Loss Uncertainty, Gain Uncertainty, and Expected Stock Returns

Midwest Finance Association
2020 Annual Meeting at ZOOM

Discussant: James Yae (University of Houston)

My Brain at First Sight

93
pages » 37

t-stat = 8 ~ 23

11 presentations

Bullet-proof

35
tables
Double sort, triple sort, ...

Make all others
INSIGNIFICANT

Heads-up

1. How to Enjoy the Paper

2. Discussion Points

1) How to Interpret the Main Result
2) The Main Innovation
3) A New Perspective
4) Other Papers
5) Other Comments

3. Conclusion

How to Enjoy the Paper

Wrong way to enjoy this paper

1) Another variance risk premium paper?

2) Another "… and the cross-section" paper?

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But, remember 35 tables in 93 pages!

and 3 years of revision by 4 great minds!

Discussion Point #1:

How to Interpret the Main Result

Ridiculously Simple View

Gain QRP: $\mathrm{QRP}_t^g \equiv \mathbb{E}_t\left[g_{t,t+1}^2\right] - \mathbb{E}_t^{\mathbb{Q}}\left[g_{t,t+1}^2\right]$

Loss QRP: $\mathrm{QRP}_t^l \equiv \mathbb{E}_t^{\mathbb{Q}}\left[l_{t,t+1}^2\right] - \mathbb{E}_t\left[l_{t,t+1}^2\right]$

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where $$\mathbb{E}_t^{\mathbb{Q}}\left[g_{t,t+\tau}^2\right] = e^{r_f\tau}\int_{S_t}^{\infty}\frac{1-\ln\left(K/S_t\right)}{K^2/2}C_t\left(\tau;K\right)dK$$

$$\mathbb{E}_t^{\mathbb{Q}}\left[l_{t,t+\tau}^2\right] = e^{r_f\tau}\int_{0}^{S_t}\frac{1+\ln\left(S_t/K\right)}{K^2/2}P_t\left(\tau;K\right)dK$$

Ridiculously Simple View

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where $\mathbb{E}_t^{\mathbb{Q}}\left[g_{t,t+\tau}^2\right] =$ Call option bundle price

$\mathbb{E}_t^{\mathbb{Q}}\left[l_{t,t+\tau}^2\right] =$ Put option bundle price

Ridiculously Simple View

Gain QRP: $\mathrm{QRP}_t^g \equiv$ Benchmark $-$ Call prices

Loss QRP: $\mathrm{QRP}_t^l \equiv$ Put Prices $-$ Benchmark

Ridiculously Simple View

Academic view

Gain QRP: $\text{QRP}_t^g \equiv \text{Benchmark} - \text{Call prices}$

Loss QRP: $\text{QRP}_t^l \equiv \text{Put Prices} - \text{Benchmark}$

Gain QRP $\downarrow$: Abnormally expensive call!

Everyone wants this stock!

Low premium! Lottery demand?

Loss QRP $\uparrow$: Abnormally expensive put!

No one buys this stock without high premium Value stocks?

Ridiculously Simple View

Savvy traders' view: Buy Low, Sell High!

Gain QRP: $\mathrm{QRP}_t^g \equiv$ Benchmark − Call prices

Loss QRP: $\mathrm{QRP}_t^l \equiv$ Put Prices − Benchmark

Gain QRP ↓: Abnormally expensive call!

The stock is also overheated!

Yes, they are right.

Loss QRP ↑: Abnormally expensive put!

Then the stock is on sale!

Yes, they are right.

Discussion Point #2:

The Main Innovation

Why Did We Miss This?

Squared monthly return

$$r^2_{t-1,t} = \underbrace{\mathrm{RV}_{t-1,t}}_{\text{quadratic variation}} + \underbrace{2\mathrm{RA}_{t-1,t}}_{\textbf{Realized Autocovariance!!!}}$$

$$\Big(\sum_{j=1}^{1/\delta} r_{t-1+j\delta}\Big)^2$$

---

where $$\mathrm{RV}_{t-1,t} = \sum_{j=1}^{1/\delta} r^2_{t-1+j\delta}$$

$$\mathrm{RA}_{t-1,t} = \sum_{i=1}^{1/\delta-1} \sum_{j=1}^{1/\delta-i} r_{t-1+j\delta} r_{t-1+j\delta+i\delta}$$

Why Did We Miss This?

$$r_{t-1,t}^2 = \underbrace{\mathrm{RV}_{t-1,t}}_{\text{quadratic variation}} + \underbrace{2\mathrm{RA}_{t-1,t}}_{\textbf{Realized Autocovariance!!!}}$$

Continuous time modeling with serial-correlation?

