Why Volatility in Not Yet an Asset Class:

How to Find Sustainable Yield and
Tail Risk Opportunities in the Options Market

Margaret Sundberg

Quantitative Trader & Portfolio Manager

Vivek Kapoor

CEO/CIO

VOLARIS
CAPITAL MANAGEMENT

Presentation Overview

NATURE OF S&P 500 INDEX RETURNS

↓

IMPLICATIONS FOR OPTIONS

Generalized Auto Regressive Asset Model[1]

Optimal Hedge Monte-Carlo[2]

↓

FIVE CARDINAL CHARACTERISTICS OF OPTIONS

↓

WHY VOLATILITY IS NOT YET AN ASSET CLASS

Analysis of SPX Index Volatility Indexes

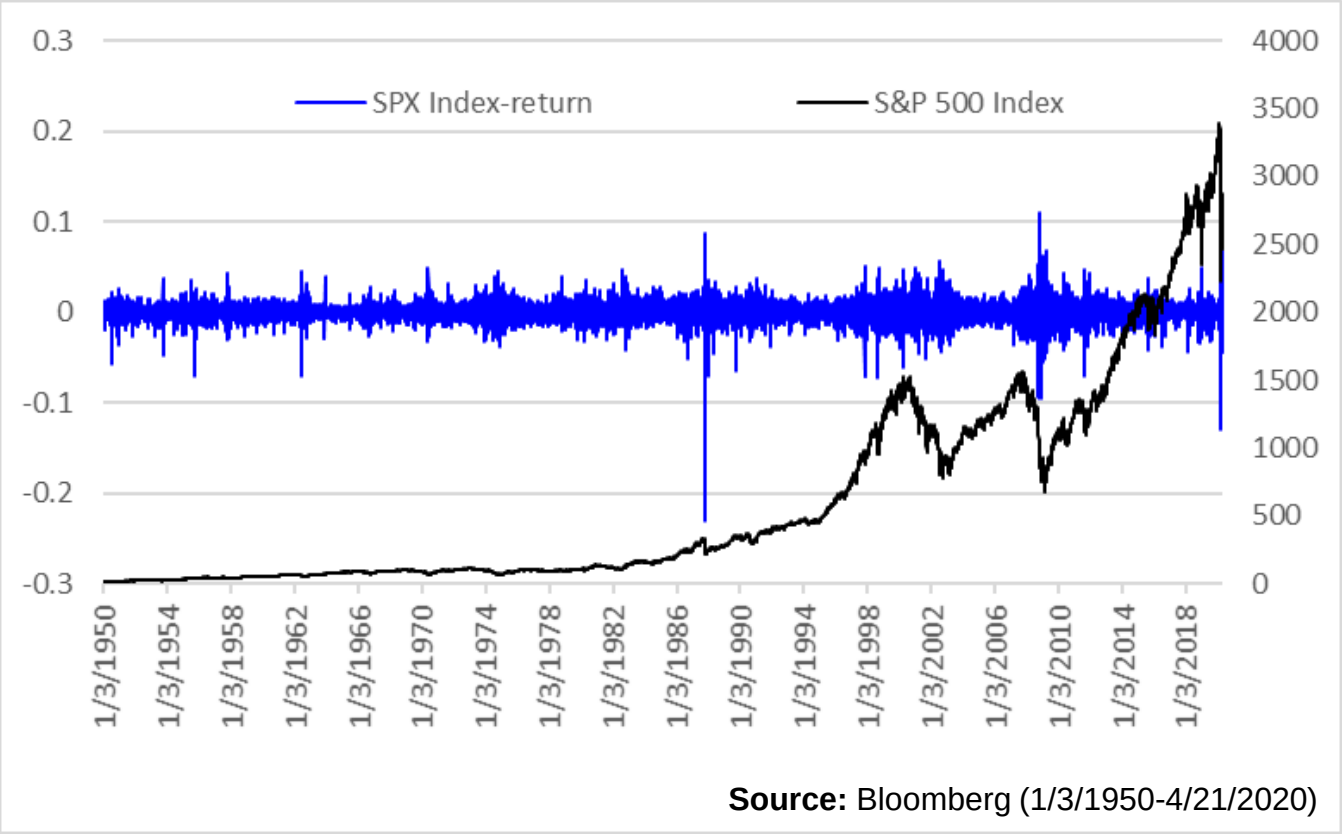
↓

SUSTAINABLE YIELD AND TAIL-RISK OPPORTUNITIES

[1]Wang, J., A. Petrelli, R. Balachandran, O. Siu, J. Zhang, R. Chatterjee, V. Kapoor, General Auto-Regressive Asset Model, *ssrn*, 142855, July 2009.

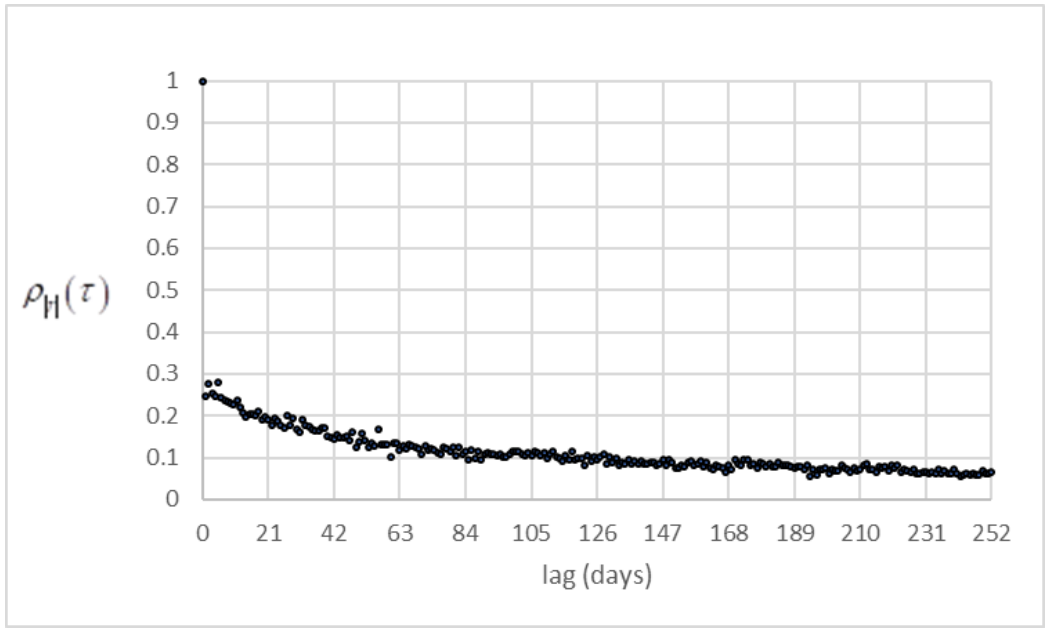
[2]Petrelli, A., R. Balachandran, O. Siu, R. Chatterjee, J. Zhang, V. Kapoor, Optimal Dynamic Hedging of Equity Options: Residual-Risks, Transaction-Costs, & Conditioning, *ssrn*, 1530046, April 2010.

Markets Rhythms and Rhymes

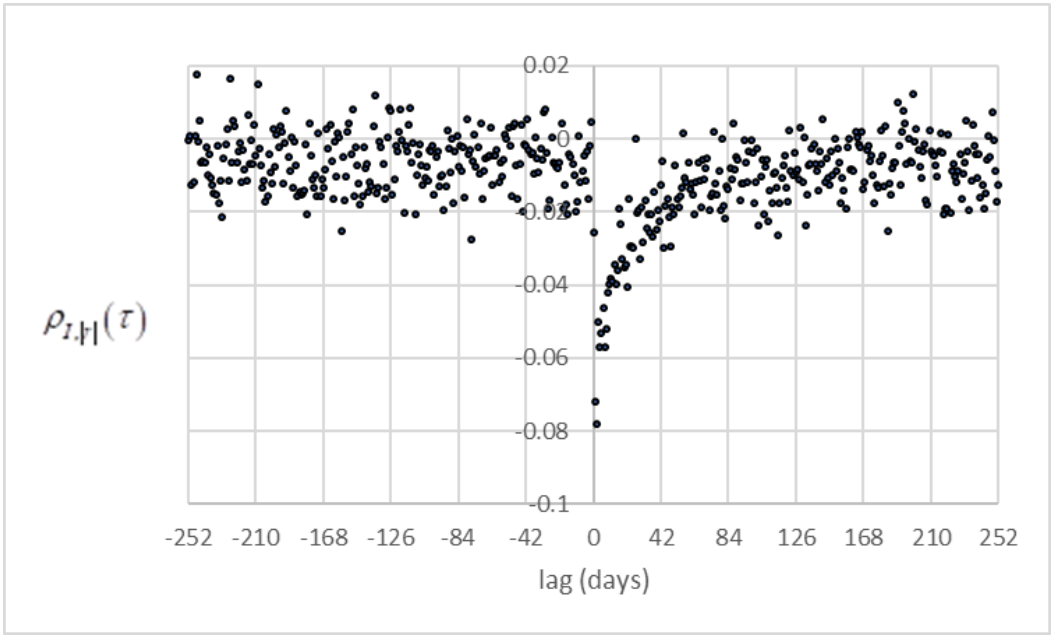


Source: Bloomberg (1/3/1950-4/21/2020)

Markets Rhythms and Rhymes



The autocorrelation of magnitude (|r|) of S&P 500 Index's daily returns (1/3/1950-3/29/2019).



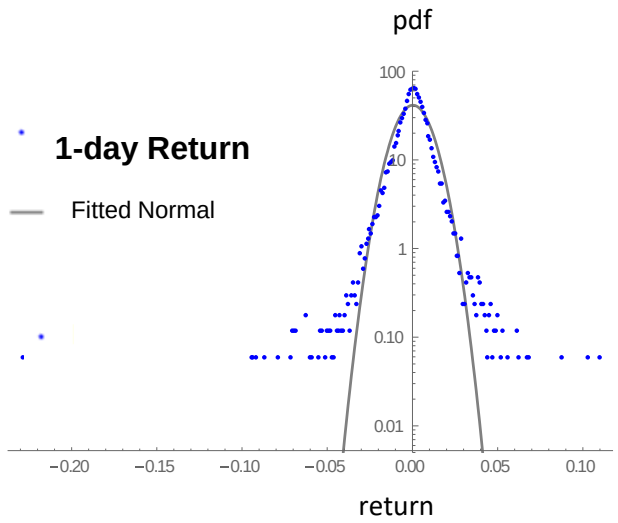
The cross-correlation of sign (I) and magnitude (|r|) of S&P 500 Index daily returns (1/3/1950-3/29/2019).

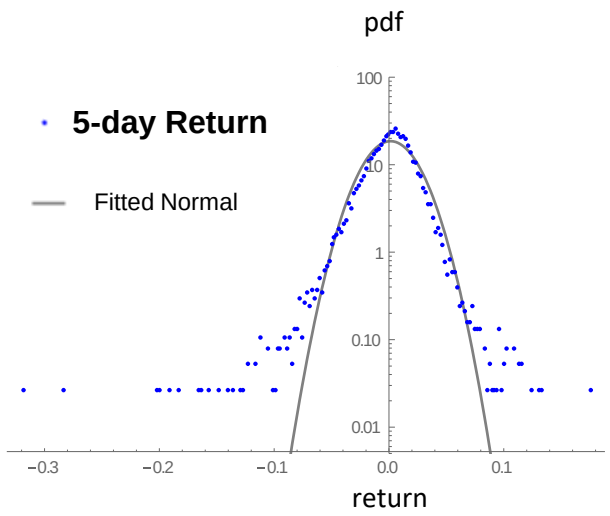
DataSource: Bloomberg.

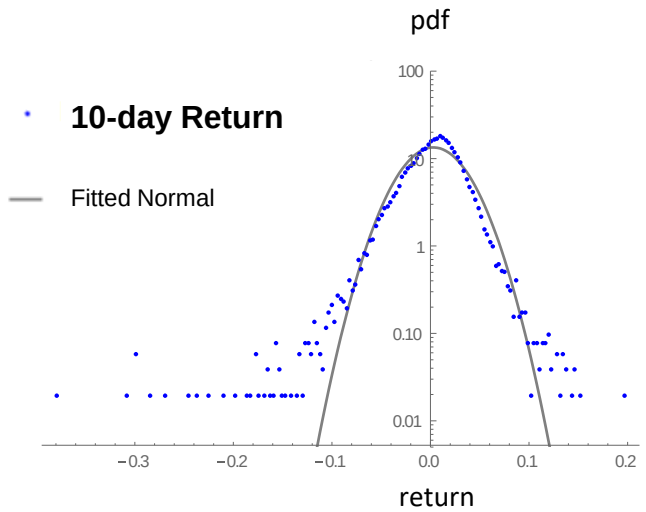
Probability Density of the 1-day, 5-day, 10-day, and 21-day S&P 500 Index Returns

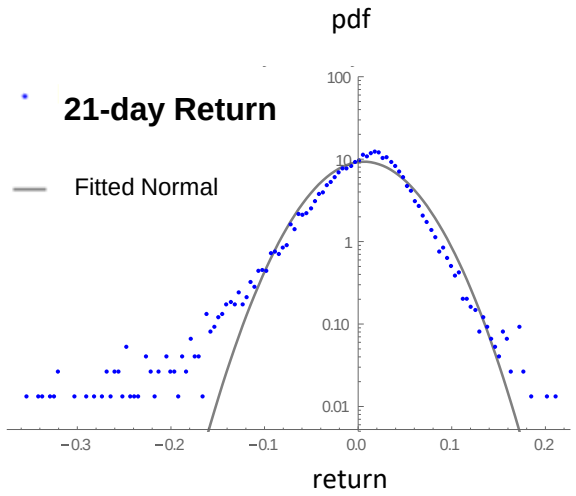
Buildup of asymmetry and persistence of kurtosis

Holding horizon (i.e., term)









Confidence Level (%)	S&P 500 One-Day Return	Return of Fitted Normal
99.9	-0.06	-0.03
99	-0.03	-0.02
95	-0.01	-0.02
90	-0.01	-0.01

Confidence Level (%)	S&P 500 Five-Day Return	Return of Fitted Normal
99.9	-0.12	-0.07
99	-0.06	-0.05
95	-0.03	-0.04
90	-0.02	-0.03

Confidence Level (%)	S&P 500 Ten-Day Return	Return of Fitted Normal
99.9	-0.18	-0.09
99	-0.08	-0.07
95	-0.05	-0.05
90	-0.03	-0.04

Confidence Level (%)	S&P 500 Twenty-One Day Return	Return of Fitted Normal
99.9	-0.26	-0.13
99	-0.12	-0.10
95	-0.07	-0.07
90	-0.04	-0.05

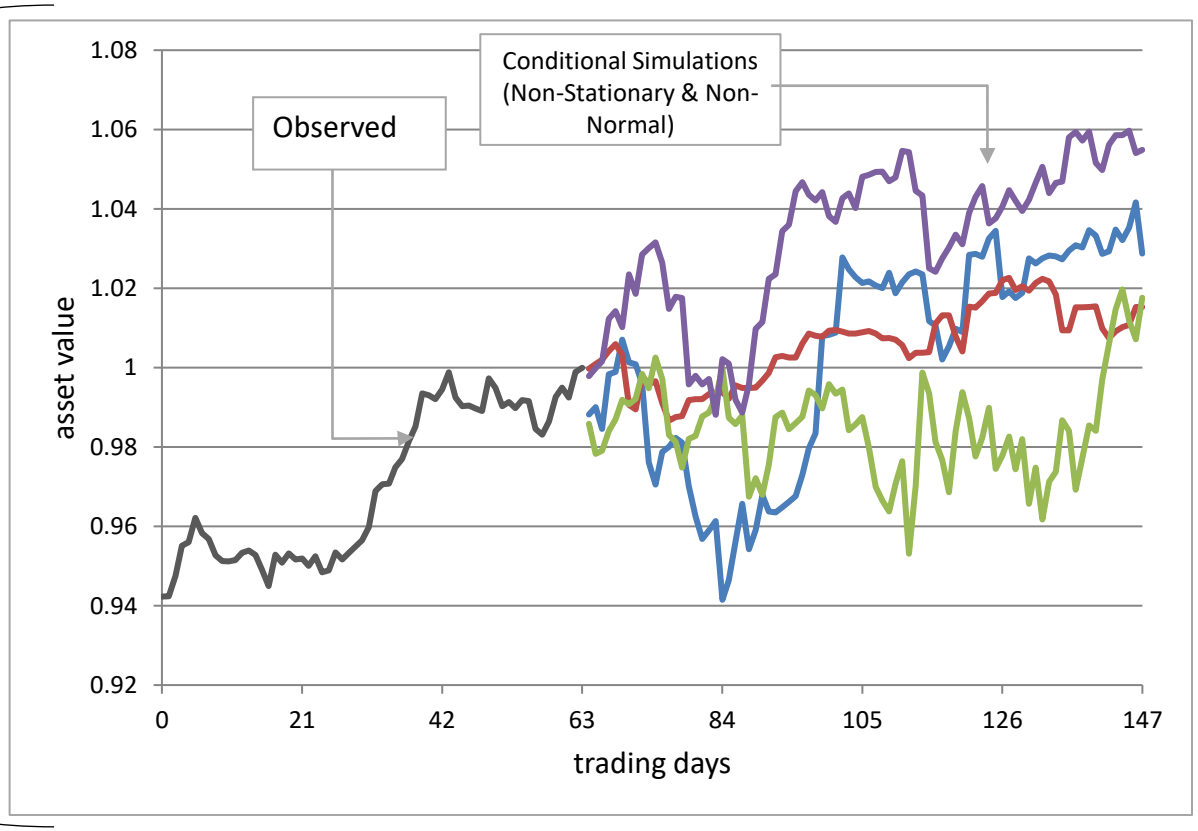
VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg, Volaris Capital Management, LLC.

