NEUBERGER BERMAN

Harnessing Small-Cap Volatility

Cboe Risk Management Conference – March 2, 2020

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Russell 2000 Index Option Markets

Russell 2000 30-Day At-The-Money Put Option Premiums (January 2005 – January 2020)

Option markets charge investors substantial premiums to speculate or to mitigate risk.

Long-term investors can earn attractive rates of return by underwriting equity market risk.

Small cap equity index option exposures can offer compensation for:

- Rates Sensitivity
- Liquidity
- Sector Concentrations
- Economic Cyclicality
- Increased Speculation
- Higher Growth Rates
- Earnings Volatility

Source: Cboe and Bloomberg. Implied volatility premium is derived from the Cboe Russell 2000 Volatility Index ("RVX") Index and the Russell 2000 Index. Indexes are unmanaged and are not available for direct investment. Investing entails risks, including possible loss of principal. Past performance is no guarantee of future results.

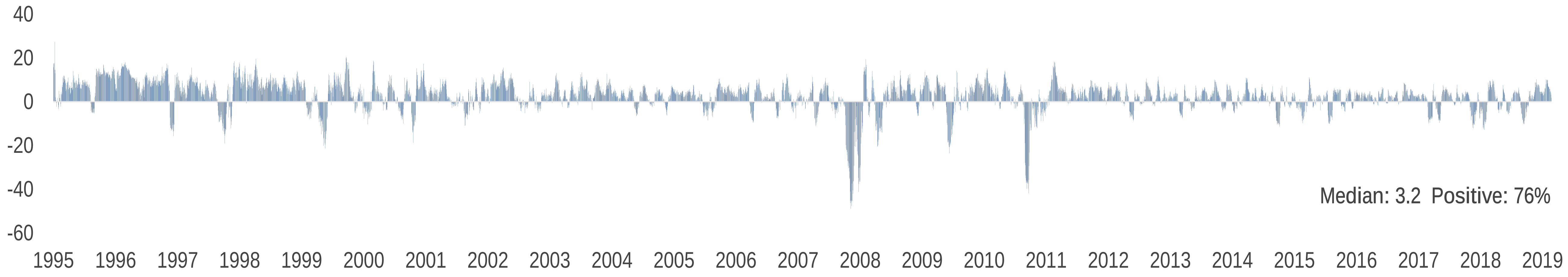
Russell 2000 Index Option Markets

Implied volatility premium

Implied Volatility Premium (Profit Margin)	=	Implied Volatility (Revenue)	−	Realized Volatility (Cost-of-Goods-Sold)	−	Operating Expenses

To be profitable, revenue must be greater than the cost-of-goods-sold over the long-run.

Russell 2000 30-Day Implied Volatility Premium (December 1995 – January 2020)



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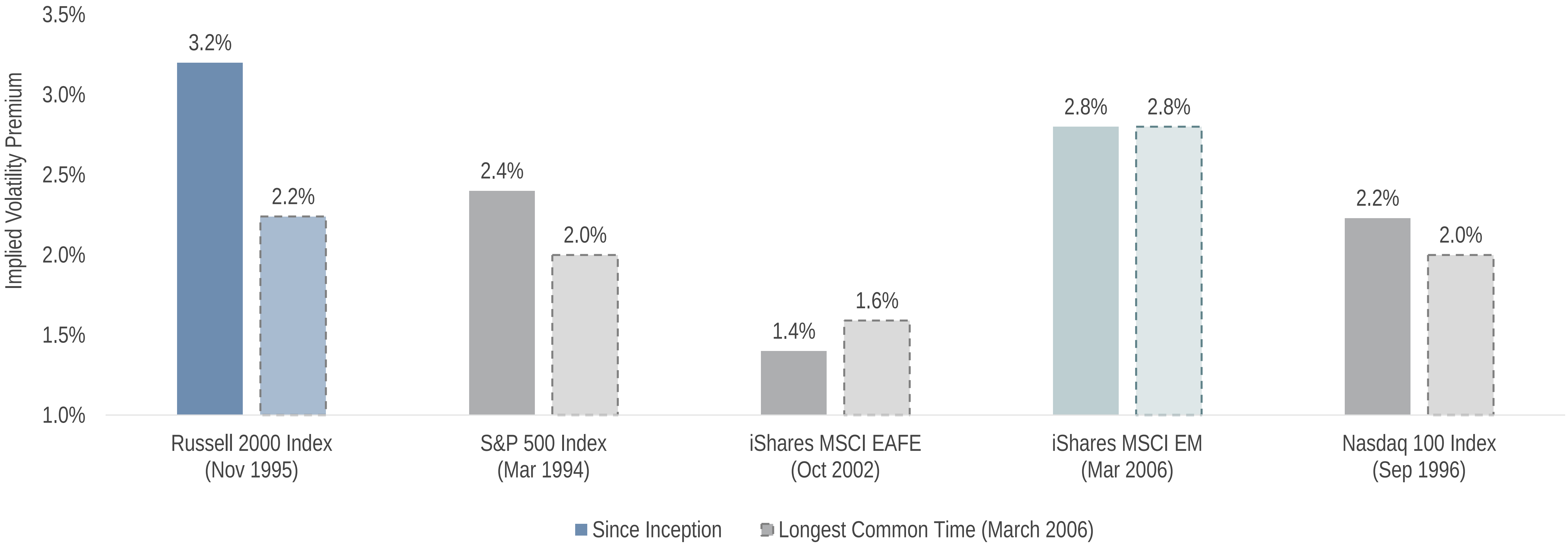
Russell 2000 Index Option Markets

Index put option implied volatility premiums[1]

Median Implied Volatility Premiums (30D, ATM Put Option)



[1] Put option premiums are estimated based on option implied volatility data sourced from Bloomberg and standard option price calculations. Premium yields are calculated as the option premium divided by the option strike price.