We know how strong short-term reversal is. ☹

$$\frac{dS_t}{S_{t-}} = \mu_S\, dt + \sigma_t dB_t + (e^{Z_{g,t}} - 1)\, d + (e^{-Z_{b,t}} - 1)\, dN_{b,t},$$

Kilic and Shaliastovich (2019) used both LHS and RV but did not point out how they are mathematically different.

Why Did We Miss This?

$$r^2_{t-1,t} = \underbrace{\mathrm{RV}_{t-1,t}}_{\text{quadratic variation}} + \underbrace{2\mathrm{RA}_{t-1,t}}_{\textbf{Realized Autocovariance???}}$$

Q1. BTW, what is inside the autocovariance-looking term?

Q2. Is it just serial-correlation or something else?

Q3. Stronger results with E[$r^2_{t-1,t}$] than E[RV]. Why?

Really, why?

Discussion Point #3:

A New Perspective

Create a Derivative for Myself?

(My return) = $g^2 - l^2$ contingent on stock returns

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Risk premium of my asset $= E^P[g^2 - l^2] - E^Q[g^2 - l^2]$
$= \text{Gain QRP} + \text{Loss QRP}$

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This measure will also explain CS.

Of course, the following works better.

(My return) = $1.3g^2 - 0.7l^2$

RP(My return) = 1.3Gain QRP + 0.7Loss QRP

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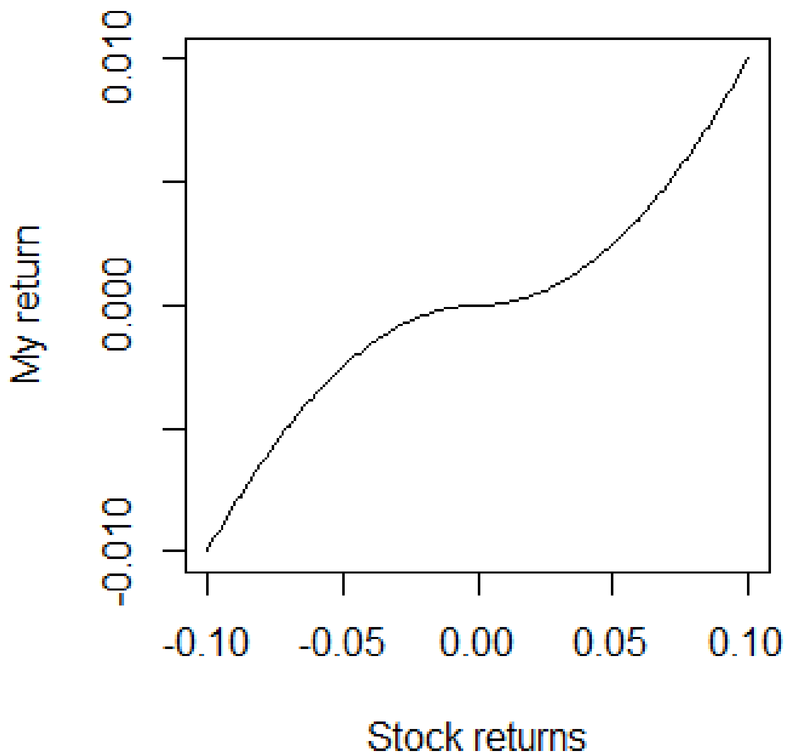

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Maybe
RP(my asset) $\approx$ RP(the stock) ?

A Toy Example

Suppose stock i's monthly log return r_i follows iid $N(\mu_i, \sigma_i^2)$
Constant volatilities. No true VRP. No serial correlation.