Implications for Options: Real-World Approach to Understanding Opportunities and Risks in Options

Data-driven Stochastic Modeling

CONDITIONAL MARKET SIMULATOR

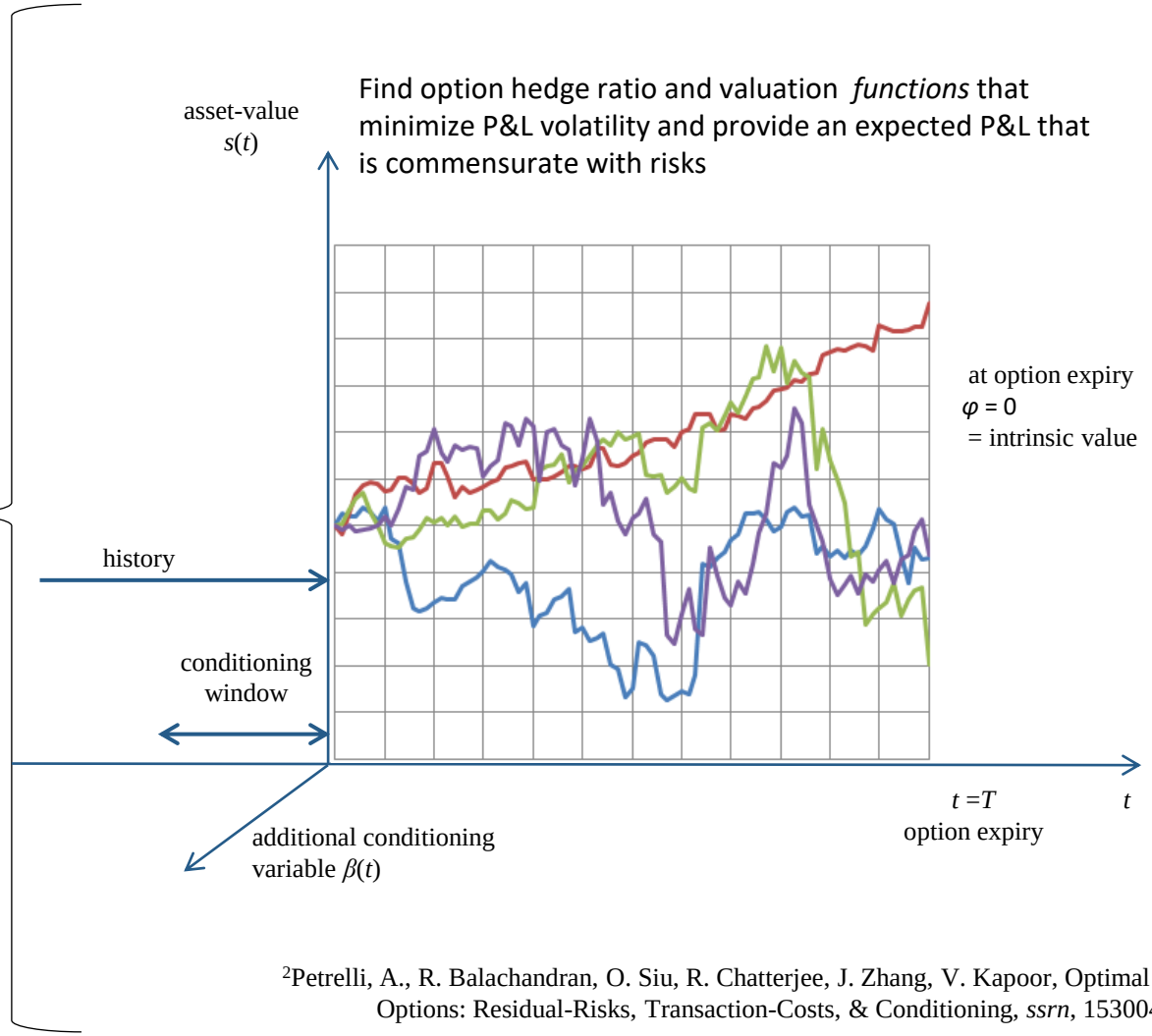


VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg, Volaris Capital Management, LLC.

Implications for Options: Real-World Approach to Understanding Opportunities and Risks in Options

OPTION HEDGE OPTIMIZER



The Optimal Hedge Monte-Carlo (OHMC) method is applied to determine the following:

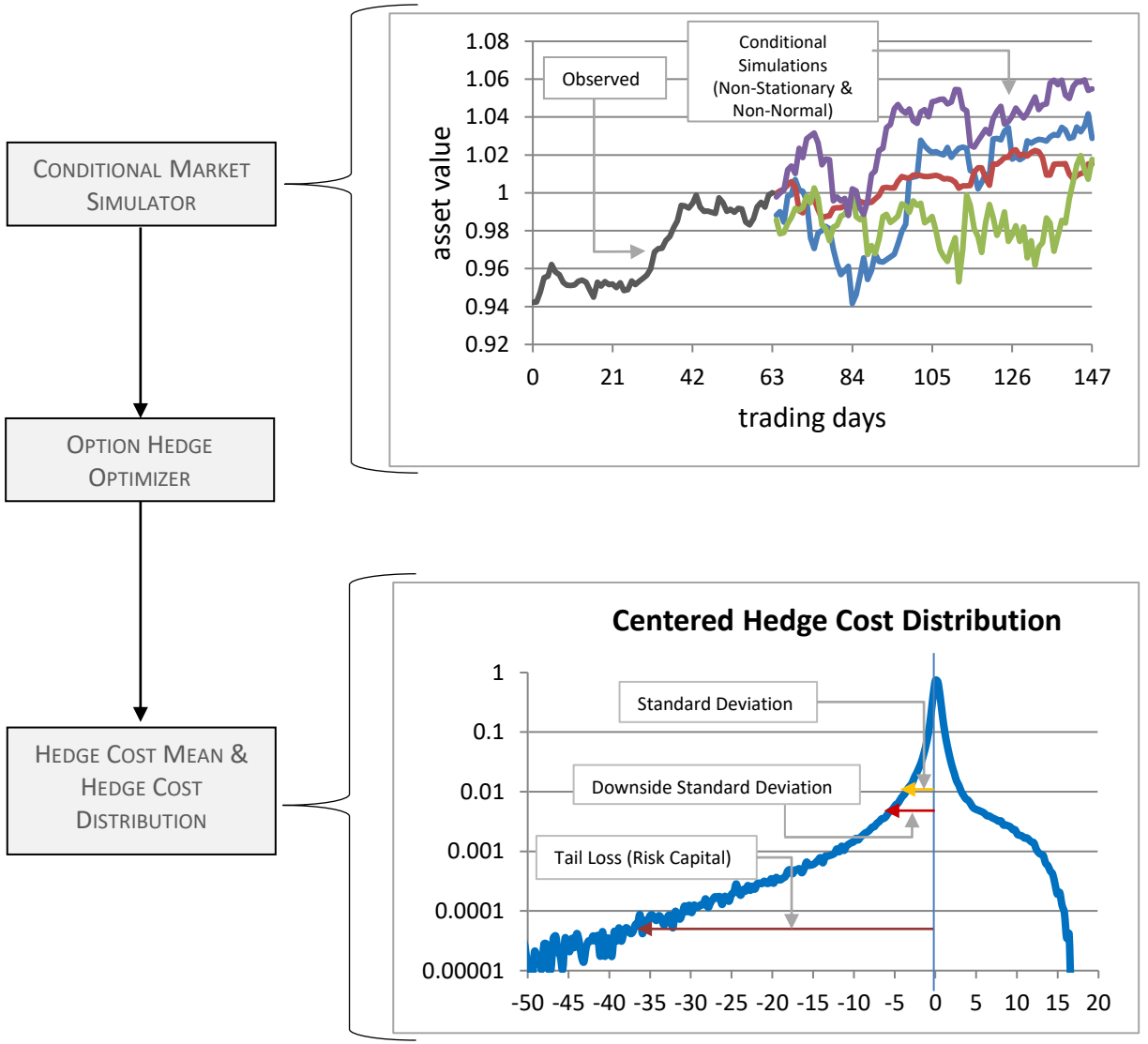
1) optimal option hedging strategy and its expected costs;
2) *irreducible risks* while hedging options;
3) impact of transaction costs on hedging costs and hedge-performance;
4) impact of *conditioning* hedging strategy on realized volatility.

[2]Petrelli, A., R. Balachandran, O. Siu, R. Chatterjee, J. Zhang, V. Kapoor, Optimal Dynamic Hedging of Equity Options: Residual-Risks, Transaction-Costs, & Conditioning, *ssrn*, 1530046, April 2010.

VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg, Volaris Capital Management, LLC.

Implications for Options: Real-World Approach to Understanding Opportunities and Risks in Options



VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg, Volaris Capital Management, LLC.

Five Cardinal Characteristics of Options

1. DISPARITY BETWEEN OUT OF THE MONEY PUTS AND CALLS

2. ASYMMETRY BETWEEN BUYER AND SELLER

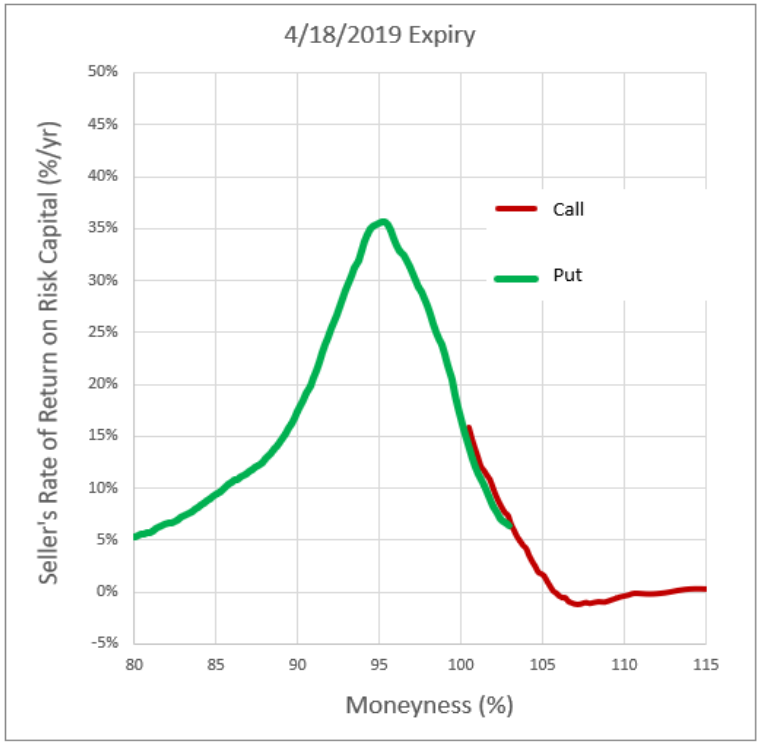
3. EXPLODING ASYMMETRY AT EXPIRY

4. EXPLODING ASYMMETRY WITH OUT-OF-THE-MONEYNESS

5. RATIONALE FOR TIMING

1. Disparity Between Out of the Money Puts and Calls

Comparison of an option *bid-price* with expected hedging costs provides an estimate of the option-seller's *expected P&L*. The *expected P&L* when compared to the *hedge-cost distribution* reveals the option's risk-return profile from a seller's perspective.



A sample snapshot is shown from February 11, 2019 of the estimated risk-return profile of an option seller.

Sellers Rate of Expected Return on Risk Capital

$$\theta(T) = \frac{\ln[\Theta + 1]}{T} (1/\text{year})$$

$$\Theta = \frac{\text{Bid Price - Expected Hedging Cost}}{\text{Risk-Capital}}$$

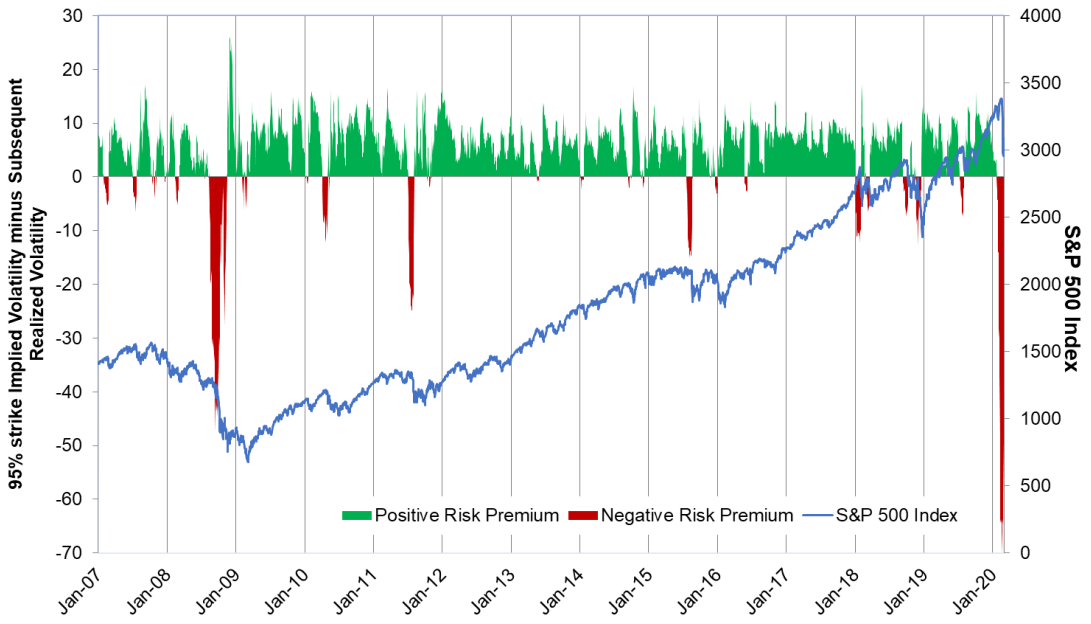
T: duration of derivative (years)

VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg, Volaris Capital Management, LLC.

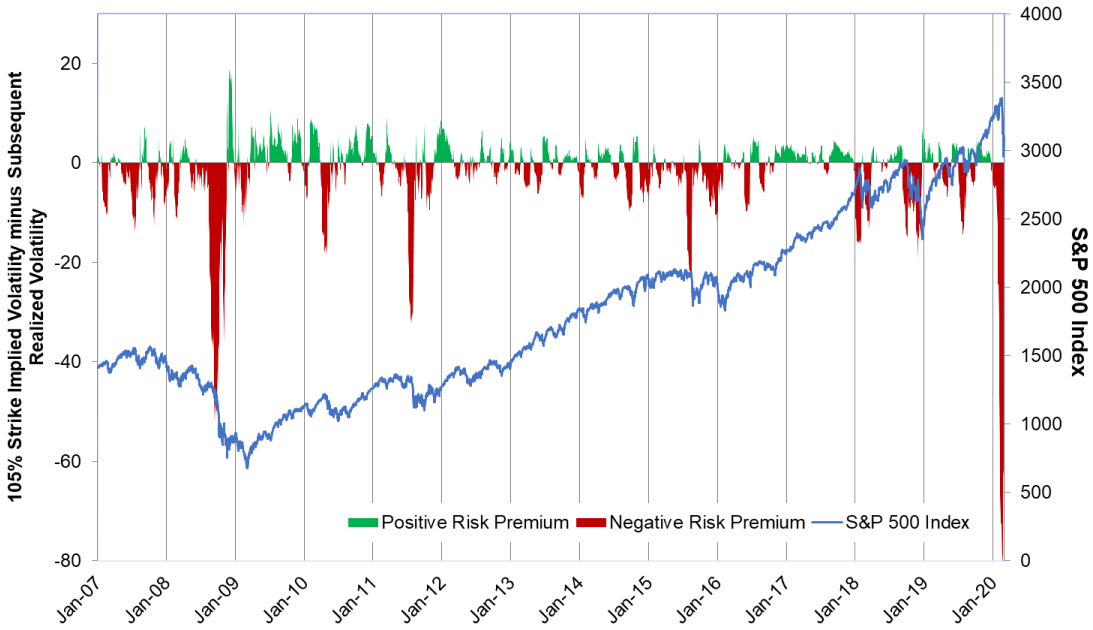
1. Disparity Between Out of the Money Puts and Calls (Cont.)

