Commonality in Volatility Risk Premium

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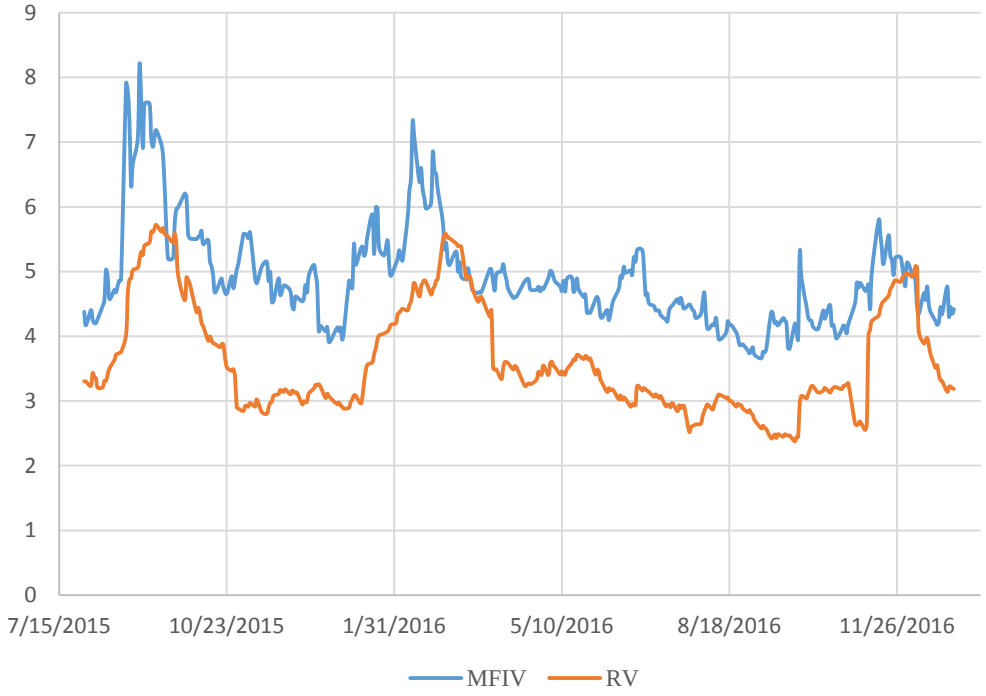
Background

- Option implied volatility on average overestimates realized volatility.

Model-free implied volatility and Expected Realized volatility (30 calendar days) of Nifty