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Wrong VRP: $E^P[RV_i] - E^Q[r_i^2] = \sigma_i^2 - (\sigma_i^2 + r_f^2)$
$$= -r_f^2$$

Net QRP: $E^P[r_i^2] - E^Q[r_i^2] = (\mu_i^2 + \sigma_i^2) - (\sigma_i^2 + r_f^2)$
$$= \mu_i^2 - r_f^2$$

- The autocovariance-looking term RA has this term even with zero autocorrelation!
- Remember autocovariance notations in the text book are about demeaned series.

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Net QRP: $E^P\left[r_i^2\right] - E^Q\left[r_i^2\right] = (\mu_i^2 + \sigma_i^2) - \left(\sigma_i^2 + r_f^2\right)$

$$= \mu_i^2 - r_f^2$$

QRP has information about the expected return of the stock.

What about Gain QRP and Loss QRP?

A Toy Example

<u>Assumptions</u>

500 stocks

Expected returns: from 3% to 30% (annualized)

The riskfree rate: 2% (annualized)

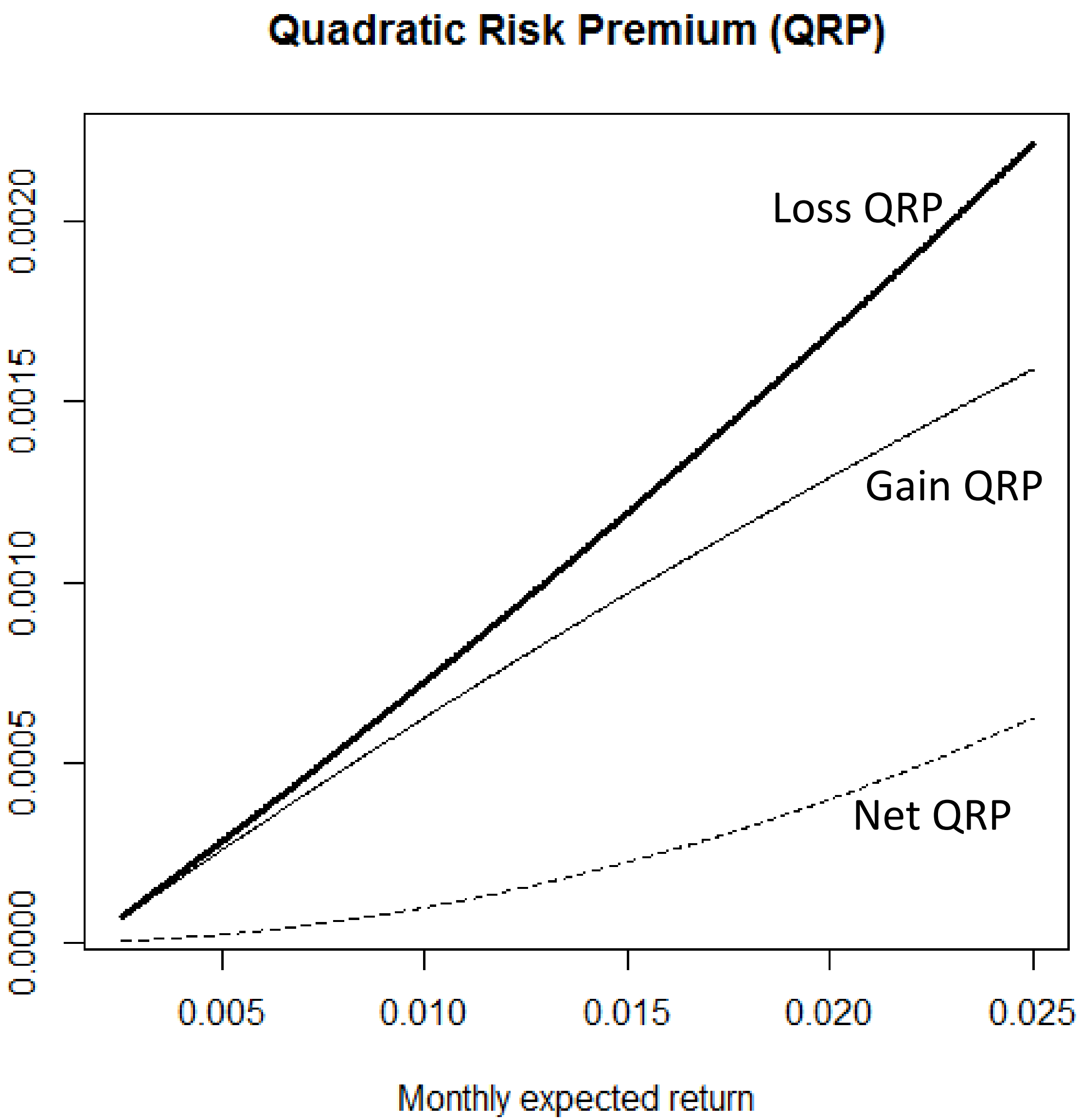
Volatility: 30% (annualized)

