during various market valuation levels as measured by Shiller's Cyclically Adjusted P/E ratio (CAPE). By partitioning the CAPE history into four equally-sized buckets, it is shown that the PUT Index has superior risk-adjusted performance compared to the S&P 500 in all four market valuation level groups. This superior performance presented itself both in the form of consistently higher Sharpe ratios and positive alpha. During times of market overvaluation, not only was alpha elevated and significant, but also the PUT Index outperformed the S&P 500 on an absolute basis with notably lower volatility.

Given the view that markets may now be overvalued, we provide an in-depth look at two historical periods of market overvaluation: the Dot-Com Bubble Inception to Crash (1997-2002), and the Housing Bubble Start through to Global Financial Crisis (2005-2009). Over both historical periods, the PUT Index not only outperformed the S&P 500, but also outperformed other risk-reducing investment alternatives, despite each period being selected to incorporate its respective subsequent crash event. For both periods, the PUT Index produced the highest average return, the highest risk-adjusted return, and the highest alpha.

In conclusion, PutWrite strategies appear to consistently provide positive alpha across varying market valuation levels. This alpha is attributed to the collection of the volatility risk premium embedded in PutWrite. What is particularly surprising is that in overvalued markets, alpha generation does not wane, but rather becomes more prominent. Historically, it has been observed that PutWrite strategies have allowed investors to participate in further market gains during the period leading up to a correction, and the continued collection of alpha contributes to downside protection when market valuations revert.

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