Discussion of

# Treasury Yield Implied Volatility and Real Activity

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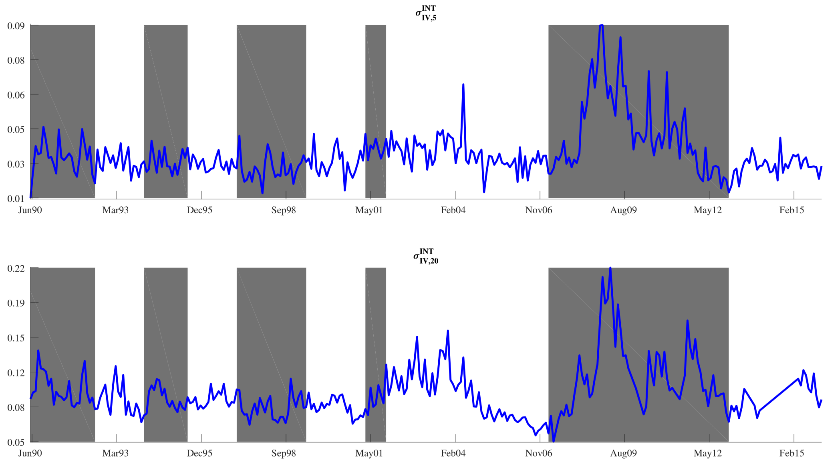
  3. Regress macro variables of interest from $t+1$ to $t+H$ on $YIV_t$
- Results
  - High YIV predicts low growth in macro quantities
  - High YIV predicts high vol in macro quantities
  - Holds with VAR specification, controls (incl. VIX), and excl. crisis

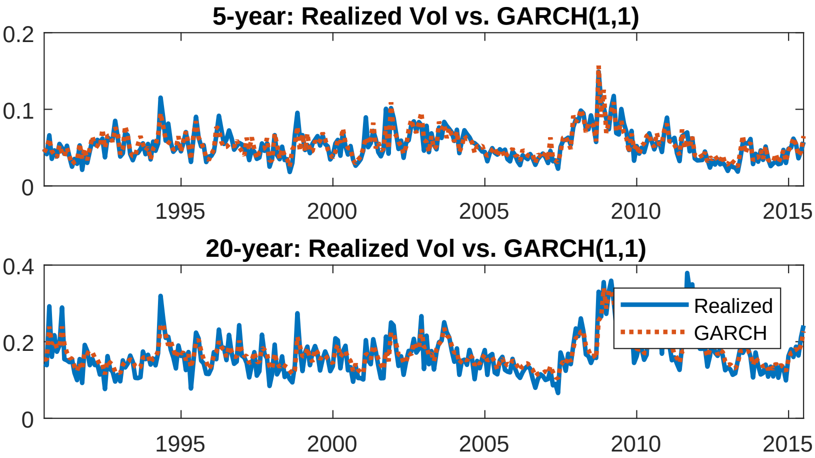
# Expected Physical Volatility or Variance Risk Premium?

- Option-implied volatility $= \text{Var}_t^{\mathbb{Q}}[r_{t+1}]$ under risk-neutral measure
- Bond returns drawn from physical distribution $\mathbb{P}$
- Variance Risk Premium $= \text{Var}_t^{\mathbb{Q}}[r_{t+1}] - \text{Var}_t^{\mathbb{P}}[r_{t+1}]$
- Which component is predicting macro outcomes? Let's take a look:
- Two proxies for conditional vol under physical measure
  1. Realized daily vol in bond "returns" (daily changes in prices of GSW zero-coupon bonds) – assume bond return vol is a martingale
  2. Estimate GARCH(1,1)