<u>Calculate Gain QRP & Loss QRP</u> using

$$
\begin{aligned}
\mathbb{E}_t\left[l_{t,t+1}^2\right] &= \left(\mu_t^2+\sigma_t^2\right)\Phi\left(-\frac{\mu_t}{\sigma_t}\right)-\mu_t\sigma_t\phi\left(\frac{\mu_t}{\sigma_t}\right)\\
\mathbb{E}_t\left[g_{t,t+1}^2\right] &= \left(\mu_t^2+\sigma_t^2\right)\Phi\left(\frac{\mu_t}{\sigma_t}\right)+\mu_t\sigma_t\phi\left(\frac{\mu_t}{\sigma_t}\right),
\end{aligned}
$$

QRPs Should Explain the Expected Returns!

even without VRP and Serial-Correlation



Don’t be fooled by slopes

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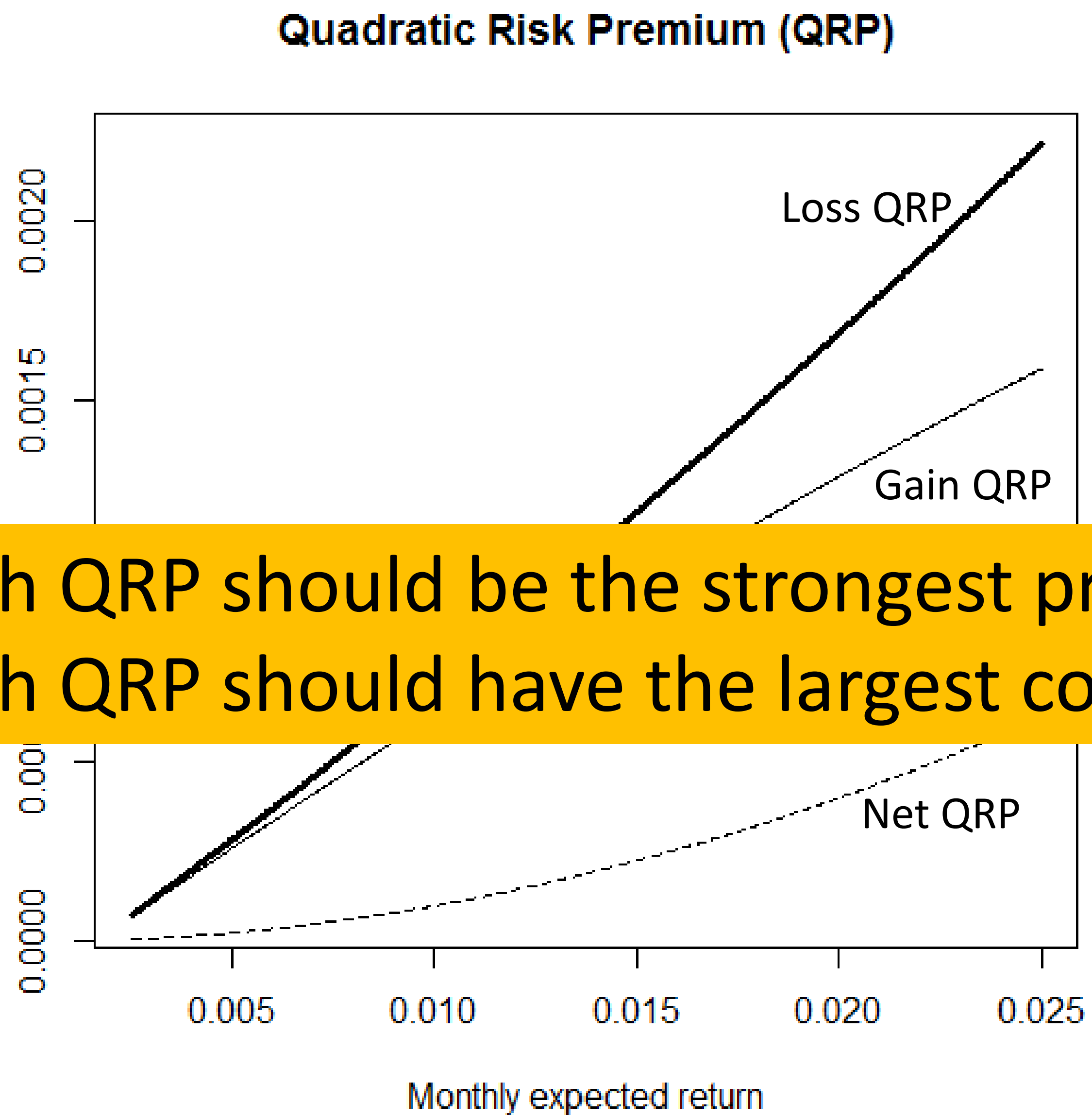