OTM Put Option Risk Premium for S&P 500



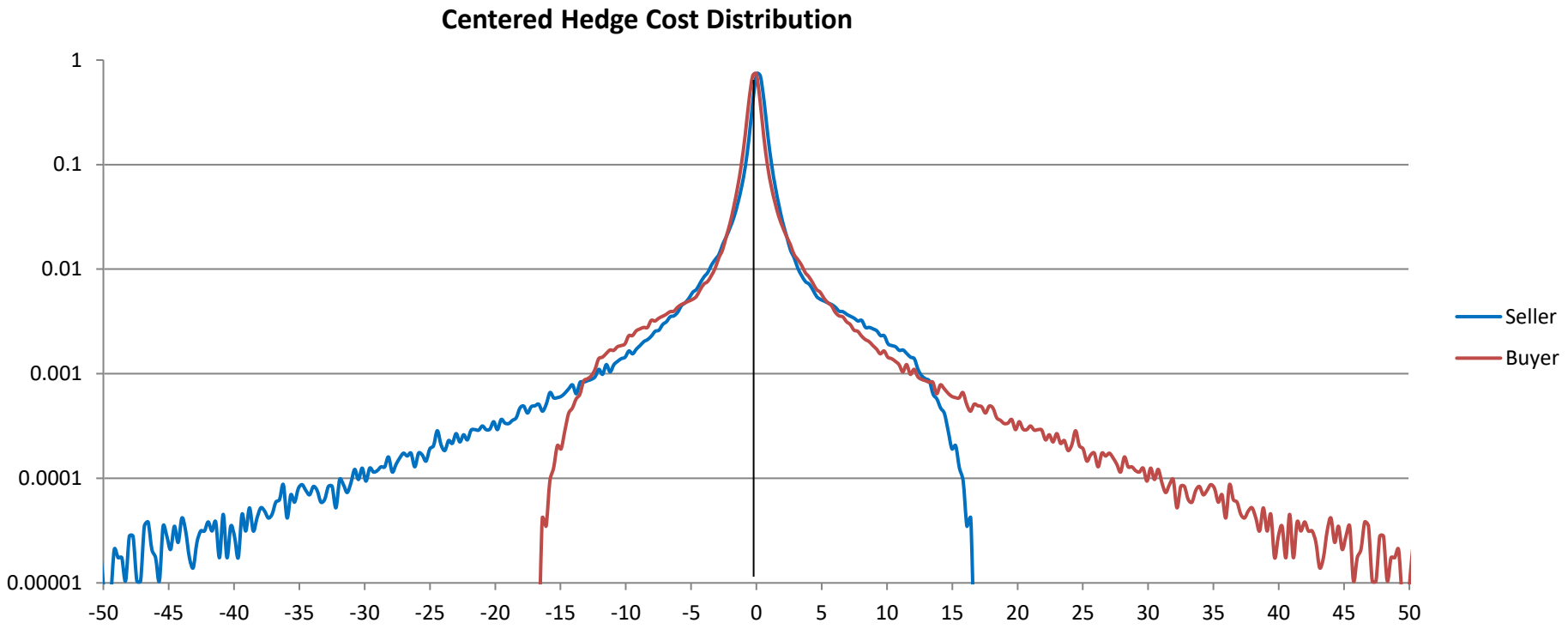
Source: Bloomberg.

OTM Call Option Risk Premium for S&P 500



Source: Bloomberg.

2. Asymmetry Between Buyer and Seller

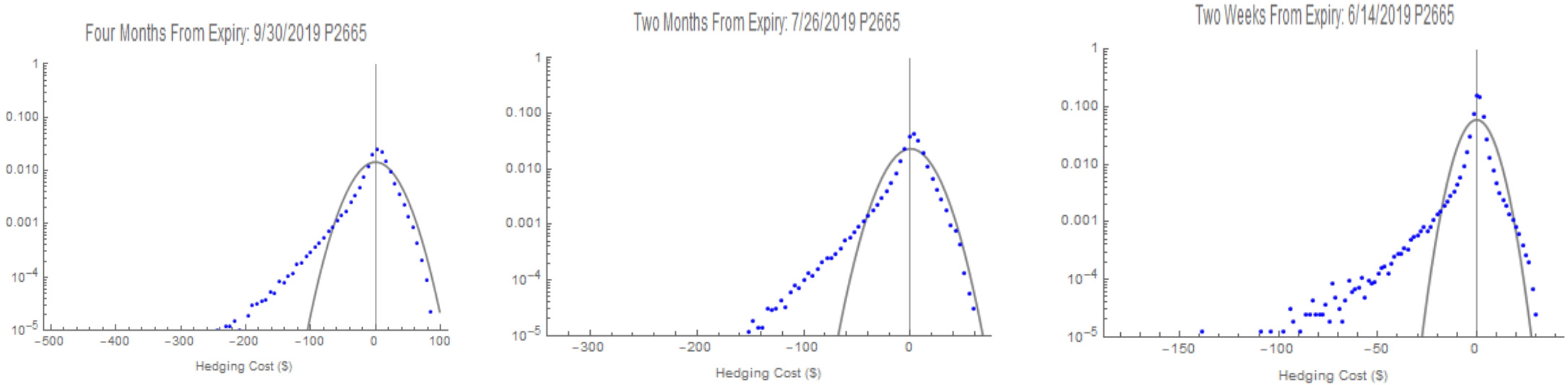


VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg, Volaris Capital Management, LLC.

3. Exploding Asymmetry at Expiry

Decreasing Tenor



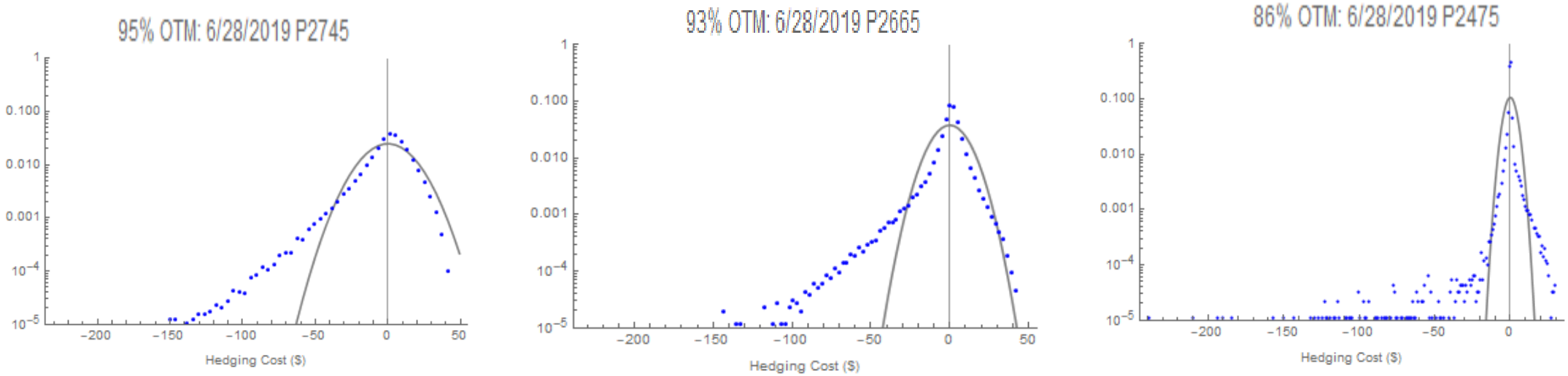
	Four Months (9/30/2019 P2665)	Two Months (7/26/2019 P2665)	Two Weeks (6/14/2019 P2665)
Average Hedging Cost ($)	50.65	24.81	4.19
Standard Deviation ($)	27.48	17.20	6.62
Downside Standard Deviation ($)	35.01	22.09	9.26
99% Confidence Level Loss ($)	100.73	64.05	26.94
1% Confidence Level Gain ($)	55.48	35.76	14.63
Standard Deviation/Average Hedging Cost	0.54	0.69	1.58
Downside Standard Deviation/Average Hedging Cost	0.69	0.89	2.21
99% Confidence Level Loss/Average Hedging Cost	1.99	2.58	6.43

VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg, Volaris Capital Management, LLC.

4. Exploding Asymmetry with Out-of-the-Moneyness

Increasing OTMness →



	1 month 95% OTM (6/28/2019 P2745)	1 month 93% OTM (6/28/2019 P2655)	1 month 86% OTM (6/28/2019 P2475)
Average Hedging Cost ($)	29.59	10.24	0.86
Standard Deviation ($)	15.96	10.46	3.72
Downside Standard Deviation ($)	19.87	13.90	5.16
99% Confidence Level Loss ($)	54.87	41.51	6.17
1% Confidence Level Gain ($)	30.09	23.00	7.95
Standard Deviation/Average Hedging Cost	0.54	1.02	4.35
Downside Standard Deviation/Average Hedging Cost	0.67	1.36	6.03
99% Confidence Level Loss/Average Hedging Cost	1.85	4.05	7.21

VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg, Volaris Capital Management, LLC.

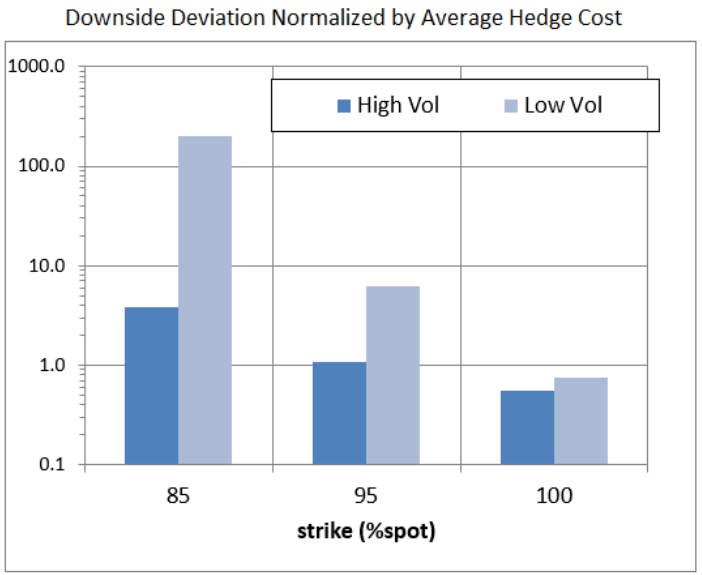
5. Rationale for Timing (part A)

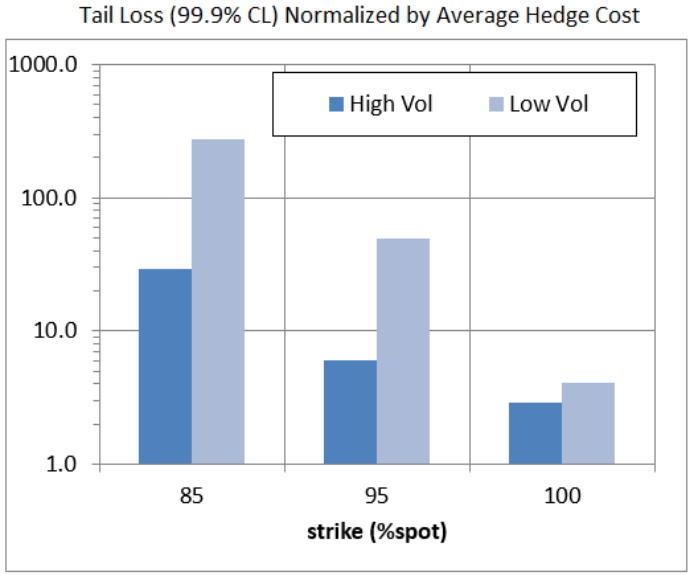
Low-Volatility Regime

Strike (% spot)	Std Deviation (x avg hedge cost)	Downside Std Deviation (x avg hedge cost)	99.9% Confidence Loss (x avg hedge cost)
85	146.6	199.8	276.7
95	4.5	6.1	48.9
100	0.6	0.7	4.0

High-Volatility Regime

Strike (% spot)	Std Deviation (x avg hedge cost)	Downside Std Deviation (x avg hedge cost)	99.9% Confidence Loss (x avg hedge cost)
85	2.8	3.8	29.2
95	0.8	1.1	6.0
100	0.4	0.5	2.9





Hedge cost statistics of seller-optimal-hedger of a 1-month expiry put shown as a function of out-of-the-moneyness in a low-volatility regime and a high volatility regime.

VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg, Volaris Capital Management, LLC.

5. Rationale for Timing (part B)

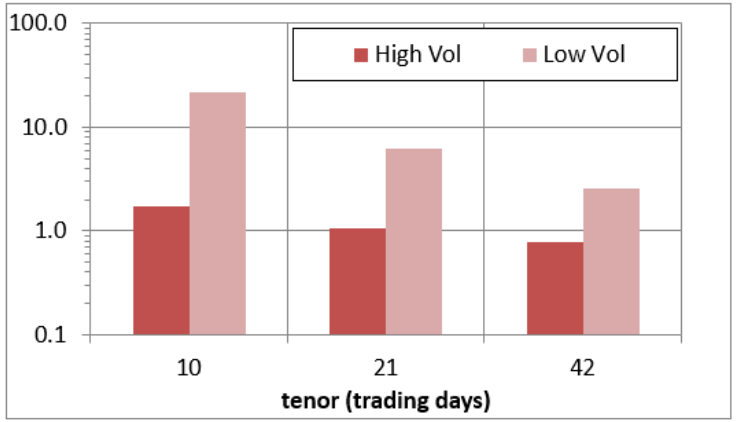
Low-Volatility Regime

Tenor (days)	Std Deviation (x avg hedge cost)	Downside Std Deviation (x avg hedge cost)	99.9% Confidence Loss (x avg hedge cost)
10	15.5	21.6	190.8
21	4.5	6.1	48.9
42	1.9	2.6	16.3

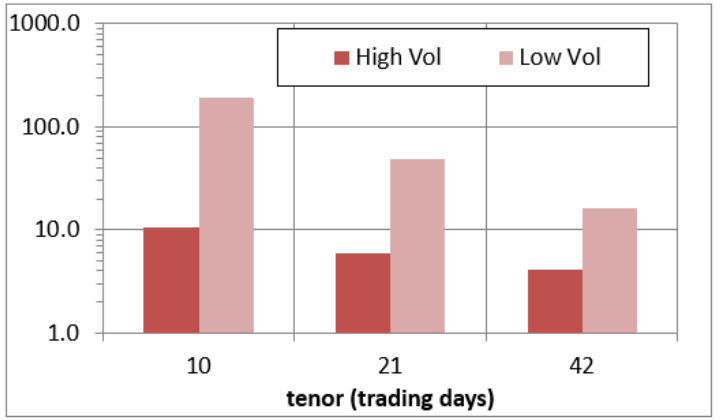
High-Volatility Regime

Tenor (days)	Std Deviation (x avg hedge cost)	Downside Std Deviation (x avg hedge cost)	99.9% Confidence Loss (x avg hedge cost)
10	1.2	1.7	10.4
21	0.8	1.1	6.0
42	0.6	0.8	4.1

Downside Deviation Normalized by Average Hedge Cost



Tail Loss (99.9% CL) Normalized by Average Hedge Cost



Hedge cost statistics of seller-optimal-hedger of a 95% put shown with increasing tenor in a low-volatility regime and a high volatility regime.

VOLARIS CAPITAL MANAGEMENT

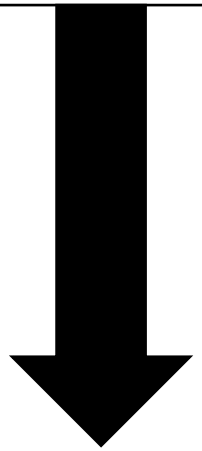
Source: Bloomberg, Volaris Capital Management, LLC.

Five Cardinal Characteristics of Options

1. DISPARITY BETWEEN OUT OF THE MONEY PUTS AND CALLS
2. ASYMMETRY BETWEEN BUYER AND SELLER
3. EXPLODING ASYMMETRY AT EXPIRY
4. EXPLODING ASYMMETRY WITH OUT-OF-THE-MONEYNESS
5. RATIONALE FOR TIMING

Do S&P 500 Index Volatility Indexes reflect an awareness of these cardinal characteristics?

No, they do NOT!



The cardinal characteristics of options on S&P 500 Index , central to designing viable volatility investment strategies, are rarely incorporated into Indexes representing volatility as an asset class.