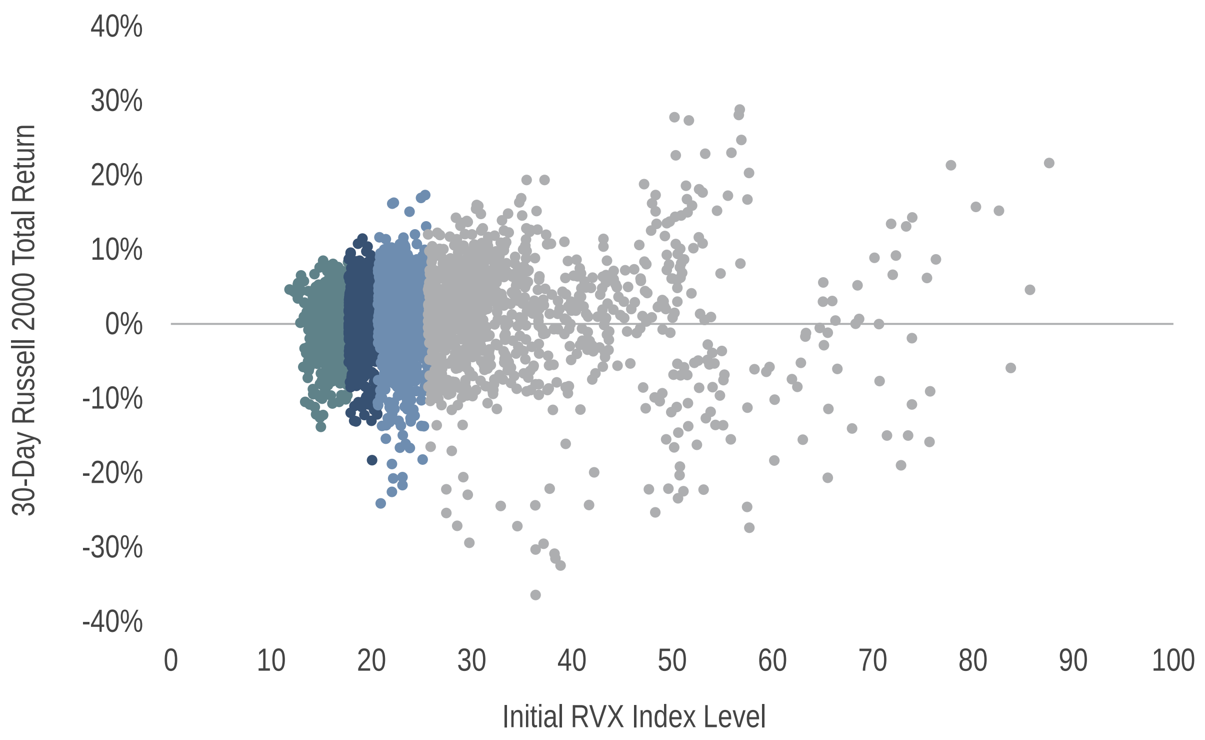
Sources: Cboe, Bloomberg LP. This material is intended as a broad overview of the Portfolio Managers' style, philosophy and process and is subject to change without notice. The use of tools cannot guarantee performance. Unless otherwise indicated, returns shown reflect reinvestment of dividends and distributions. Indexes are unmanaged and are not available for direct investment. Investing entails risks, including possible loss of principal. Past performance is no guarantee of future results.