Q1. Which QRP should be the strongest predictor?

Q2. Which QRP should have the largest coefficient?

Make QRPs More Realistic!

1. Add measurement errors. (alternatively, assign different volatilities)
 - Follow the variance & correlation estimates in the paper

2. Generate 20 years of the monthly returns of 500 stocks.

3. Run Fama-Macbeth regressions.

Easy to replicate the table in the paper. Question: But why is net QRP not working?

Measurement errors!

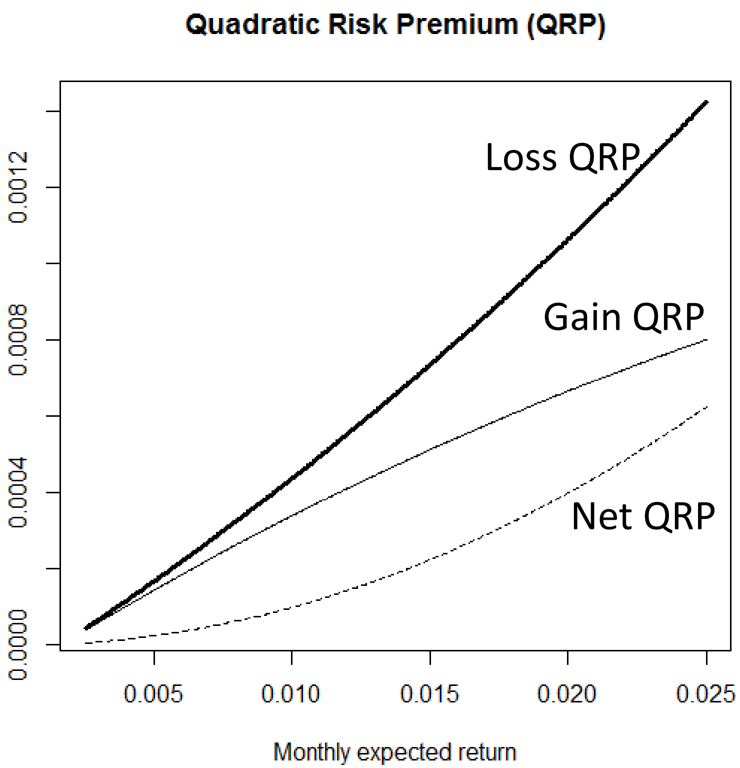
	I	II
QRP	0.10	
	(1.19)	
Gain QRP		1.31***
		(7.06)
Loss QRP		0.71***
		(6.39)