Indexes Evaluated over the Past Economic Cycle (Daily Time Series: March 2008 – March 2020)

COMPARISON INDEXES

- **SPX Index**
- **SPTR Index**
- **LBUSTRUU Index**

VOLATILITY INDEXES

- **VIX Index**
- **SPVIXSTR Index**
- **SPVXSPIT Index**
- **CNDR Index**
- **PUT Index**

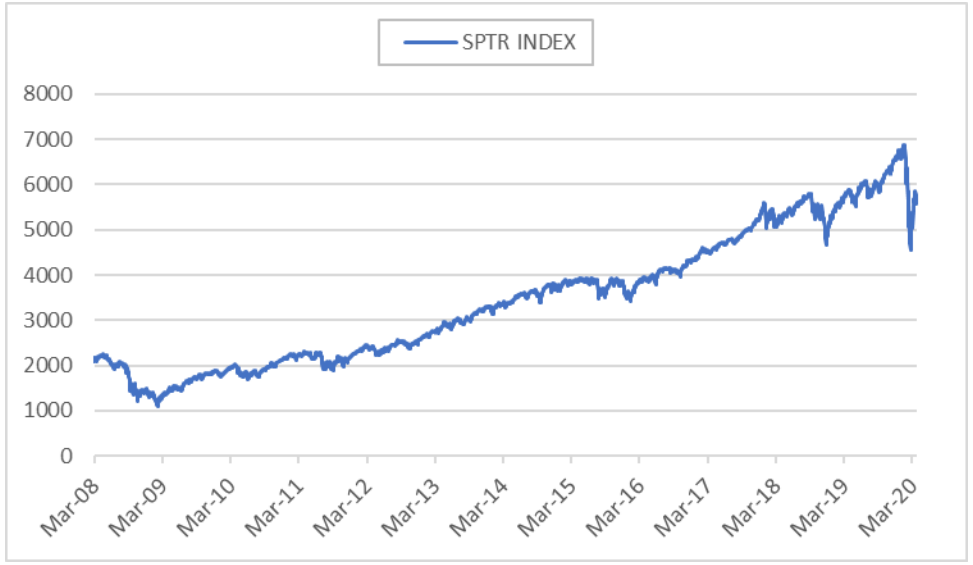
Five Cardinal Characteristics of SPX Index Options	SPVIXTR Index	SPVXSPIT Index	CNDR Index	PUT Index
1. Disparity Between Out of the Money Puts and Calls	X	X	X	✔
2. Asymmetry Between Buyer and Seller	X	X	✔	X
3. Exploding Asymmetry at Expiry	✔	✔	X	X
4. Exploding Asymmetry with Out-of-the-Moneyness	X	X	X	X
5. Elements of Timing	X	X	X	X

The cardinal characteristics of options that are recognized by the volatility index are indicated by a ✔ *and the properties ignored in the index construction are indicated by a* X.

SPTR Index: Risk-Return of Large Cap

SPTR Index (S&P 500 Total Return Index): SPTR Index reflects effects of reinvested dividends on the SPX Index.

SPTR Index Level



SPTR Index Statistics

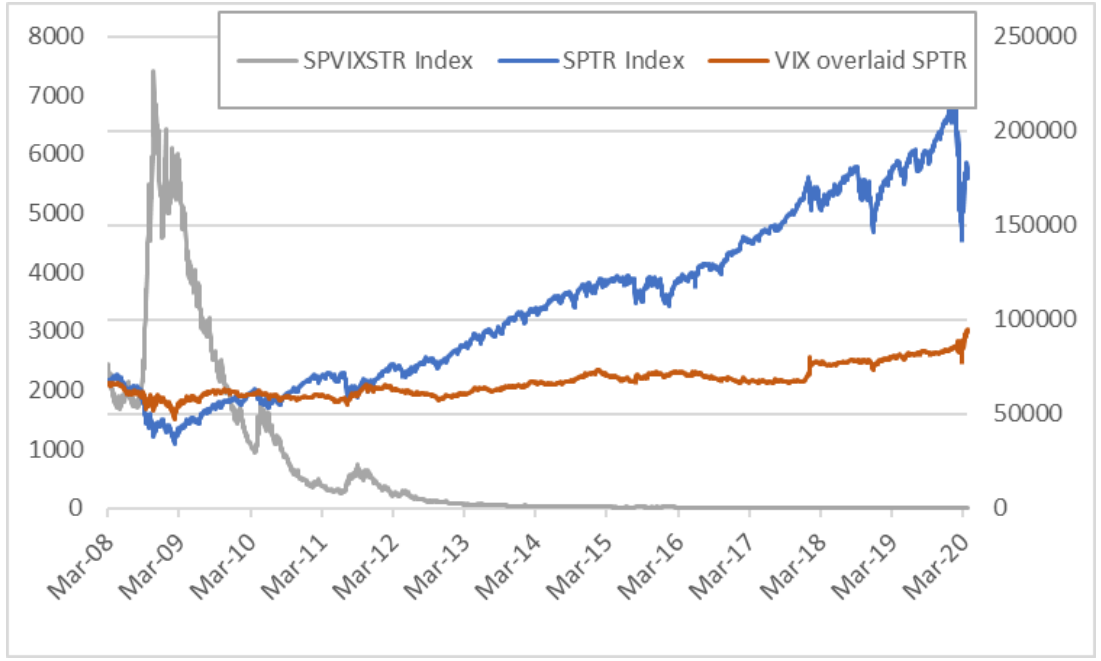
CAGR	8.5%
Volatility	21.2%
Information Ratio	0.40
Upside Volatility	19.6%
Downside Volatility	22.8%

VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg.

Going Broke Buying Volatility: SPVIXSTR Index

SPVIXSTR Index (S&P 500 VIX Short-Term Futures Index Total Return): Represents long exposure to one-month maturity VIX futures contracts.



- **SPTR Index Level**
- **SPVIXSTR Index Level (buy and hold long volatility exposure)**
- **VIX-overlaid S&P Index Total Return Tail-Hedged Portfolio (84% SPTR Index and 16% SPVIXSTR Index)**

	SPVIXSTR Index	S&P 500 TR Index	VIX overlaid S&P 500 TR Tail-Hedged Portfolio
CAGR:	-43.7%	8.5%	3.0%
Volatility:	70.6%	21.2%	12.6%
IR:	-0.61	0.40	0.23
Upward Volatility:	82.8%	19.6%	13.7%
Downward Volatility:	59.1%	22.8%	11.5%

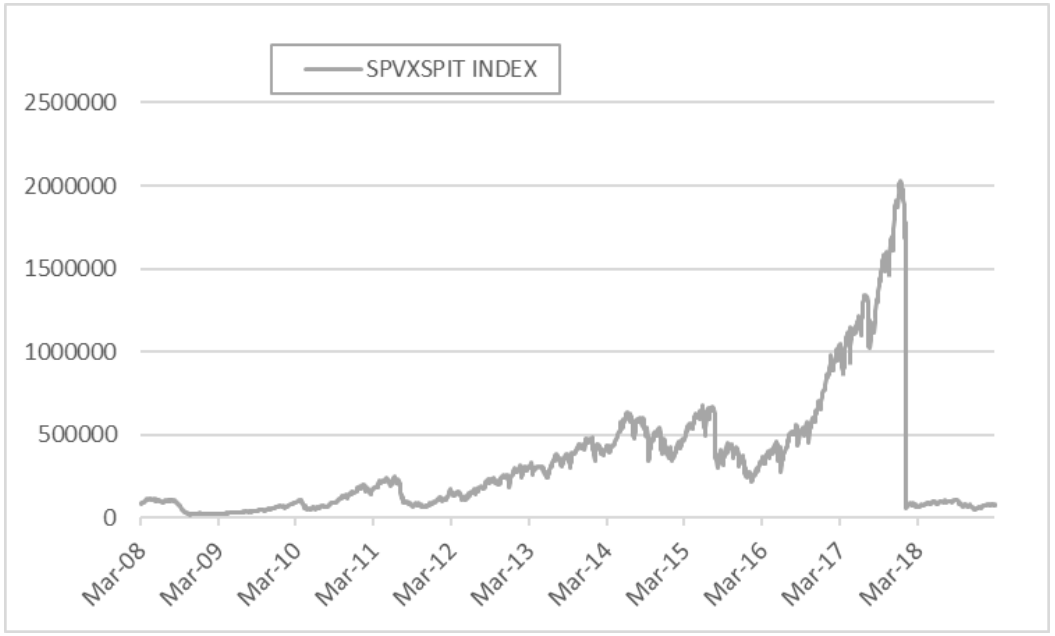
VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg.

Going Broke Selling Volatility: SPVXSPIT Index

SPVXSPIT Index (S&P 500 VIX Short-Term Futures Inverse Index Total Return): Represents short exposure to one-month maturity VIX futures contracts.

SPVXSPIT Index Level



SPVXSPIT Index Statistics

CAGR	-10.6%
Volatility	117.3%
Information Ratio	-0.09
Upside Volatility	56.2%
Downside Volatility	170.4%

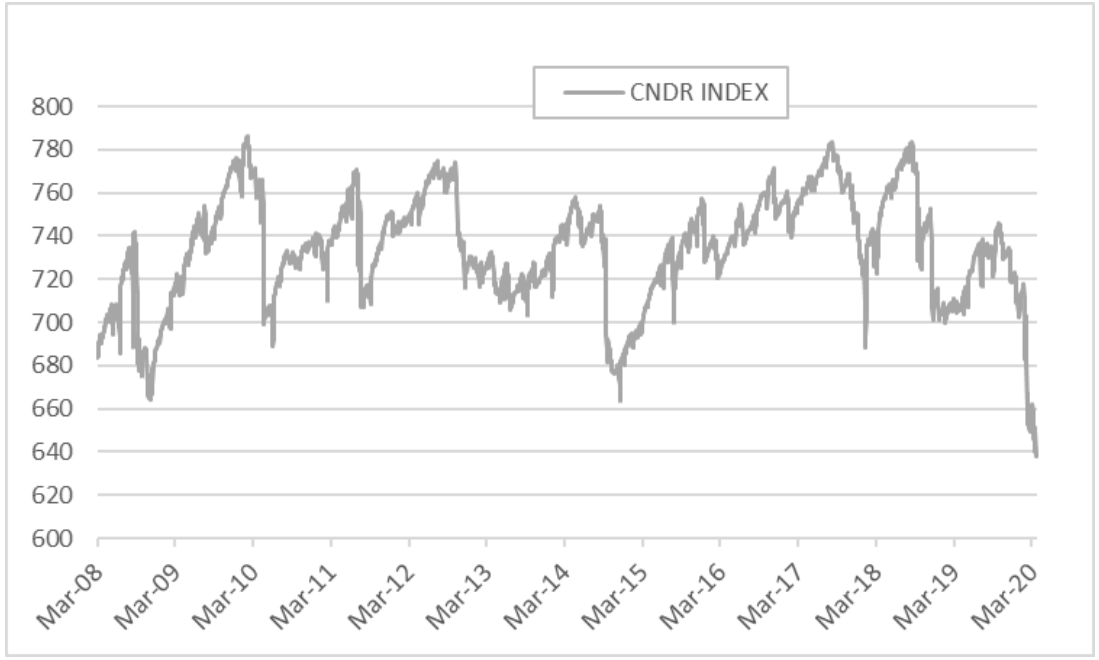
VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg.

Going **Nowhere** Buying and Selling Volatility

CNDR Index (S&P 500 Iron Condor Index): Represents exposure to one-month put and call spreads symmetrically specified in terms of option sensitivity and carried to expiry. T-Bills are used to collateralize and to accrue interest.

CNDR Index Level



CNDR Index Statistics

CAGR	-0.6%
Volatility	7.8%
Information Ratio	-0.08
Upside Volatility	6.1%
Downside Volatility	9.9%

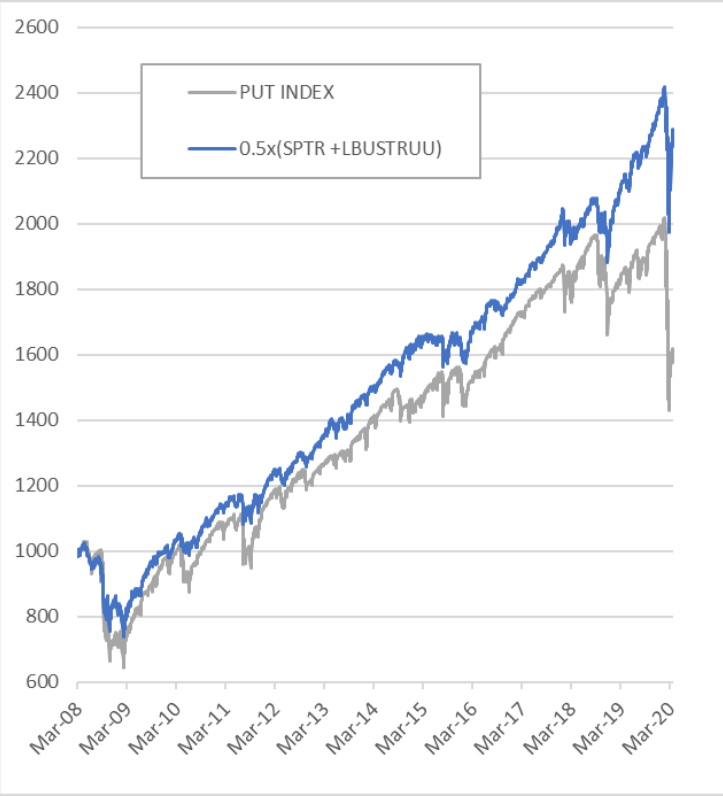
VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg.

Unimpressive Lot of Downside Protection Seller

PUT Index (S&P 500 PutWrite Index): Represents selling 1-month at-the-money puts and carrying them to expiry, fully collateralized with T-Bills, that are also used to accrue interest.

LBUSTRUU Index (Barclays US Aggregate Bond Index)



	PUT Index	50% SPTR + 50% LBUSTRUU
CAGR:	4.1%	7.1%
Volatility:	15.5%	10.2%
Information Ratio:	0.27	0.69

VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg.

Five Cardinal Characteristics of SPX Index Options	SPVIXTR Index	SPVXSPIT Index	CNDR Index	PUT Index
1. Disparity Between Out of the Money Puts and Calls	X	X	X	✓
2. Asymmetry Between Buyer and Seller	X	X	✓	X
3. Exploding Asymmetry at Expiry	✓	✓	X	X
4. Exploding Asymmetry with Out-of-the-Moneyness	X	X	X	X
5. Elements of Timing	X	X	X	X

For volatility indexes to successfully represent volatility as an asset class worthy of a fiduciary's consideration for an investor's portfolio allocation, there must be a degree of consensus on basic risk-return features of S&P 500 Index options and there must be an attempt to intelligently reflect that in the index definitions.

July 2019

Challenges of Indexation in S&P 500 Index Volatility Investment Strategies

Margaret Sundberg
Quantitative Trader and Portfolio Manager
*Volaris Capital Management**

Abstract: S&P 500 Index option-based volatility indexes have untenable risk-return profiles. These volatility indexes are not designed with consideration of important real-world risk characteristics of options and fail to represent *volatility* as a differentiated *asset-class* with relevance to the long-term utility of investors. Implications of the S&P 500 Index return distribution on the profit and loss (P&L) distribution of a directionally hedged option position are presented. The ensuing *five* cardinal characteristics of options on S&P 500 Index, central to designing viable *volatility* investment strategies, are enumerated.

https://ssrn.com/abstract=3427350

https://www.volariscapital.com/research.html

Presentation Overview

NATURE OF S&P 500 INDEX RETURNS

↓

IMPLICATIONS FOR OPTIONS

Generalized Auto Regressive Asset Model[1]

Optimal Hedge Monte-Carlo[2]

↓

FIVE CARDINAL CHARACTERISTICS OF OPTIONS

↓

WHY VOLATILITY IS NOT YET AN ASSET CLASS

Analysis of SPX Index Volatility Indexes

[1]Wang, J., A. Petrelli, R. Balachandran, O. Siu, J. Zhang, R. Chatterjee, V. Kapoor, General Auto-Regressive Asset Model, *ssrn*, 142855, July 2009.

[2]Petrelli, A., R. Balachandran, O. Siu, R. Chatterjee, J. Zhang, V. Kapoor, Optimal Dynamic Hedging of Equity Options: Residual-Risks, Transaction-Costs, & Conditioning, *ssrn*, 1530046, April 2010.

Sustainable Yield and Tail Risk Opportunities

Home | Design | Process | Research | Leadership | Citizenship | Opportunities | Contact

- *We provide investors access to yield and tail-risk opportunities in the options market.*

- *Our insights, based on experience and active research, are applied to pursue client's goals.*

www.volariscapital.com

Contact: Margaret Sundberg, Portfolio Manager, margaret.sundberg@volariscapital.com
Contact: Vivek Kapoor, CEO/CIO, vivek.kapoor@volariscapital.com

Important Legal Information and Disclosures

Volaris Capital Management, LLC is not affiliated with Interactive Brokers LLC, or any other FINRA broker-dealer

This material has been prepared by Volaris Capital Management LLC ("Volaris") on the basis of publicly available information, internally developed data and other third-party sources believed to be reliable. Volaris has not sought to independently verify information obtained from public and third-party sources and makes no representations or warranties as to accuracy, completeness or reliability of such information. All opinions and views constitute judgments as of the date of writing without regard to the date on which the reader may receive or access the information, and are subject to change at any time without notice and with no obligation to update. This material is for informational and illustrative purposes only and is intended solely for the information of those to whom it is distributed by Volaris. No part of this material may be reproduced or retransmitted in any manner without the prior written permission of Volaris. Volaris does not represent, warrant or guarantee that this information is suitable for any investment purpose and it should not be used as a basis for investment decisions. This material does not purport to contain all of the information that a prospective investor may wish to consider. This material is not to be relied upon as such or used in substitution for the exercise of independent judgment. Past performance does not guarantee or indicate future results.

This material should not be viewed as a current or past recommendation or a solicitation of an offer to buy or sell any securities or investment products or to adopt any investment strategy. The investment views and market opinions/analyses expressed herein may not reflect those of Volaris as a whole and different views may be expressed based on different investment styles, objectives, views or philosophies. To the extent that these materials contain statements about the future, such statements are forward looking and subject to a number of risks and uncertainties. All images are for illustrative purposes only.