Notes On Market Structure

Option implied volatility 'prices' risk: January 2004 – January 2020

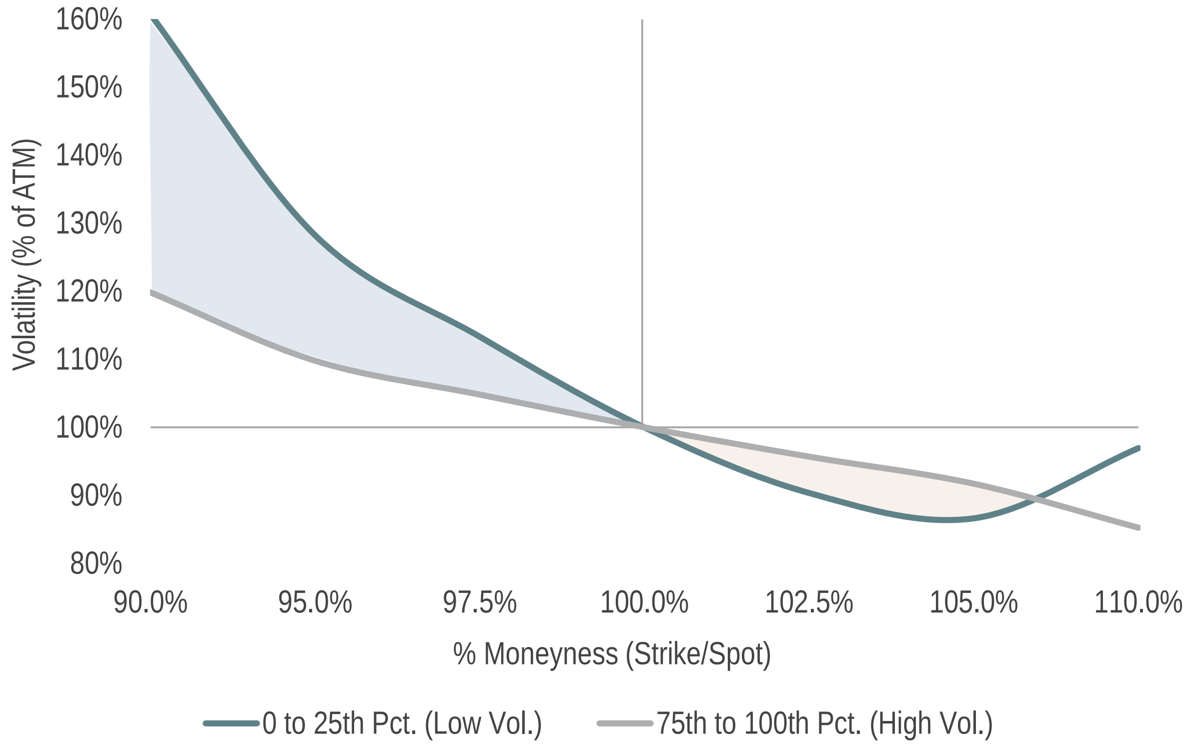
Implied volatility levels do not forecast the direction of underlying indexes. Rather, they are a forecast of index price risk, i.e., return dispersion.

30D Russell 2000 TR by Starting Cboe Russell 2000 Volatility Index ("RVX") Level



At low implied volatility levels, out-of-the-money options become comparatively expensive relative to periods of high volatility levels.

Russell 2000 30D Option Implied Volatility (IV) as a % of ATM Implied Volatility



This material is intended as a broad overview of the Portfolio Managers' style, philosophy and process and is subject to change without notice. Index returns sourced from Cboe and Bloomberg. Russell 2000 Index returns based on monthly Russell 2000 Total Return Index. Analysis limited to inception of the Cboe Russell 2000 Volatility Index (RVX). The use of tools cannot guarantee performance. Unless otherwise indicated, returns shown reflect reinvestment of dividends and distributions. Indexes are unmanaged and are not available for direct investment. Investing entails risks, including possible loss of principal. Past performance is no guarantee of future results. See Additional Disclosures at the end of this piece, which are an important part of this presentation.

Notes On Market Structure

Ample Liquidity[1]

Index Market Cap.	$2,550 Billion
Open Interest*	$78 Billion
Average Daily Trading Volume (YTD)*	$4.4 Billion
Contract Size (Notnl.)	~$166,000
Open Interest Put/Call Ratio*	2.2x

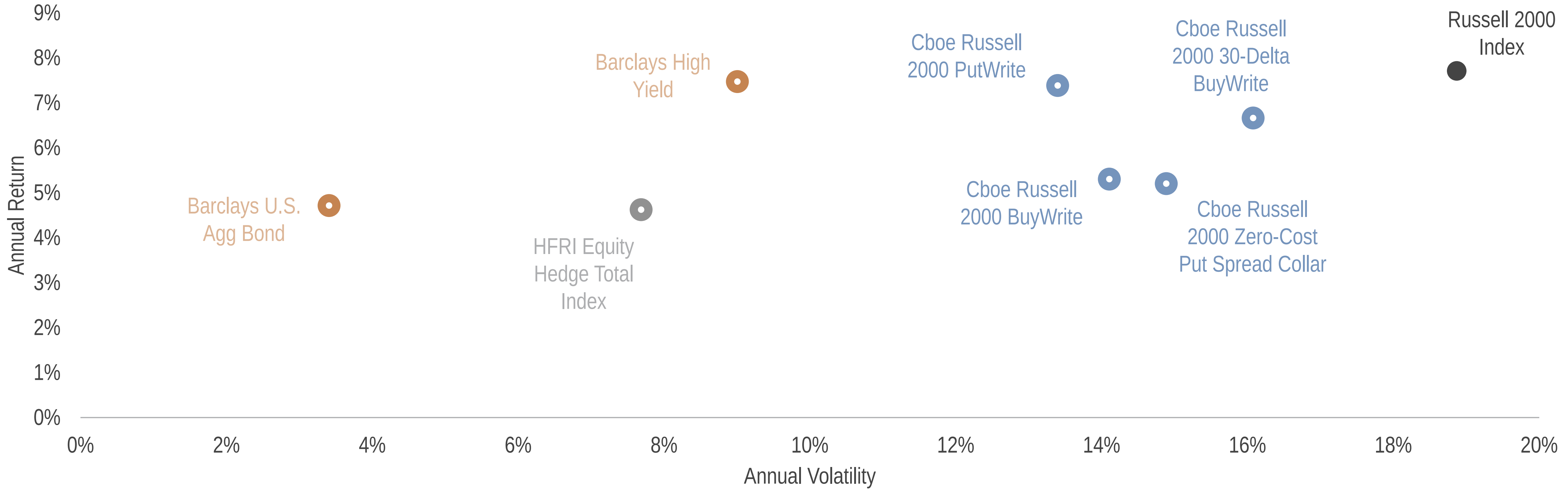
[1] Data as of February 10, 2020. This material is intended as a broad overview of the Portfolio Managers' style, philosophy and process and is subject to change without notice. The use of tools cannot guarantee performance. Unless otherwise indicated, returns shown reflect reinvestment of dividends and distributions. Indexes are unmanaged and are not available for direct investment. Investing entails risks, including possible loss of principal. Past performance is no guarantee of future results.