Loss Uncertainty, Gain Uncertainty, and Expected Stock Returns

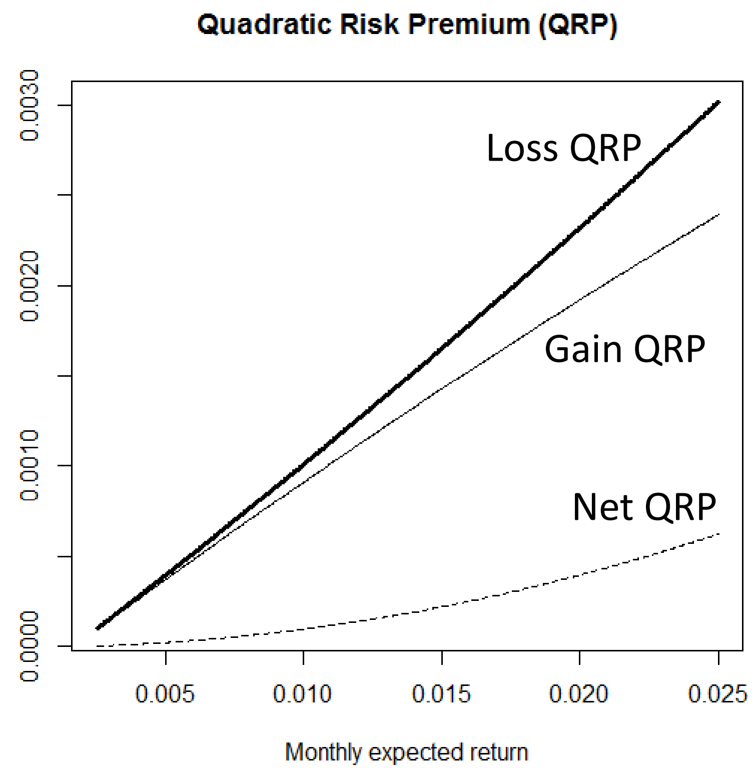
Measurement Errors Matter w/ High Vol

Individual stocks have higher total volatility than the market. Therefore, net QRP or VRP might not work on individual stocks.