Presentation Overview

NATURE OF S&P 500 INDEX RETURNS

↓

IMPLICATIONS FOR OPTIONS

Generalized Auto Regressive Asset Model[1]

Optimal Hedge Monte-Carlo[2]

↓

FIVE CARDINAL CHARACTERISTICS OF OPTIONS

↓

WHY VOLATILITY IS NOT YET AN ASSET CLASS

Analysis of SPX Index Volatility Indexes

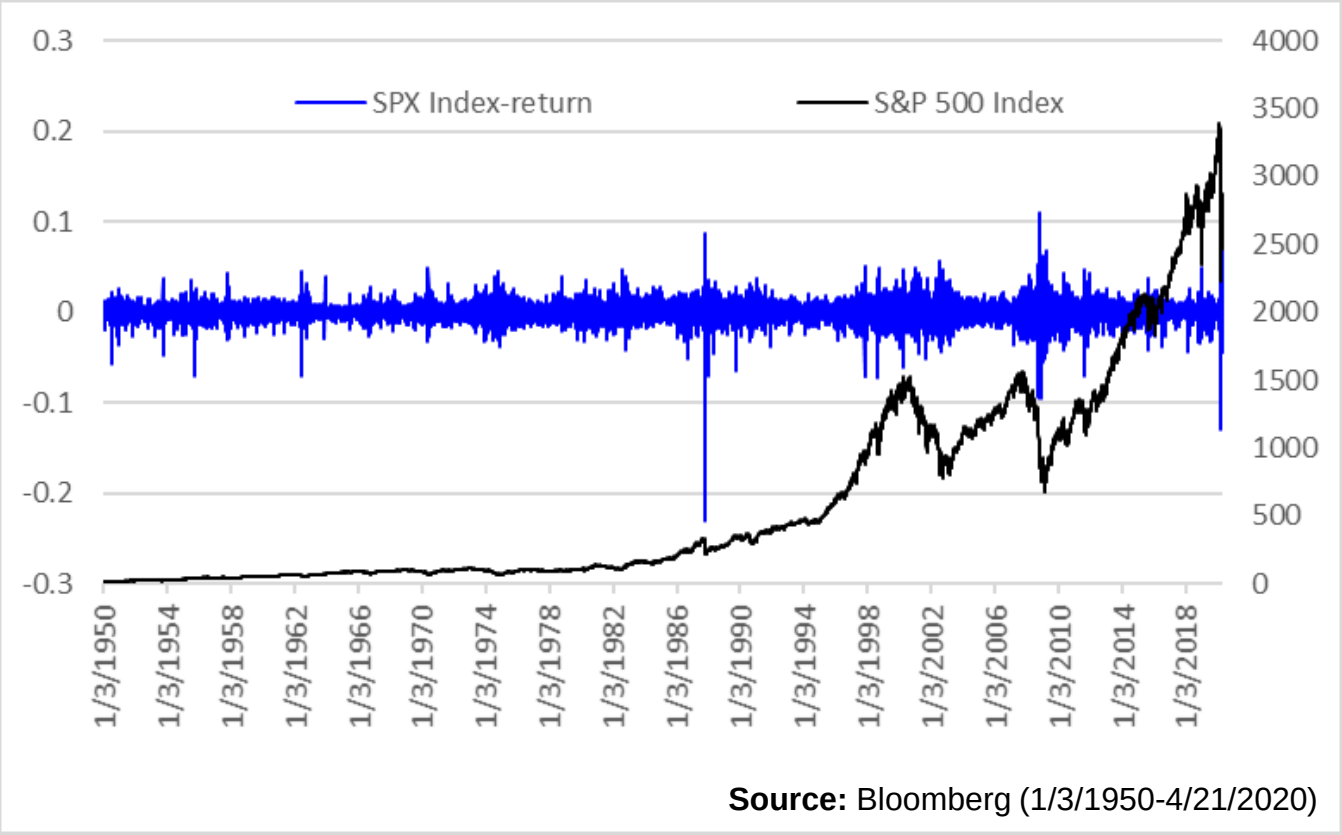
↓

SUSTAINABLE YIELD AND TAIL-RISK OPPORTUNITIES

[1]Wang, J., A. Petrelli, R. Balachandran, O. Siu, J. Zhang, R. Chatterjee, V. Kapoor, General Auto-Regressive Asset Model, *ssrn*, 142855, July 2009.

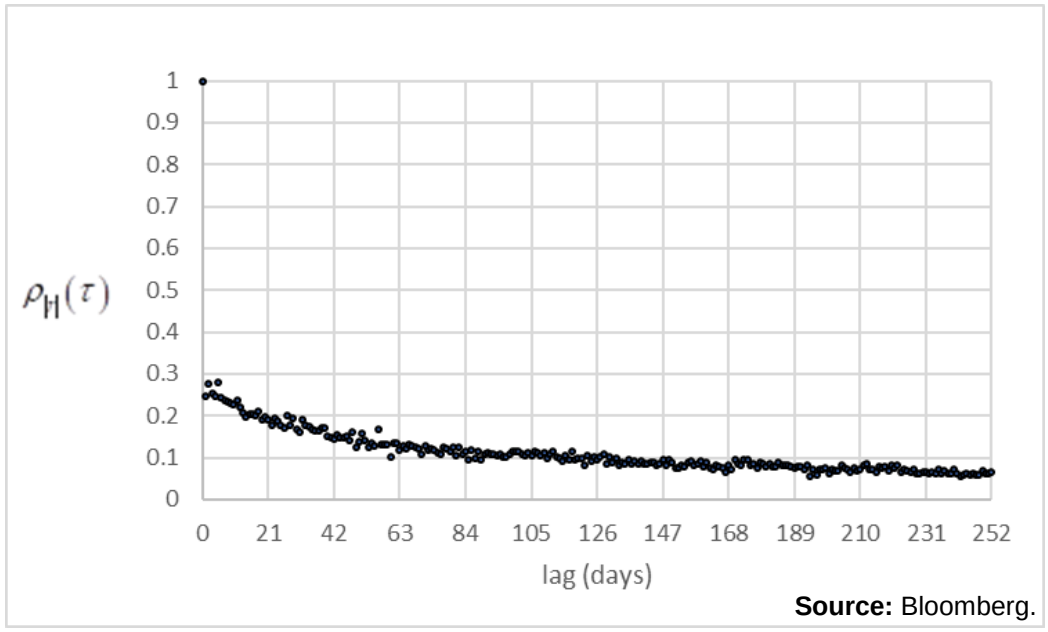
[2]Petrelli, A., R. Balachandran, O. Siu, R. Chatterjee, J. Zhang, V. Kapoor, Optimal Dynamic Hedging of Equity Options: Residual-Risks, Transaction-Costs, & Conditioning, *ssrn*, 1530046, April 2010.

Markets Rhythms and Rhymes

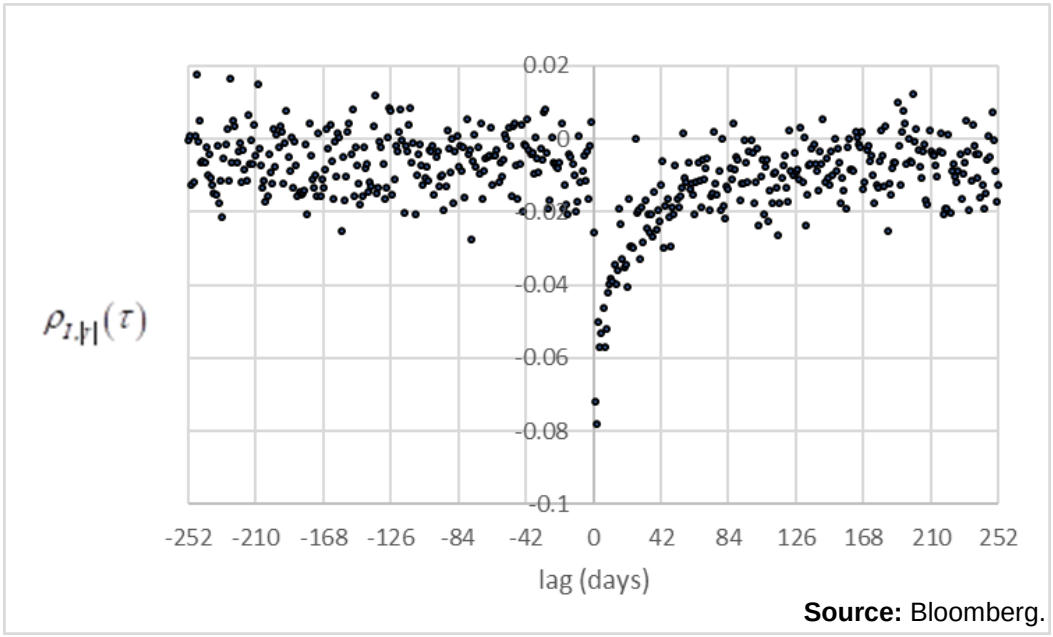


Source: Bloomberg (1/3/1950-4/21/2020)

Markets Rhythms and Rhymes



The autocorrelation of magnitude (|r|) of S&P 500 Index's daily returns (1/3/1950-3/29/2019).

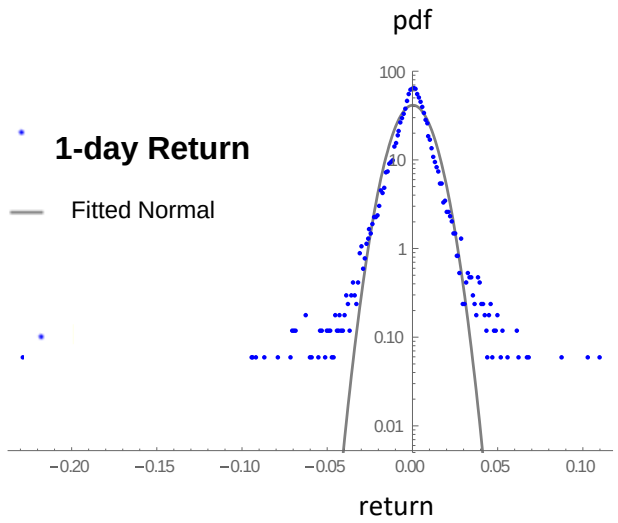


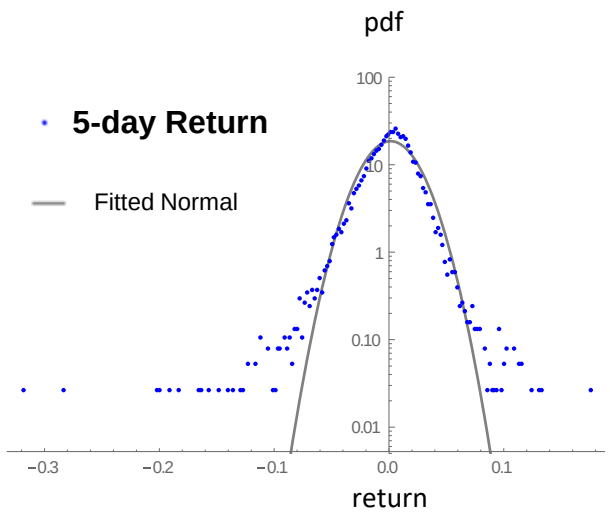
The cross-correlation of sign (I) and magnitude (|r|) of S&P 500 Index daily returns (1/3/1950-3/29/2019).

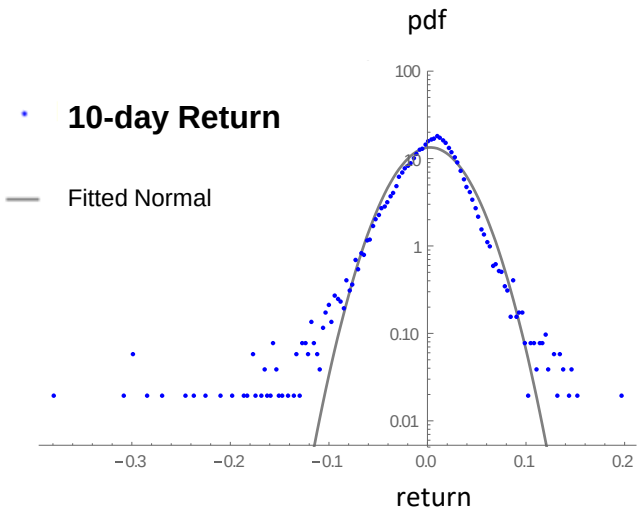
Probability Density of the 1-day, 5-day, 10-day, and 21-day S&P 500 Index Returns

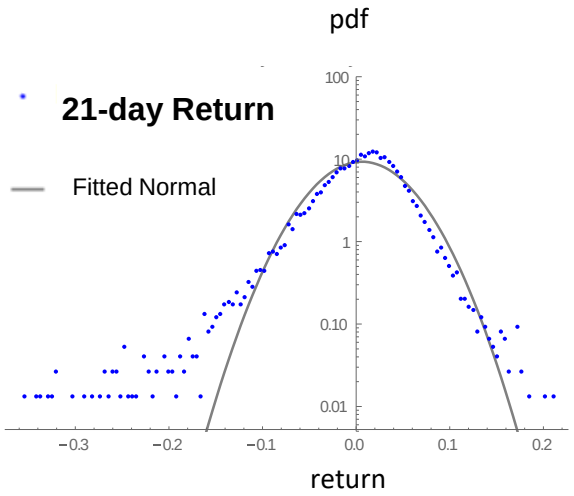
Buildup of asymmetry and persistence of kurtosis

Holding horizon (i.e., term)









Confidence Level (%)	S&P 500 One-Day Return	Return of Fitted Normal
99.9	-0.06	-0.03
99	-0.03	-0.02
95	-0.01	-0.02
90	-0.01	-0.01

Confidence Level (%)	S&P 500 Five-Day Return	Return of Fitted Normal
99.9	-0.12	-0.07
99	-0.06	-0.05
95	-0.03	-0.04
90	-0.02	-0.03

Confidence Level (%)	S&P 500 Ten-Day Return	Return of Fitted Normal
99.9	-0.18	-0.09
99	-0.08	-0.07
95	-0.05	-0.05
90	-0.03	-0.04

Confidence Level (%)	S&P 500 Twenty-One Day Return	Return of Fitted Normal
99.9	-0.26	-0.13
99	-0.12	-0.10
95	-0.07	-0.07
90	-0.04	-0.05

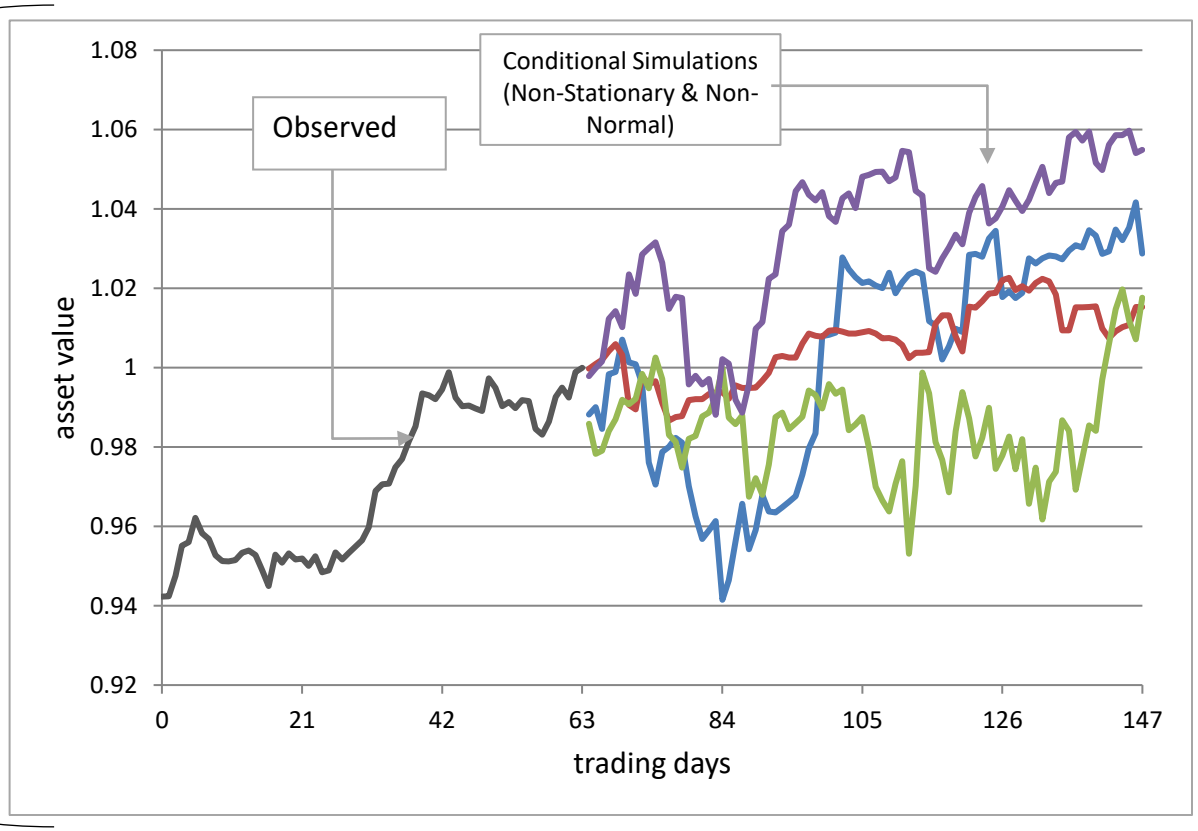
VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg, Volaris Capital Management, LLC.