Strategies & Implementation

Efficient Small Cap Exposure

January 2001 – January 2020

Index Annual Return vs. Risk

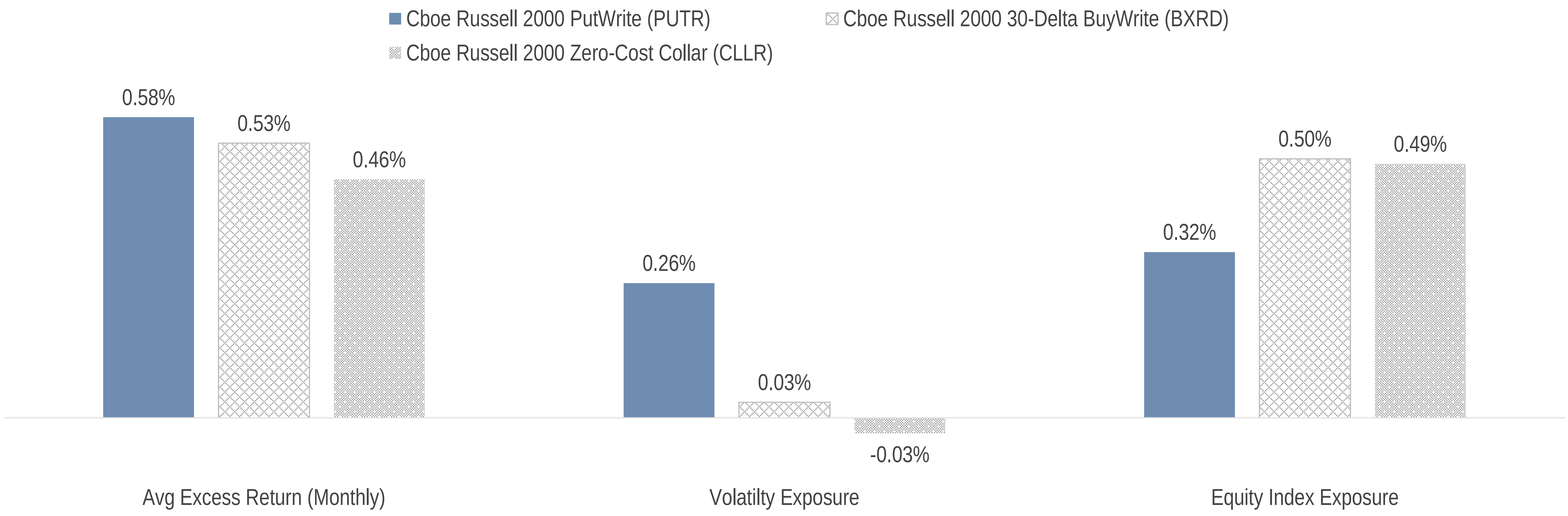


Source: Bloomberg LP and Cboe. Selected time period reflects longest common history of indexes. All returns are gross of fees except HFRI Indices. Gross of fee returns do not reflect the deduction of investment advisory fees, trading cost or any other expenses. If such fees and expenses were reflected, returns referenced would be lower. Indexes are unmanaged and are not available for direct investment. Unless otherwise indicated, returns reflect reinvestment of dividends and distributions. Investing entails risks, including possible loss of principal. **Past performance is no guarantee of future results.** See Additional Disclosures at the end of this piece, which are an important part of this presentation.

Efficient Volatility Exposure

Cboe Index Return Decomposition: January 2004 – January 2020[1]

Average Monthly Excess Return Attribution



[1] The Cboe Russell 2000 Volatility Index (RVX) incepted in January 2004.