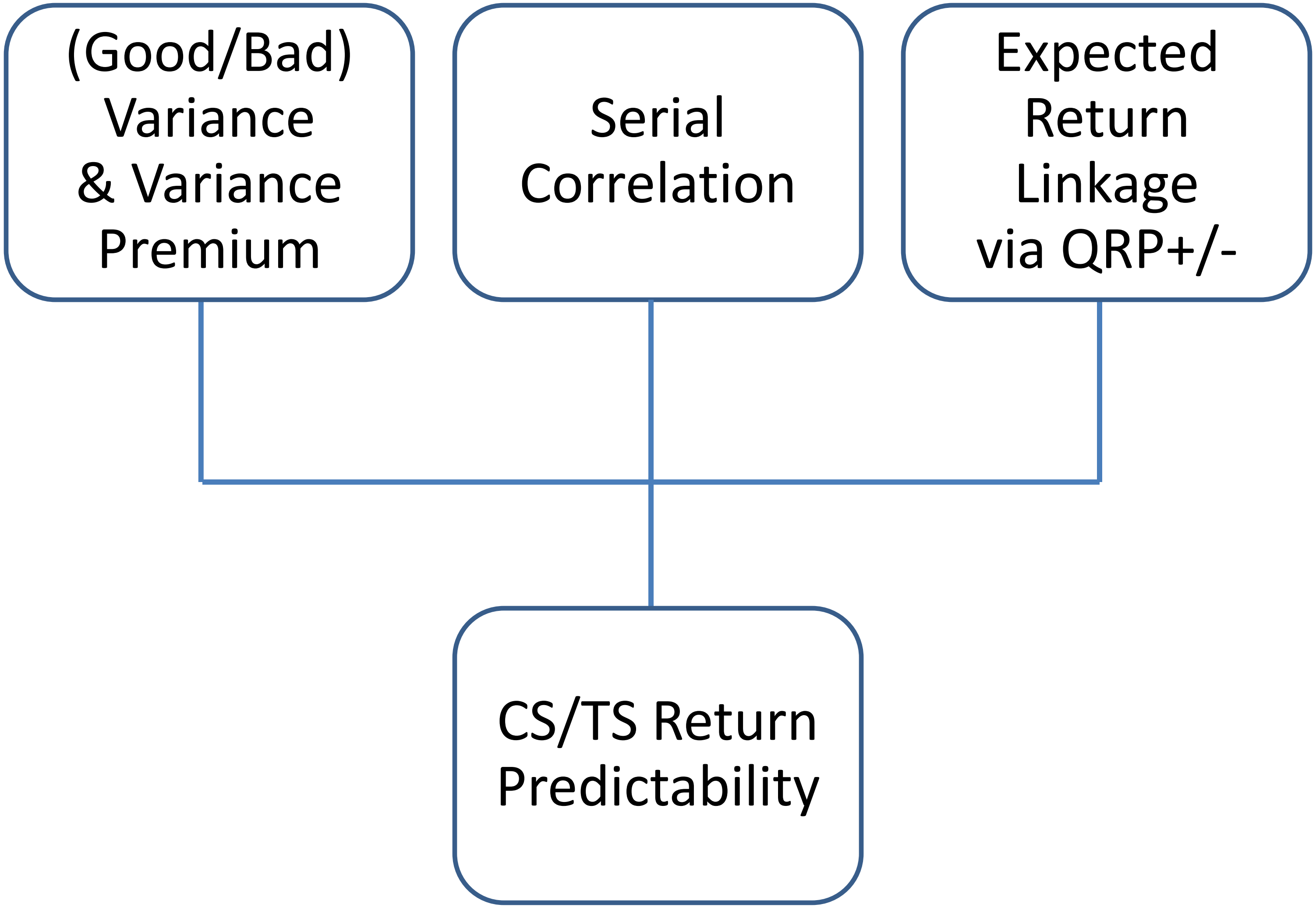
Return Vol=20%



Return Vol=50%



Three Sources of Predictability



Discussion Point #4:
Other Papers

Related Papers

Among the papers that predict equity returns by variance premium, …

Year	Journal	Authors	Asset to predict	Predictor	Physical E[.]
2009	RFS	Bollerslev et al.	Market	VRP	R-QV-P
2018	JFEt	Feunou et al.	Market	**VRP+ / VRP-**	E-QV-P
2019	JFE	Pyun	Market	VRP	E-QV-P
2019	MS	Kilic and Shaliastovich	Market / Portfolios	**VRP+ / VRP-**	R-QV-P, **E-QP-P**
?	?	This paper	**Individual stocks**	**VRP+ / VRP-**	**E-QP-P**

Working papers are NOT included

QV: quadratic variation
QP: quadratic payoff

R- : realized
E- : expected (predicted)
-P : premium

If the innovation is in the physical term,
these are the most relevant competitors.

Final Chapter

Other Comments

1. $E^P[r^2]$, $E^P[g^2]$ and $E^P[l^2]$ prediction needs $E^P[r]$ estimates. What?

$$\mathbb{E}_t\left[r_{t,t+1}^2\right] = \mu_t^2 + \sigma_t^2 \quad \mathbb{E}_t\left[g_{t,t+1}^2\right] = \left(\mu_t^2 + \sigma_t^2\right)\Phi\left(\frac{\mu_t}{\sigma_t}\right) + \mu_t\sigma_t\phi\left(\frac{\mu_t}{\sigma_t}\right), \quad \mathbb{E}_t\left[l_{t,t+1}^2\right] = \left(\mu_t^2 + \ldots\right.$$

Isn't it what we are eventually looking for? Coherency? Recursive estimation? Too little predictors? ML?

2. $E^P[r^2]$, $E^P[g^2]$ and $E^P[l^2]$ assume "monthly returns $\sim \mathrm{N}(\mu_t, \sigma_t^2)$".

3. If QRP+/- results are associated with information asymmetry, why is it different from RN-Skewness prediction? Any long-term prediction effect?

Predictor		Holding Period (month)			
		1	3	6	12
VOLSKEW	β	-0.39	-0.34	1.26	4.98
	t-stat.	-7.39	-2.98	6.50	15.30

from "A Comprehensive Look at the Option-Implied Predictors of Stock Returns" by Hitesh Doshi, Yang Luo, and James Yae

Conclusion

1. An important observation on the carelessly used proxy

2. Cross-sectional results are so strong and robust
   - Important to both academia and industry.
   - They can be even better.

3. Worth reading it. Learned a lot. A great paper with rich contents!

Thank you!