Implications for Options: Real-World Approach to Understanding Opportunities and Risks in Options

Data-driven Stochastic Modeling

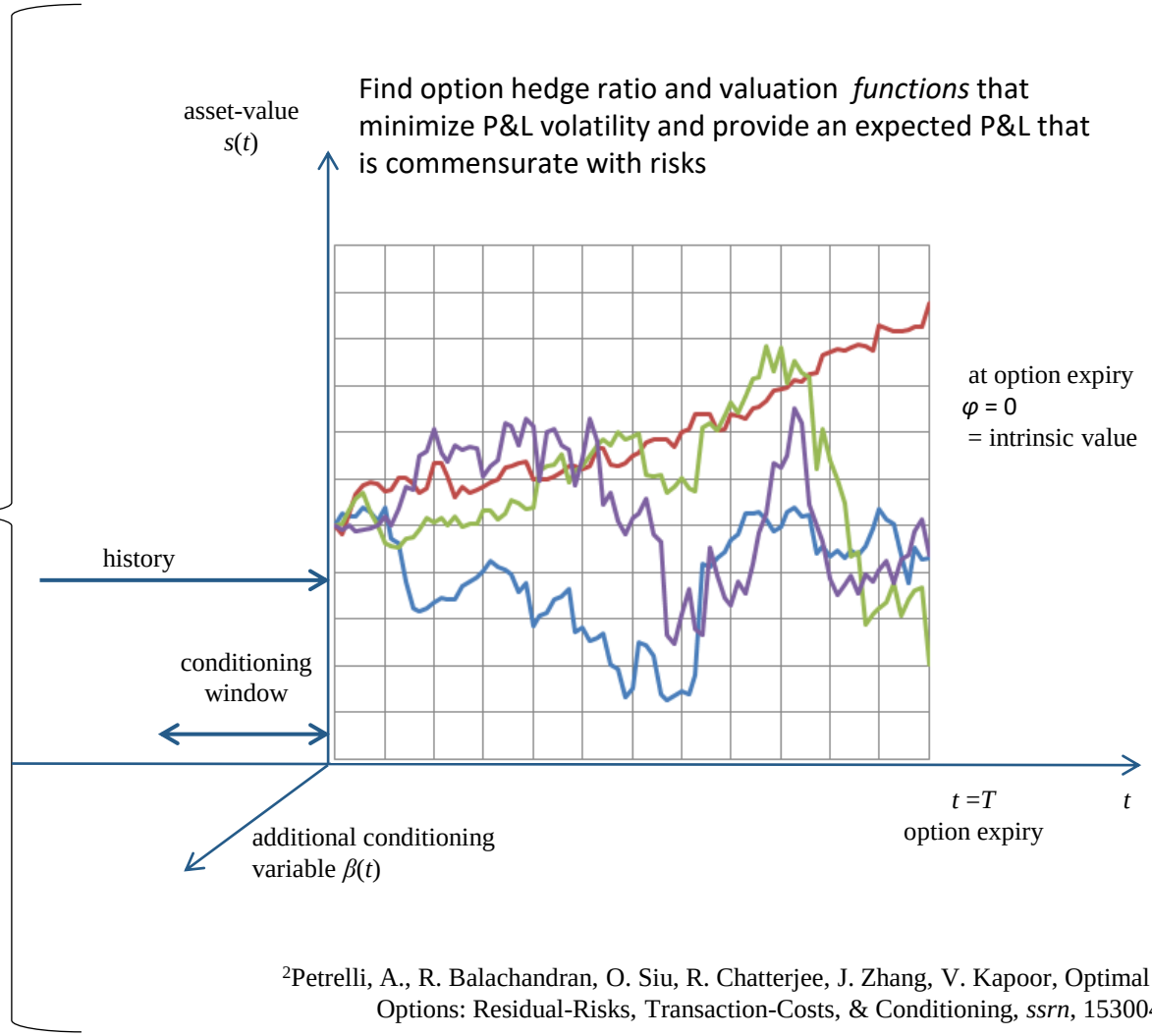
CONDITIONAL MARKET SIMULATOR



Source: Bloomberg, Volaris Capital Management, LLC.

Implications for Options: Real-World Approach to Understanding Opportunities and Risks in Options

OPTION HEDGE OPTIMIZER



The Optimal Hedge Monte-Carlo (OHMC) method is applied to determine the following:

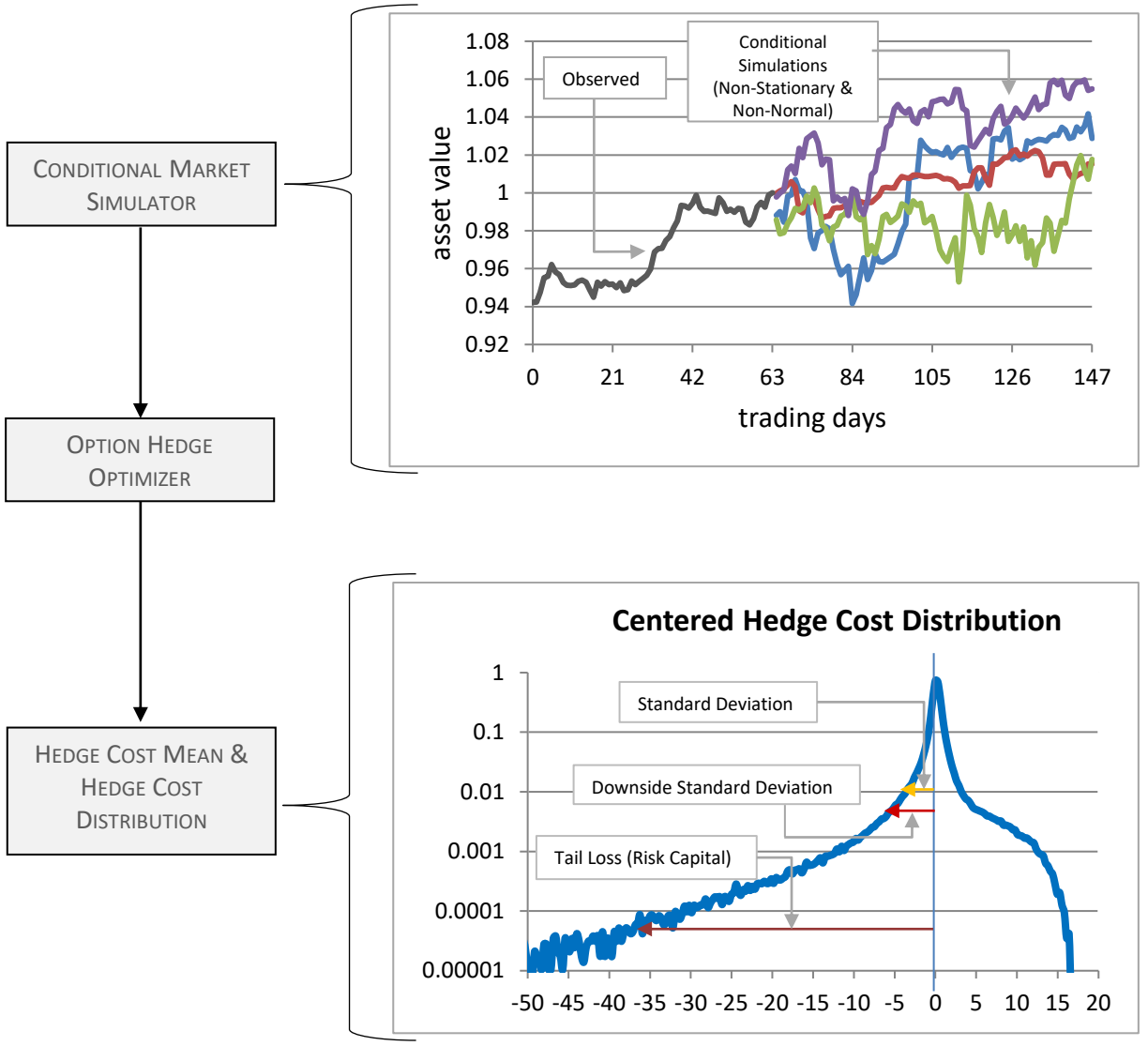
1) optimal option hedging strategy and its expected costs;
2) *irreducible risks* while hedging options;
3) impact of transaction costs on hedging costs and hedge-performance;
4) impact of *conditioning* hedging strategy on realized volatility.

[2]Petrelli, A., R. Balachandran, O. Siu, R. Chatterjee, J. Zhang, V. Kapoor, Optimal Dynamic Hedging of Equity Options: Residual-Risks, Transaction-Costs, & Conditioning, *ssrn*, 1530046, April 2010.

VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg, Volaris Capital Management, LLC.

Implications for Options: Real-World Approach to Understanding Opportunities and Risks in Options



VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg, Volaris Capital Management, LLC.

Five Cardinal Characteristics of Options

1. DISPARITY BETWEEN OUT OF THE MONEY PUTS AND CALLS

2. ASYMMETRY BETWEEN BUYER AND SELLER

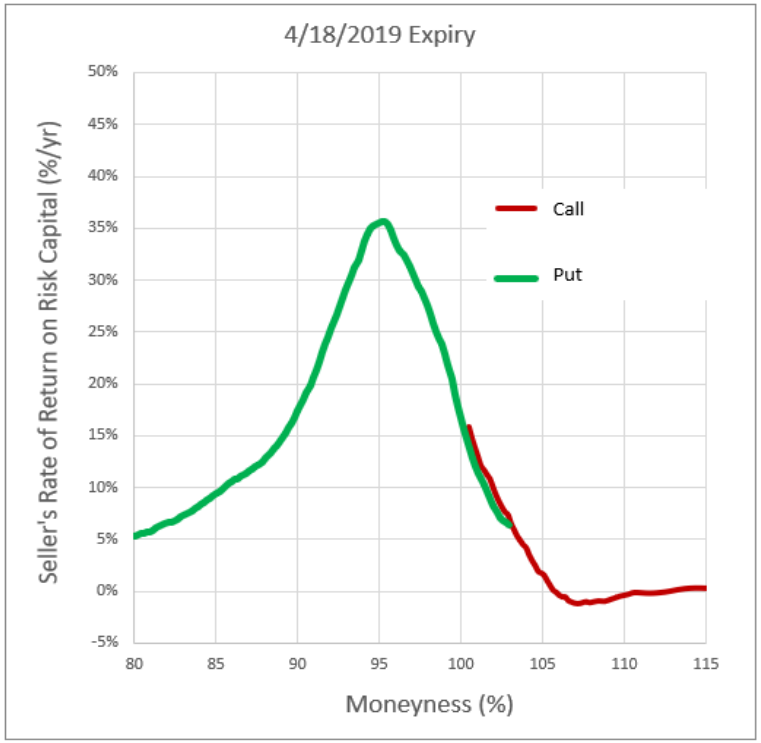
3. EXPLODING ASYMMETRY AT EXPIRY

4. EXPLODING ASYMMETRY WITH OUT-OF-THE-MONEYNESS

5. RATIONALE FOR TIMING

1. Disparity Between Out of the Money Puts and Calls

Comparison of an option *bid-price* with expected hedging costs provides an estimate of the option-seller's *expected P&L*. The *expected P&L* when compared to the *hedge-cost distribution* reveals the option's risk-return profile from a seller's perspective.



A sample snapshot is shown from February 11, 2019 of the estimated risk-return profile of an option seller.

Sellers Rate of Expected Return on Risk Capital

$$\theta(T) = \frac{\ln[\Theta + 1]}{T} (1/\text{year})$$

$$\Theta = \frac{\text{Bid Price - Expected Hedging Cost}}{\text{Risk-Capital}}$$

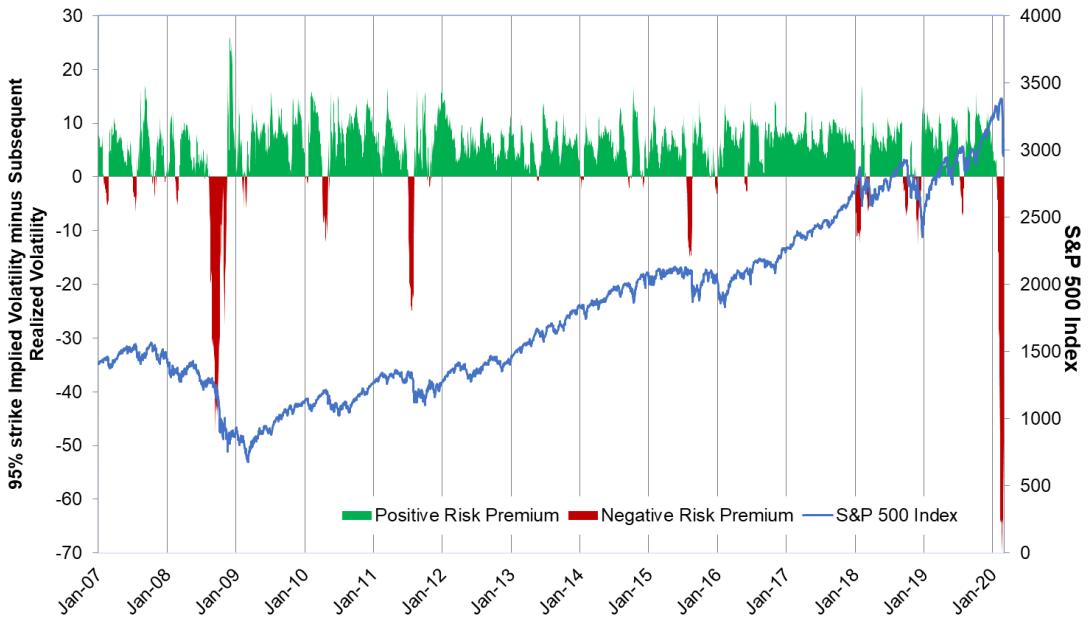
T: duration of derivative (years)

VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg, Volaris Capital Management, LLC.

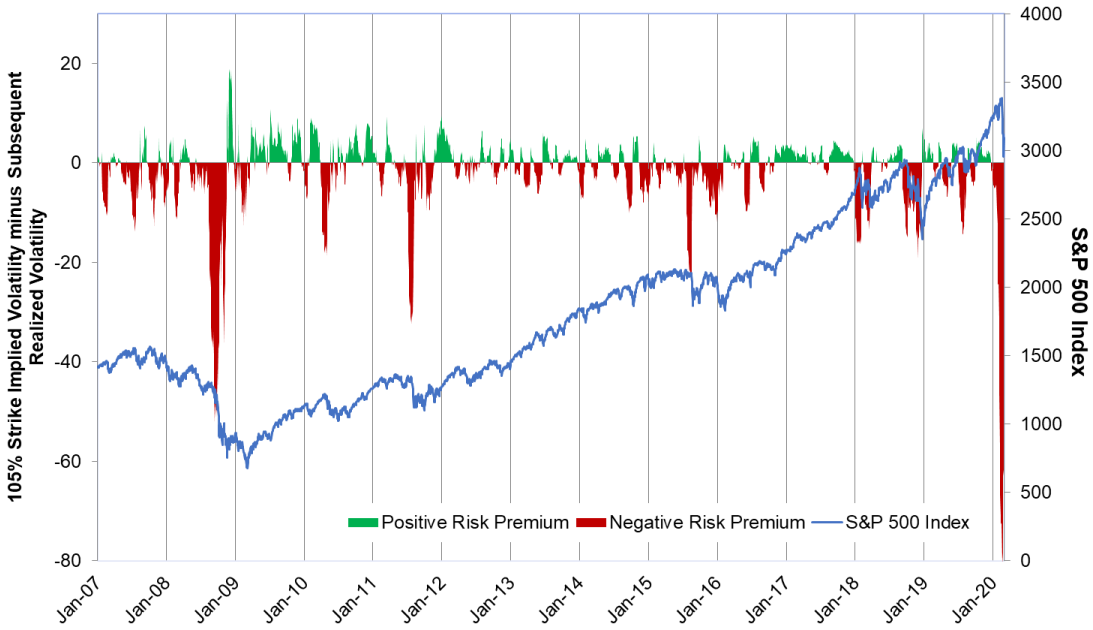
1. Disparity Between Out of the Money Puts and Calls (Cont.)