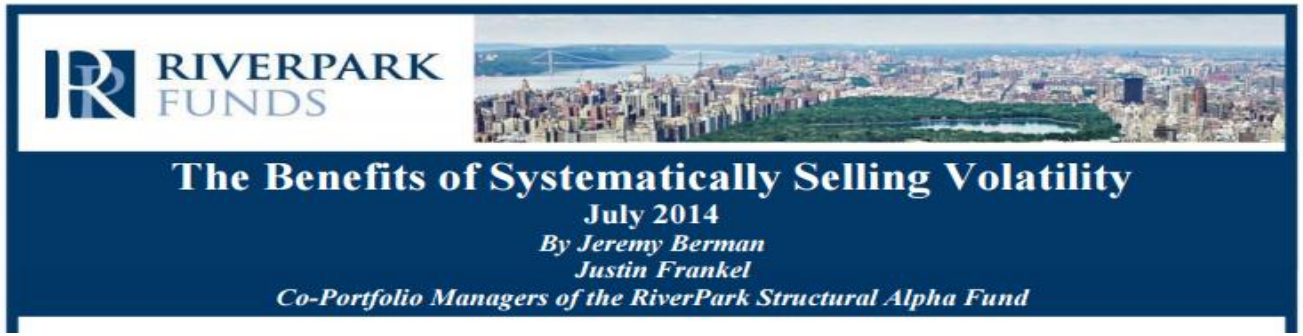


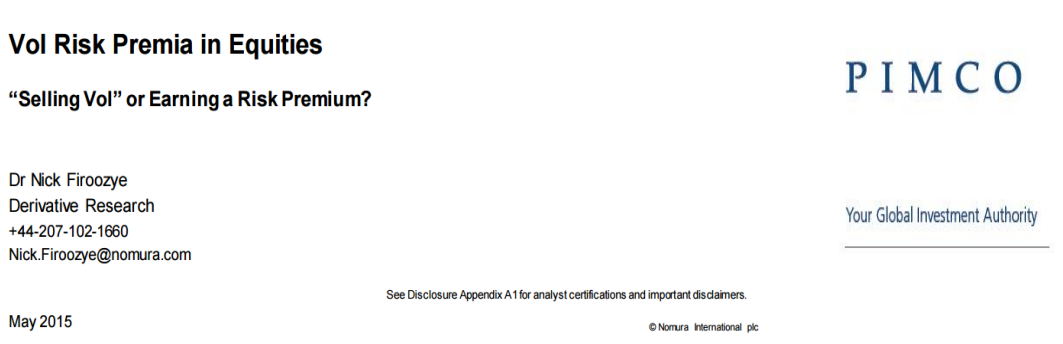
Volatility Risk Premium (VRP) of Nifty

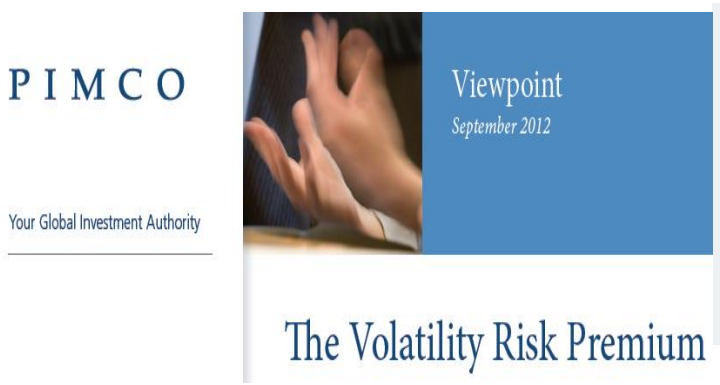
- Therefore, one can make profit by selling volatility spread.

Background

- Formally literature name the spread between implied volatility (IV) and expected realized volatility (RV) as volatility risk premium