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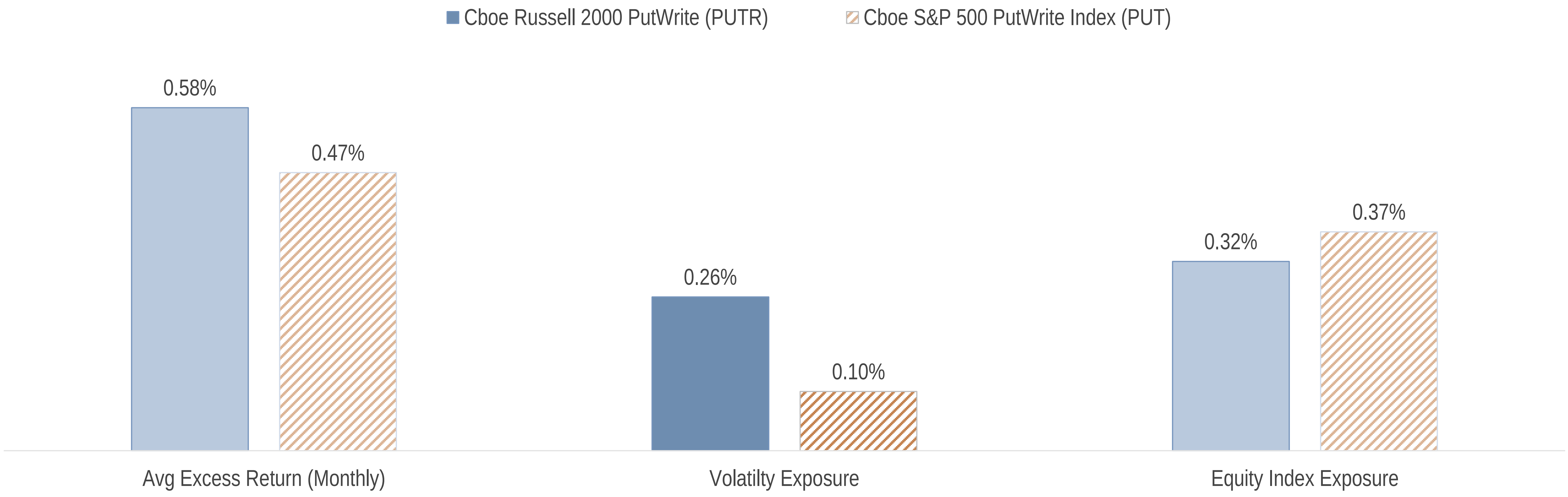

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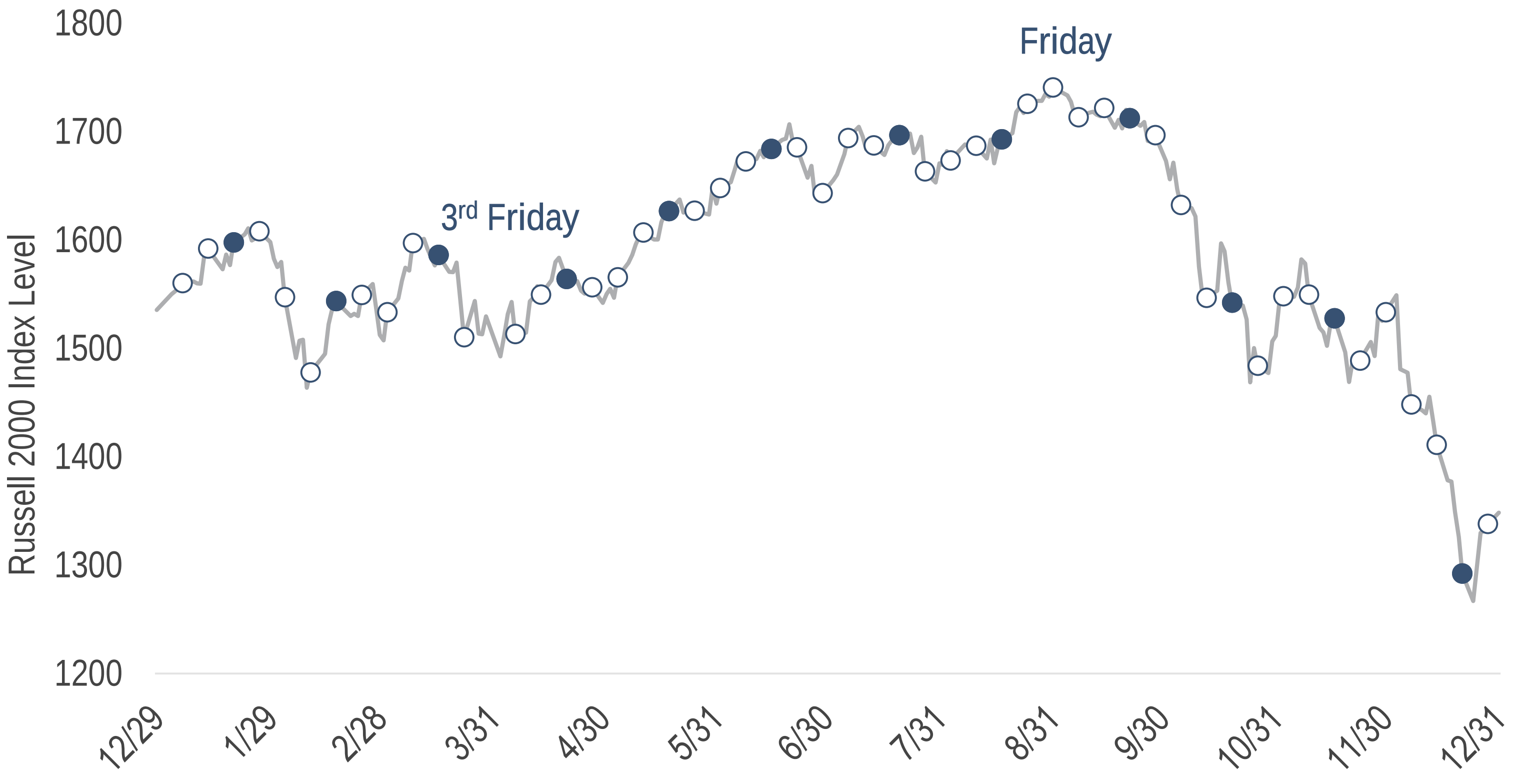
Why Option Tenor Selection Matters