OTM Put Option Risk Premium for S&P 500



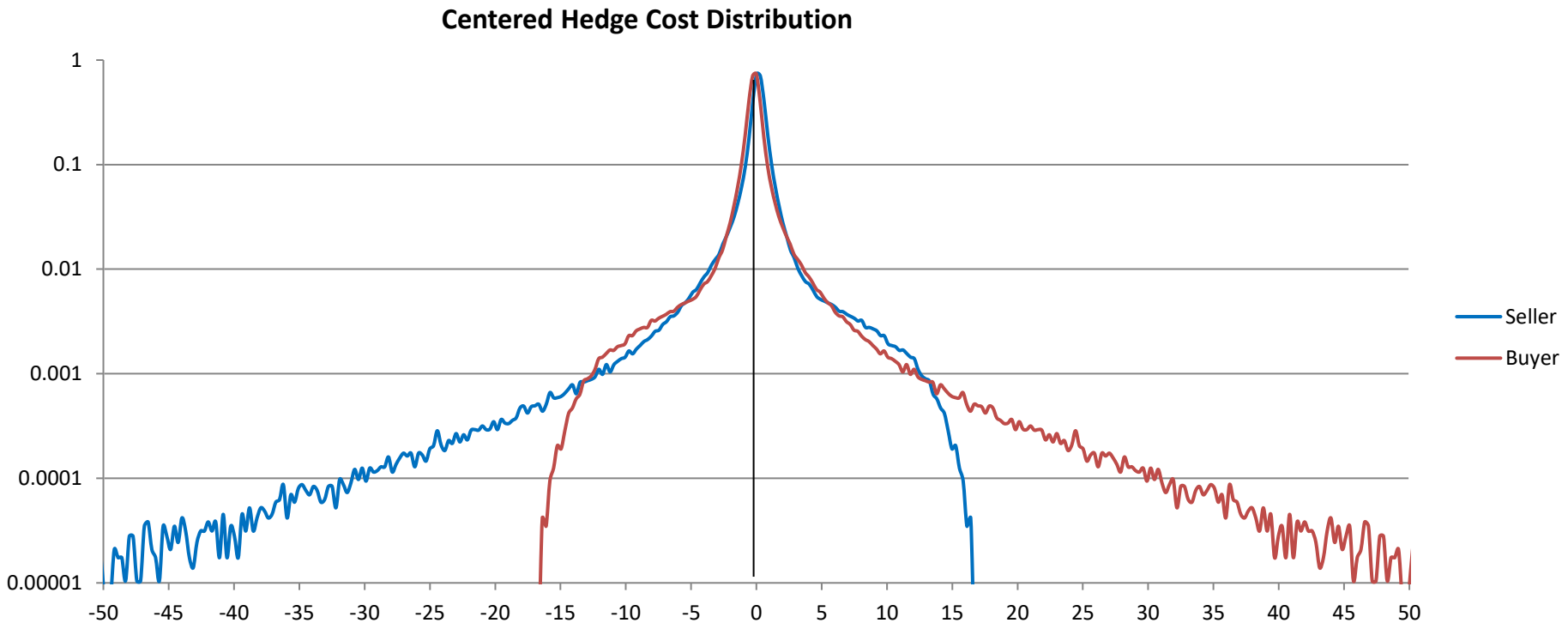
Source: Bloomberg.

OTM Call Option Risk Premium for S&P 500



Source: Bloomberg.

2. Asymmetry Between Buyer and Seller

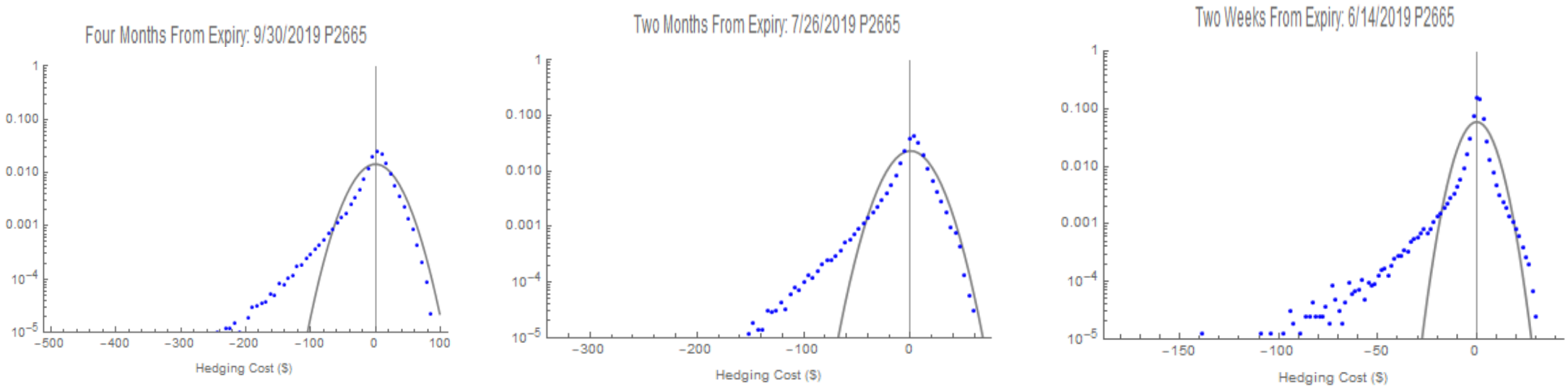


VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg, Volaris Capital Management, LLC.

3. Exploding Asymmetry at Expiry

Decreasing Tenor



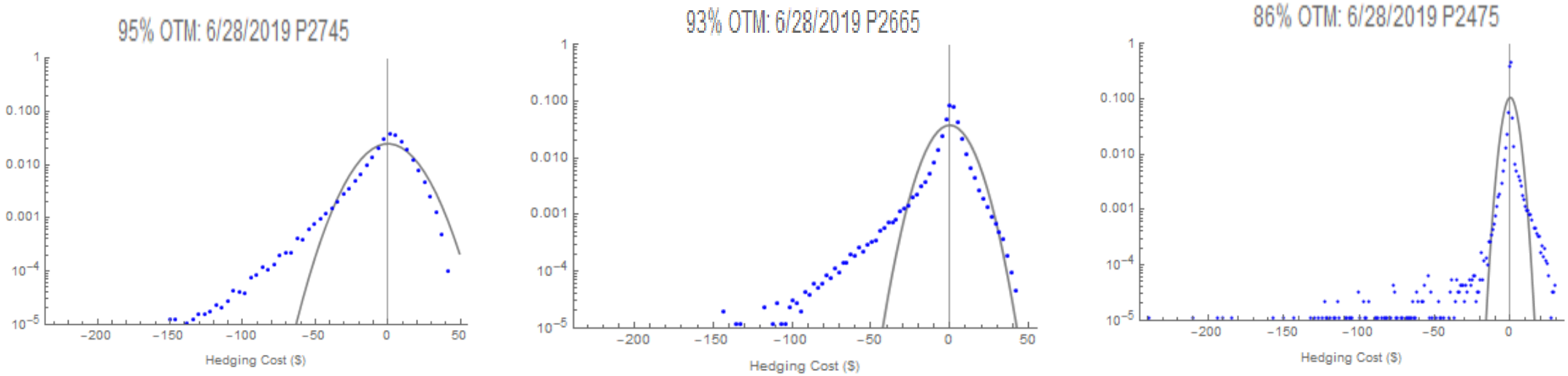
	Four Months (9/30/2019 P2665)	Two Months (7/26/2019 P2665)	Two Weeks (6/14/2019 P2665)
Average Hedging Cost ($)	50.65	24.81	4.19
Standard Deviation ($)	27.48	17.20	6.62
Downside Standard Deviation ($)	35.01	22.09	9.26
99% Confidence Level Loss ($)	100.73	64.05	26.94
1% Confidence Level Gain ($)	55.48	35.76	14.63
Standard Deviation/Average Hedging Cost	0.54	0.69	1.58
Downside Standard Deviation/Average Hedging Cost	0.69	0.89	2.21
99% Confidence Level Loss/Average Hedging Cost	1.99	2.58	6.43

VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg, Volaris Capital Management, LLC.

4. Exploding Asymmetry with Out-of-the-Moneyness

Increasing OTMness



	1 month 95% OTM (6/28/2019 P2745)	1 month 93% OTM (6/28/2019 P2655)	1 month 86% OTM (6/28/2019 P2475)
Average Hedging Cost ($)	29.59	10.24	0.86
Standard Deviation ($)	15.96	10.46	3.72
Downside Standard Deviation ($)	19.87	13.90	5.16
99% Confidence Level Loss ($)	54.87	41.51	6.17
1% Confidence Level Gain ($)	30.09	23.00	7.95
Standard Deviation/Average Hedging Cost	0.54	1.02	4.35
Downside Standard Deviation/Average Hedging Cost	0.67	1.36	6.03
99% Confidence Level Loss/Average Hedging Cost	1.85	4.05	7.21

VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg, Volaris Capital Management, LLC.

5. Rationale for Timing (part A)

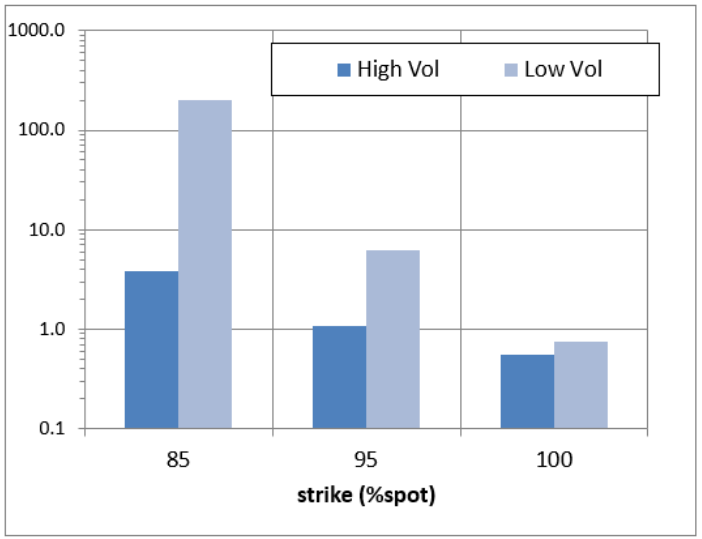
Low-Volatility Regime

Strike (% spot)	Std Deviation (x avg hedge cost)	Downside Std Deviation (x avg hedge cost)	99.9% Confidence Loss (x avg hedge cost)
85	146.6	199.8	276.7
95	4.5	6.1	48.9
100	0.6	0.7	4.0

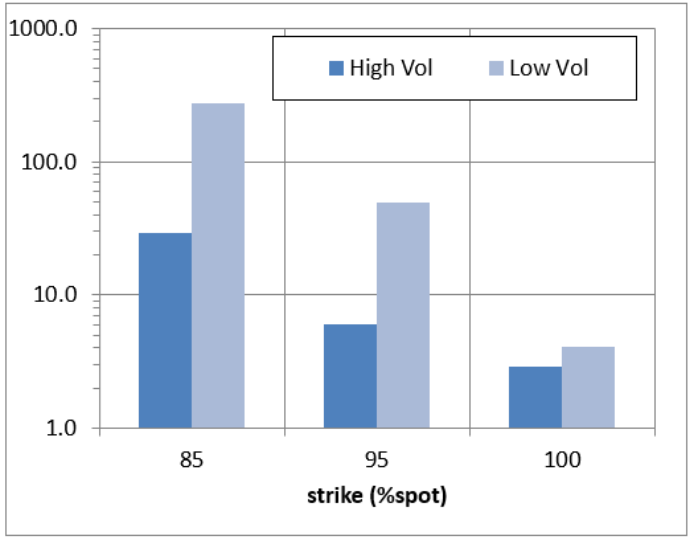
High-Volatility Regime

Strike (% spot)	Std Deviation (x avg hedge cost)	Downside Std Deviation (x avg hedge cost)	99.9% Confidence Loss (x avg hedge cost)
85	2.8	3.8	29.2
95	0.8	1.1	6.0
100	0.4	0.5	2.9

Downside Deviation Normalized by Average Hedge Cost



Tail Loss (99.9% CL) Normalized by Average Hedge Cost



Hedge cost statistics of seller-optimal-hedger of a 1-month expiry put shown as a function of out-of-the-moneyness in a low-volatility regime and a high volatility regime.

VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg, Volaris Capital Management, LLC.

5. Rationale for Timing (part B)

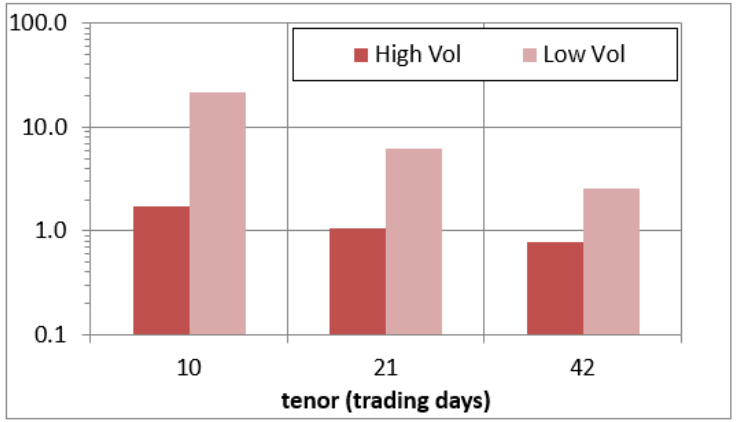
Low-Volatility Regime

Tenor (days)	Std Deviation (x avg hedge cost)	Downside Std Deviation (x avg hedge cost)	99.9% Confidence Loss (x avg hedge cost)
10	15.5	21.6	190.8
21	4.5	6.1	48.9
42	1.9	2.6	16.3

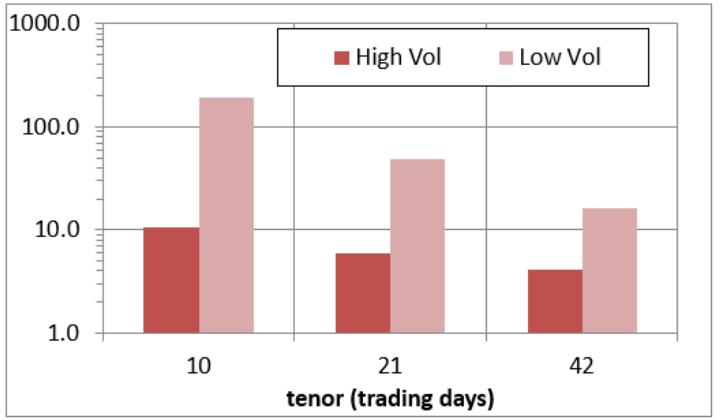
High-Volatility Regime

Tenor (days)	Std Deviation (x avg hedge cost)	Downside Std Deviation (x avg hedge cost)	99.9% Confidence Loss (x avg hedge cost)
10	1.2	1.7	10.4
21	0.8	1.1	6.0
42	0.6	0.8	4.1

Downside Deviation Normalized by Average Hedge Cost



Tail Loss (99.9% CL) Normalized by Average Hedge Cost



Hedge cost statistics of seller-optimal-hedger of a 95% put shown with increasing tenor in a low-volatility regime and a high volatility regime.

VOLARIS CAPITAL MANAGEMENT

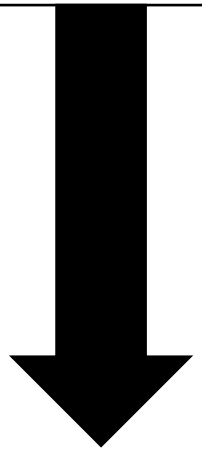
Source: Bloomberg, Volaris Capital Management, LLC.

Five Cardinal Characteristics of Options

1. DISPARITY BETWEEN OUT OF THE MONEY PUTS AND CALLS
2. ASYMMETRY BETWEEN BUYER AND SELLER
3. EXPLODING ASYMMETRY AT EXPIRY
4. EXPLODING ASYMMETRY WITH OUT-OF-THE-MONEYNESS
5. RATIONALE FOR TIMING

Do S&P 500 Index Volatility Indexes reflect an awareness of these cardinal characteristics?

No, they do NOT!



The cardinal characteristics of options on S&P 500 Index , central to designing viable volatility investment strategies, are rarely incorporated into Indexes representing volatility as an asset class.