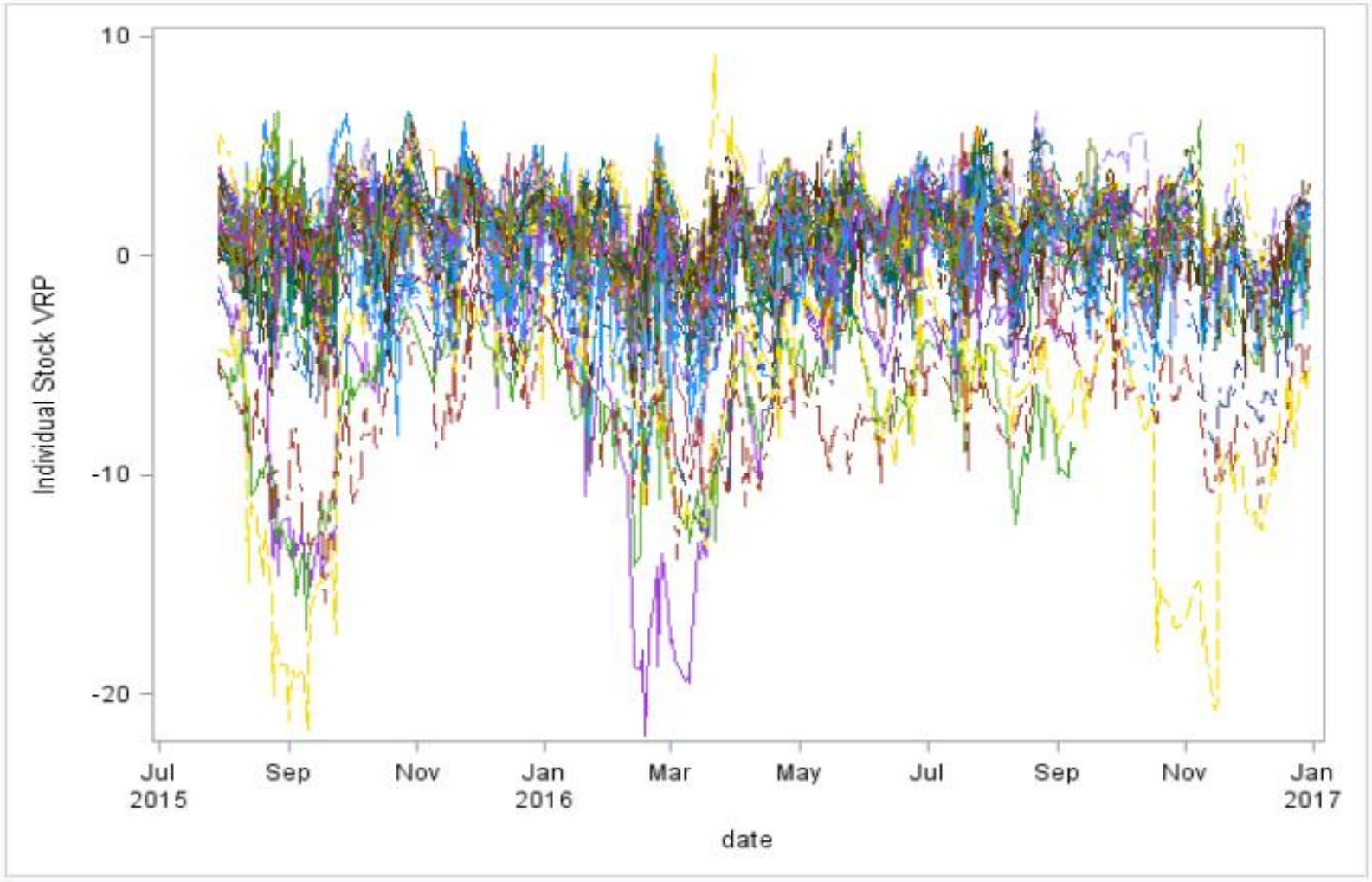




That is what we know about Index options

What is new in this paper

- We analyzed 44 individual stock VRP
- 35 individual stocks show, on average, positive VRP
- Large cross sectional variation of individual stock VRP



What is new in this paper

- Carr and Wu (2009) present evidence that possibly market only prices systematic component of volatility risk in the stock market portfolio.

- Does market price systematic component of volatility risk or does commonality in volatility risk exist?

- Existence of commonality in volatility risk would have
  - Implications on Option pricing
  - Implications on asset pricing with uncertainty in return volatility

Why commonality may exist

Risk-sharing properties of derivatives market

- Under common market volatility shocks, option buyers pay premium to option writers (Fleming,1999; Jackwerth,2000; Bakshi and Kapadia,2003, Carr and Wu,2008) to hedge risk

Informational role of derivatives market (What we argue)

- Trading activity exhibits correlated trading pattern in response to market wide volatility shocks (Chordia et. al, 2000) →Volatility informed traders create time varying net demand of volatility in the options market in response to the volatility shocks.

- Liquidity suppliers, on the other hand, supply volatility observing the net demand of volatility in the options order flow and set option prices such that implied volatility exceeds realized volatility.("Volatility markup" , Green and Figlewski, 1999)

- Thus, under common market wide volatility shocks, the "volatility markup" is implemented for the individual stock options as well as for the index options

Objectives

- The extent to which **commonality relationship exists between individual stock VRP and market VRP.**

- How **robust the commonality relationship is with the explanation of "volatility markup" hypothesis-- across market and stock specific characteristics.**

Methodology

Volatility risk premium

- Volatility risk premium of individual stocks and market are computed as

$$Market\_VRP_t = IVIX_t - E^P(RV_{t,t+30})$$

$$stock\_vrp_{j,t} = stock\_mfiv_{j,t} - E^P(stock_{rv\,j,t,t+30})$$

- $stock\_mfiv_{j,t}$ is computed by the same methodology used by NSE to calculate India VIX

- Scaled TSRV measure is used as proxy for realized volatility both for market and individual stocks.

- For ex-ante expected volatility forecast, **random walk model $\hat{\sigma} = \sigma_{t-1}$ is considered to forecast realized volatility for next thirty days** (Jindal and Vipul ,2012)

Methodology

Main Regression Equation

$$stock\_vrp_{j,t} = a + \sum_{i=-1}^{+1} b_{i+1} Market\_VRP_{t+i} + \sum_{k=-1}^{+1} c_{k+1} Market\_Volatility_{t+k} +$$

$$d_1 \Delta Market\_Volatility_t + e_1 stock\_volatility_{j,t} + f_1 \Delta stock\_volatility_{j,t} +$$

$$g_1\, stock\_size_{j,t} + h_1 stock\_size_{j,t}^2 + m_1 stock\_liquidity_{j,t} + n_1 stock\_putoi_{j,t} + \varepsilon_t$$

- Above estimation is done by pooled regression (44 individual stock options) and Newey-West (1987) t-statistics are reported

- $stock\_vrp_{j,t}$= Daily measure of VRP of stock j
- $Market\_VRP_t$ = Daily measure of market (index Nifty) VRP

- Existence of the **commonality in the VRP between individual stock and market would mean that any of the b_{i+1} coefficients would be statistically significant and positive**

Control variables

Market Specific Factors

- $Market\_Volatility$

- **When volatility level is high (low), the "volatility markup" process would yield lower (higher) VRP.** The individual stock VRP and market volatility level exhibits negative relationship if the above intuition holds true

- $\Delta Market\_Volatility$

- **Liquidity suppliers set higher (lower) implied volatility to the recent high (low) change of volatility**. Thus, the level of individual stocks VRP would be positive related to the recent changes of the market volatility.