2018: An Illustration of Short-Term Path Dependence: January 2018 – December 2018

The Effects of Tenor Selection

	Monthly Option Writing (PUTR)	One-Week Option Writing (WPTR)
Return, %	-10.0	-18.4
Volatility, %	15.0	13.3
Beta	0.74	0.67



The PUTR Index sold 12 put options in 2018 and the timing of its rolling in the first half was historically lucky. **Over longer periods, the distribution tends to be more even, as evidenced by the recent drawdown.**

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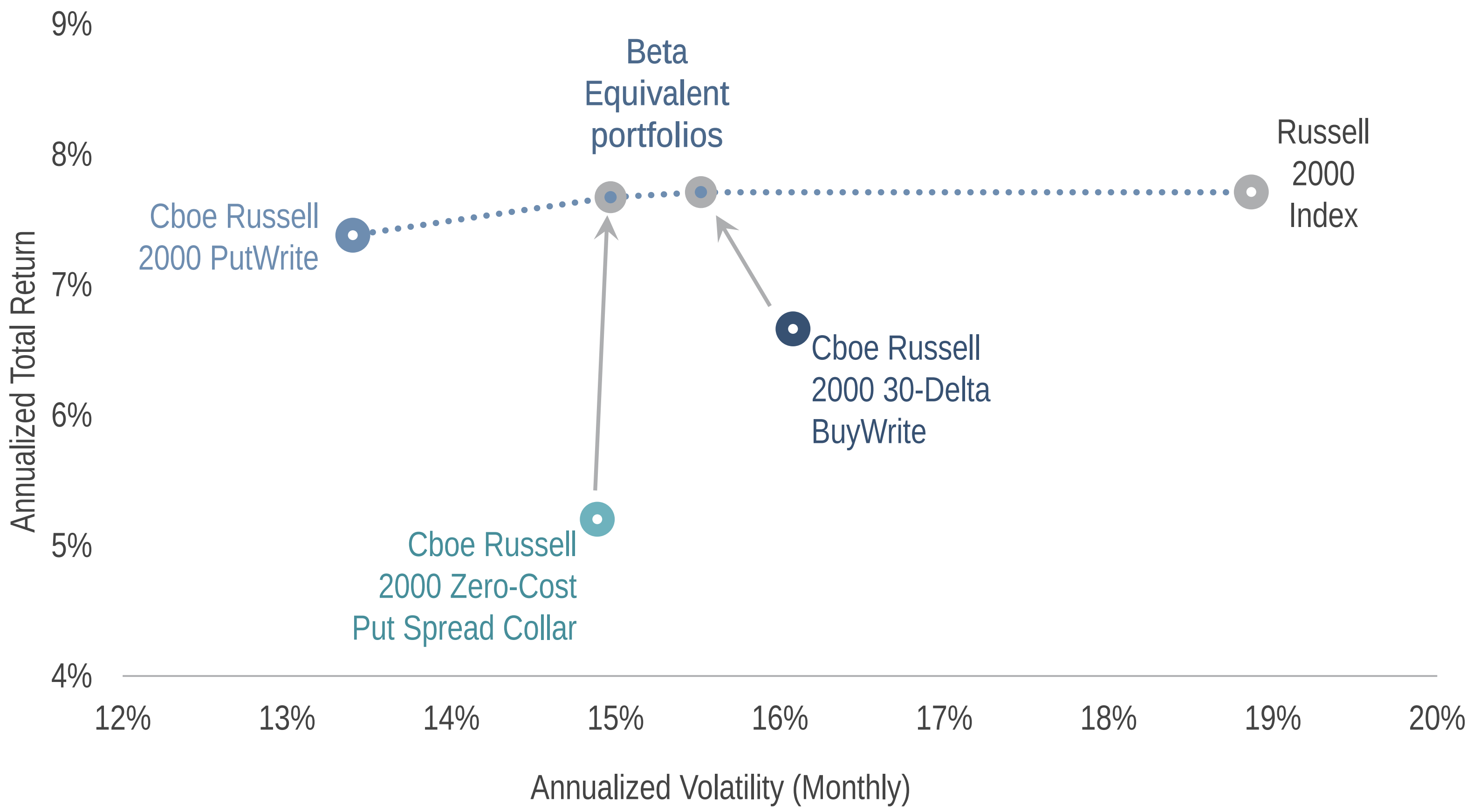
Building Efficient Allocations