Indexes Evaluated over the Past Economic Cycle (Daily Time Series: March 2008 – March 2020)

COMPARISON INDEXES

- **SPX Index**
- **SPTR Index**
- **LBUSTRUU Index**

VOLATILITY INDEXES

- **VIX Index**
- **SPVIXSTR Index**
- **SPVXSPIT Index**
- **CNDR Index**
- **PUT Index**

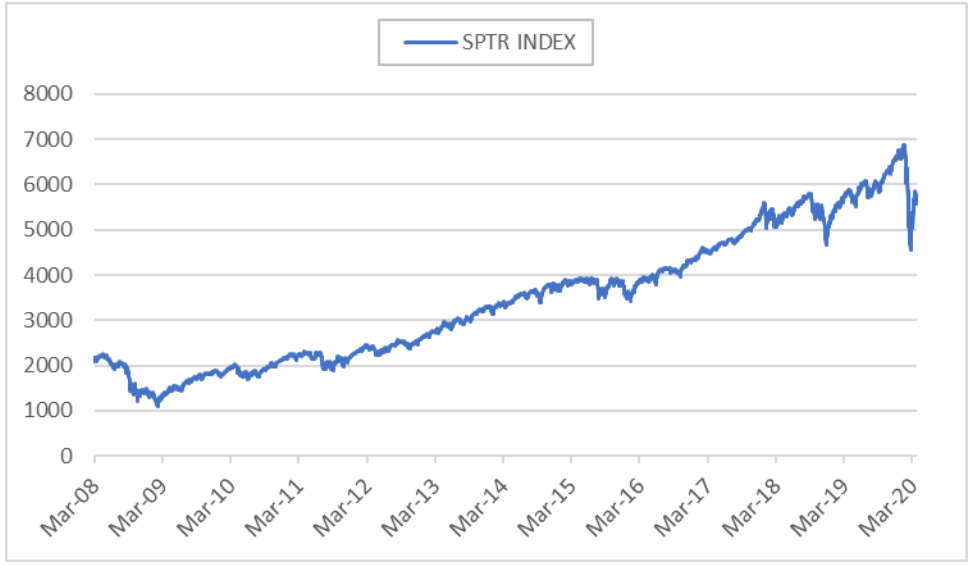
Five Cardinal Characteristics of SPX Index Options	SPVIXTR Index	SPVXSPIT Index	CNDR Index	PUT Index
1. Disparity Between Out of the Money Puts and Calls	X	X	X	✔
2. Asymmetry Between Buyer and Seller	X	X	✔	X
3. Exploding Asymmetry at Expiry	✔	✔	X	X
4. Exploding Asymmetry with Out-of-the-Moneyness	X	X	X	X
5. Elements of Timing	X	X	X	X

The cardinal characteristics of options that are recognized by the volatility index are indicated by a ✔ *and the properties ignored in the index construction are indicated by a* X.

SPTR Index: Risk-Return of Large Cap

SPTR Index (S&P 500 Total Return Index): SPTR Index reflects effects of reinvested dividends on the SPX Index.

SPTR Index Level



SPTR Index Statistics

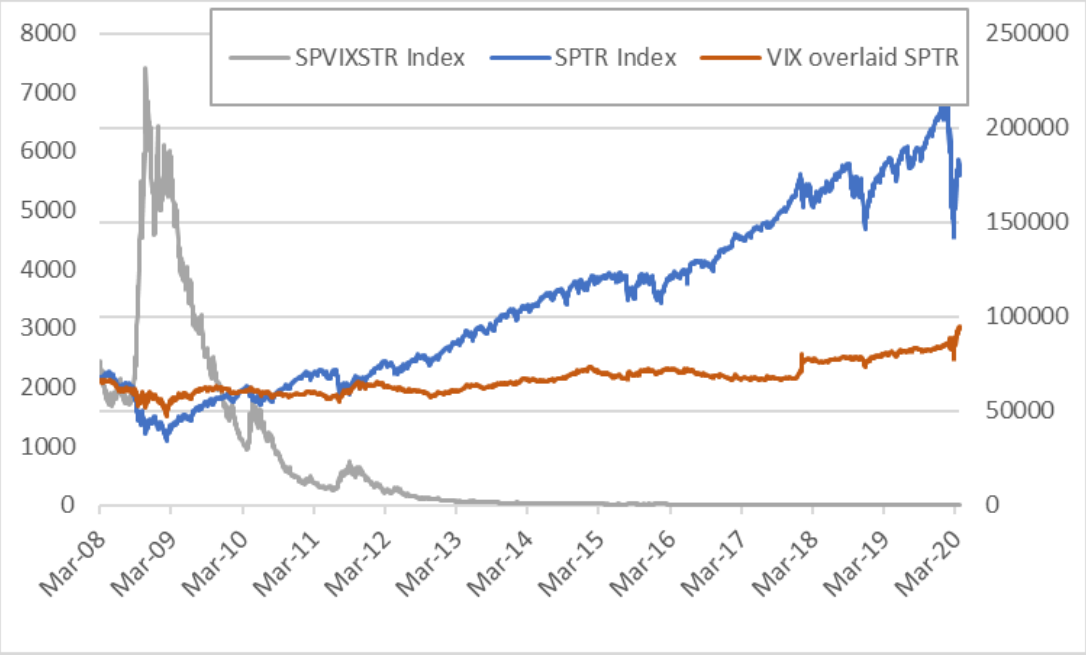
CAGR	8.5%
Volatility	21.2%
Information Ratio	0.40
Upside Volatility	19.6%
Downside Volatility	22.8%

VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg.

Going Broke Buying Volatility: SPVIXSTR Index

SPVIXSTR Index (S&P 500 VIX Short-Term Futures Index Total Return): Represents long exposure to one-month maturity VIX futures contracts.



- **SPTR Index Level**
- **SPVIXSTR Index Level (buy and hold long volatility exposure)**
- **VIX-overlaid S&P Index Total Return Tail-Hedged Portfolio (84% SPTR Index and 16% SPVIXSTR Index)**

	SPVIXSTR Index	S&P 500 TR Index	VIX overlaid S&P 500 TR Tail-Hedged Portfolio
CAGR:	-43.7%	8.5%	3.0%
Volatility:	70.6%	21.2%	12.6%
IR:	-0.61	0.40	0.23
Upward Volatility:	82.8%	19.6%	13.7%
Downward Volatility:	59.1%	22.8%	11.5%

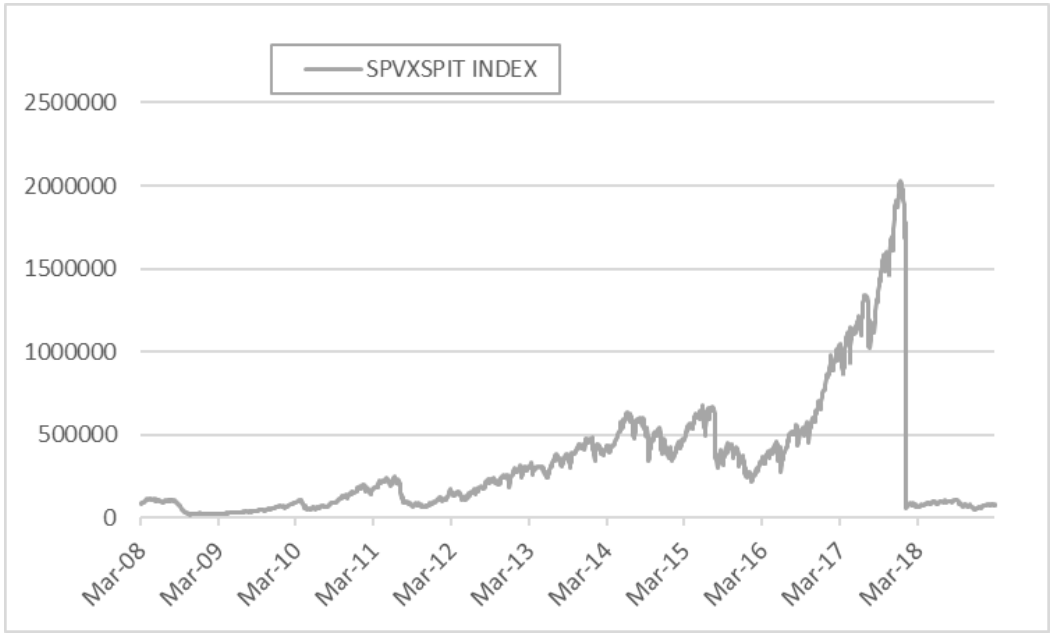
VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg.

Going Broke Selling Volatility: SPVXSPIT Index

SPVXSPIT Index (S&P 500 VIX Short-Term Futures Inverse Index Total Return): Represents short exposure to one-month maturity VIX futures contracts.

SPVXSPIT Index Level



SPVXSPIT Index Statistics

CAGR	-10.6%
Volatility	117.3%
Information Ratio	-0.09
Upside Volatility	56.2%
Downside Volatility	170.4%

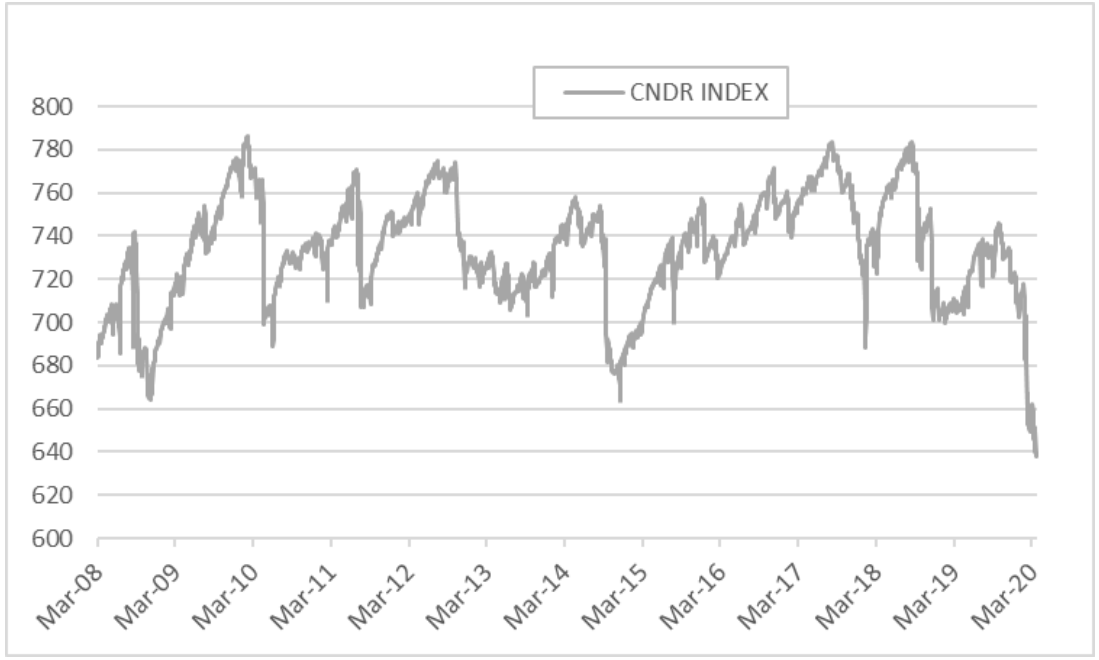
VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg.

Going **Nowhere** Buying and Selling Volatility

CNDR Index (S&P 500 Iron Condor Index): Represents exposure to one-month put and call spreads symmetrically specified in terms of option sensitivity and carried to expiry. T-Bills are used to collateralize and to accrue interest.

CNDR Index Level



CNDR Index Statistics

CAGR	-0.6%
Volatility	7.8%
Information Ratio	-0.08
Upside Volatility	6.1%
Downside Volatility	9.9%

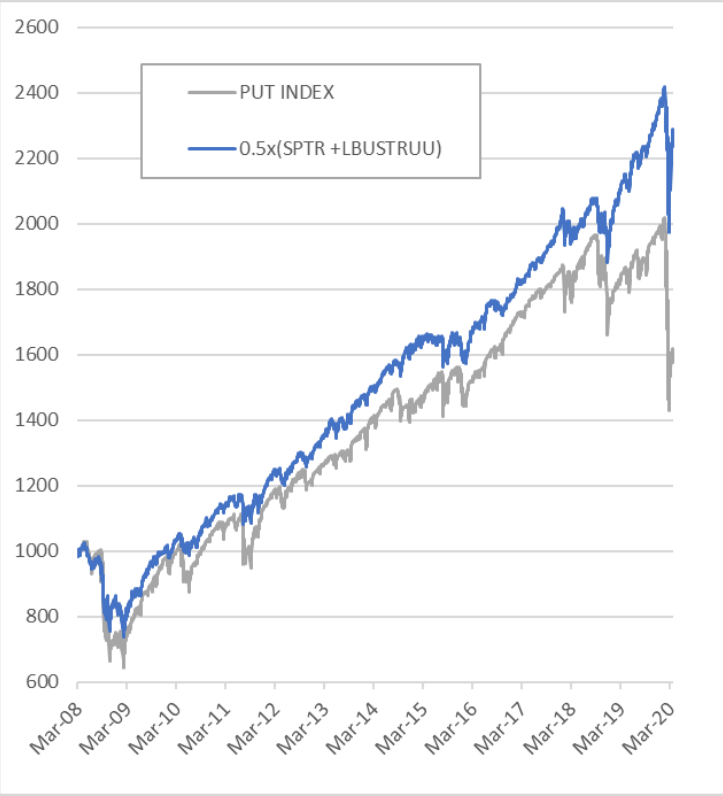
VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg.

Unimpressive Lot of Downside Protection Seller

PUT Index (S&P 500 PutWrite Index): Represents selling 1-month at-the-money puts and carrying them to expiry, fully collateralized with T-Bills, that are also used to accrue interest.

LBUSTRUU Index (Barclays US Aggregate Bond Index)



	PUT Index	50% SPTR + 50% LBUSTRUU
CAGR:	4.1%	7.1%
Volatility:	15.5%	10.2%
Information Ratio:	0.27	0.69

VOLARIS CAPITAL MANAGEMENT

Source: Bloomberg.

Five Cardinal Characteristics of SPX Index Options	SPVIXTR Index	SPVXSPIT Index	CNDR Index	PUT Index
1. Disparity Between Out of the Money Puts and Calls	X	X	X	✓
2. Asymmetry Between Buyer and Seller	X	X	✓	X
3. Exploding Asymmetry at Expiry	✓	✓	X	X
4. Exploding Asymmetry with Out-of-the-Moneyness	X	X	X	X
5. Elements of Timing	X	X	X	X

For volatility indexes to successfully represent volatility as an asset class worthy of a fiduciary's consideration for an investor's portfolio allocation, there must be a degree of consensus on basic risk-return features of S&P 500 Index options and there must be an attempt to intelligently reflect that in the index definitions.

July 2019

Challenges of Indexation in S&P 500 Index Volatility Investment Strategies

Margaret Sundberg
Quantitative Trader and Portfolio Manager
*Volaris Capital Management**

Abstract: S&P 500 Index option-based volatility indexes have untenable risk-return profiles. These volatility indexes are not designed with consideration of important real-world risk characteristics of options and fail to represent *volatility* as a differentiated *asset-class* with relevance to the long-term utility of investors. Implications of the S&P 500 Index return distribution on the profit and loss (P&L) distribution of a directionally hedged option position are presented. The ensuing *five* cardinal characteristics of options on S&P 500 Index, central to designing viable *volatility* investment strategies, are enumerated.

https://ssrn.com/abstract=3427350

https://www.volariscapital.com/research.html

Presentation Overview

NATURE OF S&P 500 INDEX RETURNS

↓

IMPLICATIONS FOR OPTIONS

Generalized Auto Regressive Asset Model[1]

Optimal Hedge Monte-Carlo[2]

↓

FIVE CARDINAL CHARACTERISTICS OF OPTIONS

↓

WHY VOLATILITY IS NOT YET AN ASSET CLASS

Analysis of SPX Index Volatility Indexes

[1]Wang, J., A. Petrelli, R. Balachandran, O. Siu, J. Zhang, R. Chatterjee, V. Kapoor, General Auto-Regressive Asset Model, *ssrn*, 142855, July 2009.

[2]Petrelli, A., R. Balachandran, O. Siu, R. Chatterjee, J. Zhang, V. Kapoor, Optimal Dynamic Hedging of Equity Options: Residual-Risks, Transaction-Costs, & Conditioning, *ssrn*, 1530046, April 2010.

Sustainable Yield and Tail Risk Opportunities

Home | Design | Process | Research | Leadership | Citizenship | Opportunities | Contact

- *We provide investors access to yield and tail-risk opportunities in the options market.*

- *Our insights, based on experience and active research, are applied to pursue client's goals.*

www.volariscapital.com

Contact: Margaret Sundberg, Portfolio Manager, margaret.sundberg@volariscapital.com
Contact: Vivek Kapoor, CEO/CIO, vivek.kapoor@volariscapital.com

Important Legal Information and Disclosures

Volaris Capital Management, LLC is not affiliated with Interactive Brokers LLC, or any other FINRA broker-dealer

This material has been prepared by Volaris Capital Management LLC ("Volaris") on the basis of publicly available information, internally developed data and other third-party sources believed to be reliable. Volaris has not sought to independently verify information obtained from public and third-party sources and makes no representations or warranties as to accuracy, completeness or reliability of such information. All opinions and views constitute judgments as of the date of writing without regard to the date on which the reader may receive or access the information, and are subject to change at any time without notice and with no obligation to update. This material is for informational and illustrative purposes only and is intended solely for the information of those to whom it is distributed by Volaris. No part of this material may be reproduced or retransmitted in any manner without the prior written permission of Volaris. Volaris does not represent, warrant or guarantee that this information is suitable for any investment purpose and it should not be used as a basis for investment decisions. This material does not purport to contain all of the information that a prospective investor may wish to consider. This material is not to be relied upon as such or used in substitution for the exercise of independent judgment. Past performance does not guarantee or indicate future results.

This material should not be viewed as a current or past recommendation or a solicitation of an offer to buy or sell any securities or investment products or to adopt any investment strategy. The investment views and market opinions/analyses expressed herein may not reflect those of Volaris as a whole and different views may be expressed based on different investment styles, objectives, views or philosophies. To the extent that these materials contain statements about the future, such statements are forward looking and subject to a number of risks and uncertainties. All images are for illustrative purposes only.