Stock Specific Factors

- $stock\_volatility_{j,t}$
- $\Delta stock\_volatility$

Control Variables

Stock Specific Factors

- $stock\_size$

- **Larger the size** of the firm **lesser** the **information asymmetry** assumed by the liquidity suppliers→ tend to set **lower volatility markup for larger sized firms→ lower stock VRP level**

- $stock\_liquidity$

- **Higher the liquidity** of the firm **lesser the information asymmetry** assumed by the liquidity suppliers→ tend to **set lower volatility markup for higher liquid firms→ lower stock VRP level**

- $stock\_putoi$

- Open interest of put option provides a natural proxy for option demand

Result (Commonality with market specific factors)

Variables	Model 1	Model 2	Model 3
Intercept	-1.057*** (-5.68)	0.242 (1.25)	0.235 (1.22)
$Market\_VRP_{t-1}$	0.164** (2.43)	0.329*** (4.57)	0.314*** (4.37)
$Market\_VRP_{t}$	0.243*** (4.92)	0.458*** (10.02)	0.491*** (10.51)
$Market\_VRP_{t+1}$	0.418*** (6.67)	0.237*** (3.87)	0.223*** (3.63)
$Market\_Volatility_{t-1}$		-0.405*** (-6.62)	-0.148*** (-2.7)
$Market\_Volatility_{t}$		-0.642*** (-11.47)	-0.958*** (-9.42)
$Market\_Volatility_{t+1}$		-0.315*** (-5.8)	-0.301*** (-5.67)
$\Delta Market\_Volatility_{t}$			0.323*** (5.16)
$Adjusted\ R^2$	0.0225	0.0572	0.0581

Result (Commonality with stock specific factors)

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Intercept	-0.404** (-2.2)	-0.318* (-1.65)	9.635*** (2.71)	-0.766 (-1.22)	10.101*** (2.74)	-2.436*** (-4.32)	8.568** (2.4)
$Market\_VRP_{t-1}$	0.189*** (2.83)	0.229*** (3.33)	0.162** (2.42)	0.164** (2.44)	0.163** (2.42)	0.165** (2.44)	0.240*** (3.45)
$Market\_VRP_{t}$	0.383*** (7.63)	0.351*** (7.11)	0.240*** (4.87)	0.243*** (4.94)	0.241*** (4.89)	0.242*** (4.92)	0.357*** (7.19)
$Market\_VRP_{t+1}$	0.324*** (5.5)	0.325*** (5.51)	0.421*** (6.74)	0.416*** (6.69)	0.419*** (6.76)	0.416*** (6.62)	0.306*** (5.19)
$stock\_volatility_{j,t}$	-0.284*** (-6.03)	-0.331*** (-5.58)					-0.360*** (-5.49)
$\Delta stock\_volatility_{j,t}$		0.192** (2.2)					0.221** (2.27)
$stock\_size_{j,t}$			-1.974*** (-2.8)		-1.999*** (-2.82)		-1.809*** (-2.63)
$stock\_size_{j,t}^2$			0.089*** (2.59)		0.090*** (2.62)		0.078** (2.32)
$stock\_liquidity_{j,t}$				-0.020 (-0.46)	-0.024 (-0.54)		-0.131* (-1.71)
$stock\_putoi_{j,t}$						0.103*** (2.58)	0.241*** (3.72)
$Adjusted\ R^2$	0.0386	0.0406	0.0297	0.0225	0.0297	0.0248	0.0565

Result (Commonality with market and stock specific factors)

Variables	Overall model
Intercept	9.990*** (2.79)
$Market\_VRP_{t-1}$	0.321*** (4.45)
$Market\_VRP_{t}$	0.490*** (10.59)
$Market\_VRP_{t+1}$	0.214*** (3.48)
$Market\_Volatility_{t-1}$	-0.061 (-1.13)
$Market\_Volatility_{t}$	-0.797*** (-8.67)
$Market\_Volatility_{t+1}$	-0.262*** (-5.31)
$\Delta Market\_Volatility_{t}$	0.321*** (5.27)
$stock\_volatility_{j,t}$	-0.189*** (-3.23)
$\Delta stock\_volatility_{j,t}$	0.131* (1.8)
$stock\_size_{j,t}$	-1.891*** (-2.74)
$stock\_size_{j,t}^{2}$	0.083** (2.46)
$stock\_liquidity_{j,t}$	-0.123 (-1.6)
$stock\_putoi_{j,t}$	0.199*** (3.09)
$Adjusted\ R^2$	0.0739

Conclusion

- The study presents the evidence that market prices systematic component of volatility risk heavily for individual stocks and for market as a whole.

- Commonality in volatility risk exists and the relationship is robust and statistically significant

- Commonality results are robust and consistent with the “volatility markup” hypothesis.

Thank you

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