January 2001 – January 2020

Index Annual Return vs. Risk



Blended allocations of Russell 2000 PutWrite and passive Russell 2000 exposure has the potential to:

- Offer more efficient equity portfolio risk reduction with less option exposure
- Preserve higher return potential of equity portfolio
- Result in lower management fees

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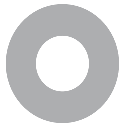
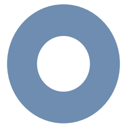
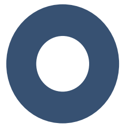
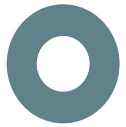
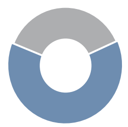
Building Efficient Allocations

January 2001 – January 2020

Summary Statistics

	Russell 2000	Cboe Russell 2000 PutWrite	Cboe Russell 2000 30-Delta BuyWrite	52% Russell 2000 48% Cboe Russell 2000 PutWrite	Cboe Russell 2000 Zero-Cost Put Spread Collar	42% Russell 2000 58% Cboe Russell 2000 PutWrite
						
Option Notional (%)	-	100	100	48	100	58
Annual Return (%)	7.7	7.4	6.7	7.7	5.2	7.7
Annual Volatility (%)	18.9	13.4	16.1	15.5	14.9	15.0
Risk-Adjusted	0.41	0.55	0.41	0.50	0.35	0.51
Beta	1.00	0.58	0.80	0.80	0.76	0.76
Drawdown	-52.9	-38.1	-50.0	-44.0	-47.9	-42.2
Up-Mkt Cap. (%)	100	59	80	80	73	76
Down-Mkt Cap. (%)	100	47	78	75	75	69

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Many Methods of Harvesting

Allocation	Objective	Implementation
Defensive Equity	Lower-Volatility Equity	• Funded Separate Account • Fund (Public or Private) • Sized consistent with other active managers or risk budgeting
Liquid Alternative	Equity L/S Exposure	• Funded Separate Account • Fund (Public or Private) • Typical allocation equivalent to that of several hedge fund allocations
Income	Yield Enhancement	• Overlay Account (margin) • Typical overlay notional exposure represents 10 – 25% of portfolio net asset value
Asset-Liability	Target Date Investments	• Funded Separate Account • Fund (Public or Private) • Risk budget allocation to reduced volatility and drawdowns dampen the funding risk

Additional Disclosures

Index Definitions

The Bloomberg Barclays U.S. High Yield Index covers the universe of fixed rate, non-investment grade debt. Eurobonds and debt issues from countries designated as emerging markets (sovereign rating of Baa1/BBB+/BBB+ and below using the middle of Moody's, S&P, and Fitch) are excluded, but Canadian and global bonds (SEC registered) of issuers in non-EMG countries are included. Original issue zeroes, step-up coupon structures, 144-As and pay-in-kind bonds (PIKs, as of October 1, 2009) are also included.

The Bloomberg Barclays U.S. Aggregate Index represents securities that are SEC-registered, taxable, and dollar denominated. The index covers the U.S. investment grade fixed rate bond market, with index components for government and corporate securities, mortgage pass-through securities, and asset-backed securities.

The Cboe Russell 2000 30-Delta BuyWrite Index is designed to track the performance of a hypothetical covered call strategy that holds a long position indexed to the Russell 2000 Index and sells a monthly out-of-the-money (OTM) Russell 2000 Index call option. The call option written is the strike nearest to the 30 Delta at 10:00 a.m. CT on the Roll Date.

The Cboe Russell 2000 BuyWrite Index is a benchmark index that measures the performance of a theoretical portfolio that sells Russell 2000 Index (RUT) call options, against a portfolio of the stocks included in the Russell 2000 Index.

The Cboe Russell 2000 One-Week PutWrite Index is designed to track the performance of a hypothetical strategy that sells an at-the-money (ATM) Russell 2000 Index put option on a weekly basis. The maturity of the written Russell 2000 put option is one week to expiry. The written Russell 2000 put option is collateralized by a money market account invested in one-month Treasury bills.

The Cboe Russell 2000 PutWrite Index is designed to track the performance of a hypothetical strategy that sells a monthly at-the-money (ATM) Russell 2000 Index put option. The written Russell 2000 put option is collateralized by a money market account invested in one-month Treasury bills.

The Cboe Russell 2000 Volatility Index (RVX) is a key measure of market expectations of near-term volatility conveyed by Russell 2000 stock index option prices. It measures the market's expectation of 30-day volatility implicit in the prices of near-term Russell 2000 options. RVX is quoted in percentage points, just like the standard deviation of a rate of return, e.g. 19.36. Cboe disseminates the RVX index value continuously during trading hours. The RVX Index is a leading barometer of investor sentiment and market volatility relating to the Russell 2000 Index.

The Cboe Russell 2000 Zero-Cost Put Spread Collar Index is designed to track the performance of a hypothetical option trading strategy that 1) holds a long position indexed to the Russell 2000 Index; 2) on a monthly basis buys a 2.5% - 5% Russell 2000 Index put option spread; and 3) sells a monthly out-of-the-money (OTM) Russell 2000 call option to cover the cost of the put spread.

The HFRI Equity Hedge Index is comprised of managers typically maintaining at least 50%, and in some cases be substantially entirely invested in equities and equity derivatives, both long and short. Strategies can be broadly diversified or narrowly focused on specific sectors and can range broadly in terms of levels of net exposure, leverage employed, holding period, concentrations of market capitalizations and valuation ranges of typical portfolios. The HFRI Emerging Markets Index is comprised of strategies according to their regional investment focus only. There is no investment strategy criteria for inclusion in these indices.

The iShares MSCI EAFE ETF seeks to track the investment results of an index composed of large- and mid-capitalization developed market equities, excluding the U.S. and Canada.

The iShares MSCI Emerging Markets ETF seeks to track the investment results of an index composed of large- and mid-capitalization emerging market equities.

The Nasdaq-100 Index is one of the world's preeminent large-cap growth indexes. It includes 100 of the largest domestic and international non-financial companies listed on the Nasdaq Stock Market based on market capitalization.

The Russell 2000 Index measures the performance of the small-cap segment of the U.S. equity universe. The Russell 2000 Index is a subset of the Russell 3000® Index representing approximately 8% of the total market capitalization of that index. It includes approximately 2,000 of the smallest securities based on a combination of their market cap and current index membership.

The S&P 500 Index consists of 500 stocks chosen for market size, liquidity, and industry group representation. It is a market value weighted index (stock price times number of shares outstanding), with each stock's weight in the Index proportionate to its market value. The "500" is one of the most widely used benchmarks of U.S. equity performance. As of September 16, 2005, S&P switched to a float-adjusted format, which weights only those shares that are available to investors, not all of a company's outstanding shares. The value of the index now reflects the value available in the public markets.

Additional Disclosures

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Options involve investment strategies and risks different from those associated with ordinary portfolio securities transactions. By writing put options, an investor assumes the risk of declines in the value of the underlying instrument and the risk that it must purchase the underlying instrument at an exercise price that may be higher than the market price of the instrument, including the possibility of a loss up to the entire strike price of each option it sells but without the corresponding opportunity to benefit from potential increases in the value of the underlying instrument. If there is a broad market decline and the investor is not able to close out its written put options, it may result in substantial losses to the investor. The investor will receive a premium from writing options, but the premium received may not be sufficient to offset any losses sustained from exercised put options. Put writing makes an explicit trade-off between up-market participation and down-market participation, while still seeking reasonable returns in flat markets. As such, in up markets, an investor typically will not participate in the full gain of the underlying index above the premium collected.

This material may include estimates, outlooks, projections and other “forward-looking statements.” Due to a variety of factors, actual events or market behavior may differ significantly from any views expressed.

Leverage. Option overlay strategies employ the use of derivatives and leverage, which involves the risk of loss greater that the actual cost of the investment, and also involves margin and collateral requirements. Leverage magnifies both the favorable and unfavorable effects of price movements in the investments made by an account, which may subject it to substantial risk of loss. In the event of a sudden, precipitous drop in value of an account’s assets occasioned by a sudden market decline, it might not be able to liquidate assets quickly enough to meet its margin or borrowing obligations. Also, because acquiring and maintaining positions on margin allows an account to control positions worth significantly more than its investment in those positions, the amount that it stands to lose in the event of adverse price movements is higher in relation to the amount of its investment. In addition, since margin interest will be one of the account’s expenses and margin interest rates tend to fluctuate with interest rates generally, it is at risk that interest rates generally, and hence margin interest rates, will increase, thereby increasing its expenses.

Representative portfolio information (characteristics, holdings, weightings, etc.) is based upon the composite or a representative/model account. Representative accounts are selected based on such factors as size, length of time under management and amount of restrictions. Any segment level performance shown (equity only or fixed income only) is presented gross of fees and focuses exclusively on the investments in that particular segment of the portfolio being measured (equity or fixed income holdings) and excludes cash. Client accounts are individually managed and may vary significantly from composite performance and representative portfolio information. Specific securities identified and described do not represent all of the securities purchased, sold or recommended for advisory clients. It should not be assumed that any investments in securities, companies, sectors or markets identified and described were or will be profitable.

Gross of fee returns do not reflects the deduction of investment advisory fees and other expense. If such fees and expense were reflected, returns referenced would be lower. Advisory fees are described in Part 2 of Neuberger Berman’s Form ADV. A client's return will be reduced by the advisory fees and any other expenses it may incur in the management of its account. The deduction of fees has a compounding effect on performance results. For example, assume Neuberger Berman achieves a 10% annual return prior to the deduction of fees each year for a period of ten years. If a fee of 1% of assets under management were charged and deducted from the returns, the resulting compounded annual return would be reduced to 8.91%. Please note that there is no comparable reduction from the indices for the fees.

Additional Disclosures

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