# Implied Vol from Cremers, Fleckenstein, and Gandhi



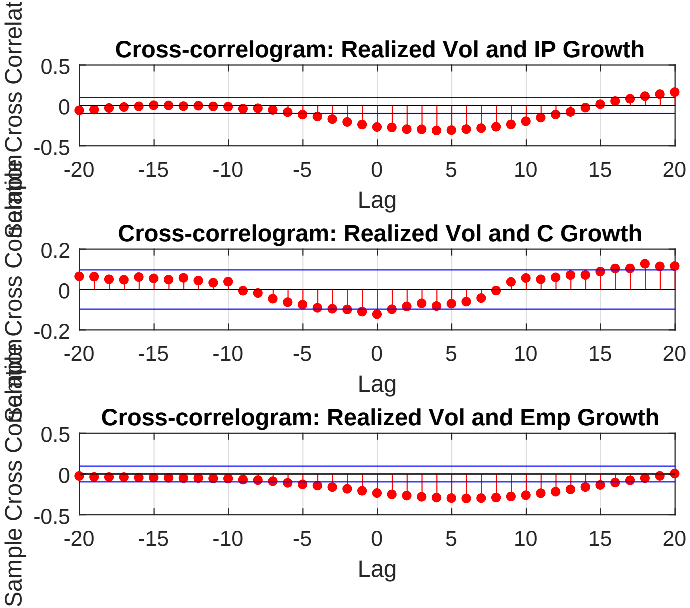
# Physical Vol



# Compare R-squared: Mostly Variance Premium?

| Horizon | 12 | 18 | 24 | 30 | 36 |
|---|---|---|---|---|---|
| | | Panel A: Industrial Production | | | |
| Implied Vol | 32.13 | 20.47 | 11.75 | 7.2 | 4.87 |
| Physical Vol | 11.77 | 7.07 | 2.79 | 0.56 | 0.00 |
| | | Panel B: Consumption | | | |
| Implied Vol | 34.48 | 27.76 | 21.63 | 17.58 | 16.11 |
| Physical Vol | 0.09 | 0.06 | 0.38 | 0.75 | 1.11 |
| | | Panel C: Employment | | | |
| Implied Vol | 44.77 | 38.55 | 29.40 | 21.78 | 15.52 |
| Physical Vol | 8.39 | 6.36 | 3.58 | 1.39 | 0.27 |

# Cross-Correlogram



# Measuring the Dependent Variable

- Let $x_t$ be log macro quantity (IP, consumption, employment)
- Then, for growth rate regressions, dependent variable is H-period ahead average of **year-on-year** growth rates

$$\frac{1}{H}\sum_{j=1}^{H}(x_{t+j} - x_{t+j-12})$$

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Consider a simple example where $H = 3$ and growth rates are quarter-on-quarter i.e.

$$\sum_{j=1}^{3}\sum_{k=0}^{2}\Delta x_{t+j-k} = \Delta x_{t-1} + 2\Delta x_t + 3\Delta x_{t+1} + 2\Delta x_{t+2} + \Delta x_{t+3}$$

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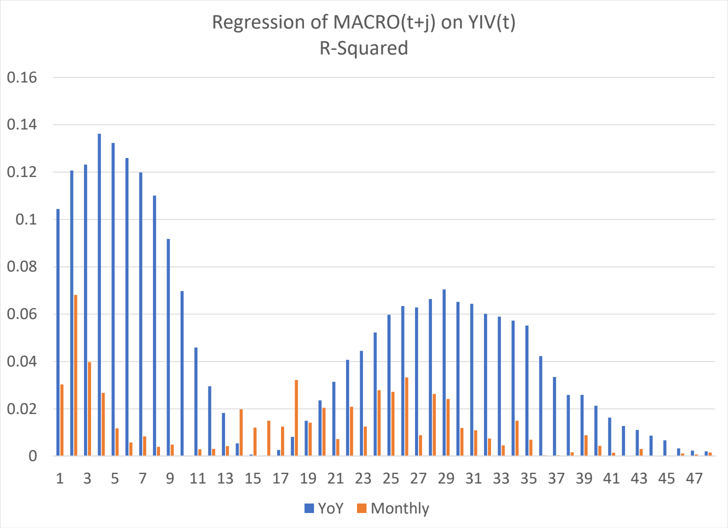
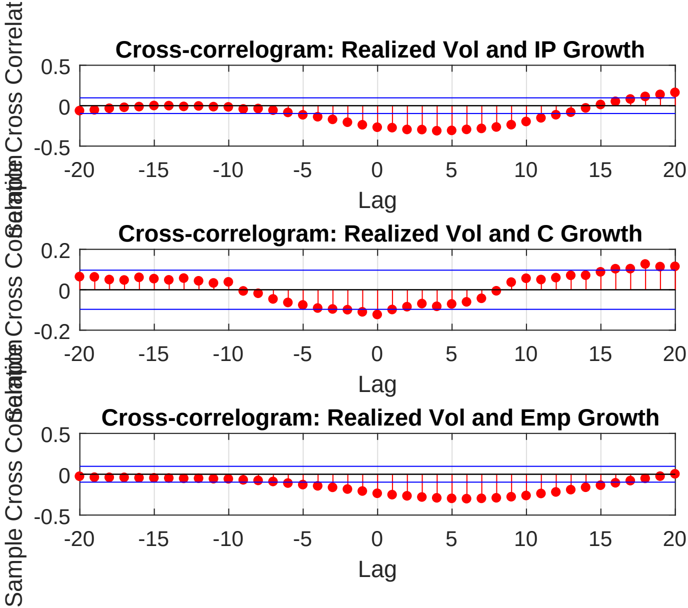
- Re-do with with seasonally adjusted monthly growth rates, at least for robustness
- With physical vols, results are...

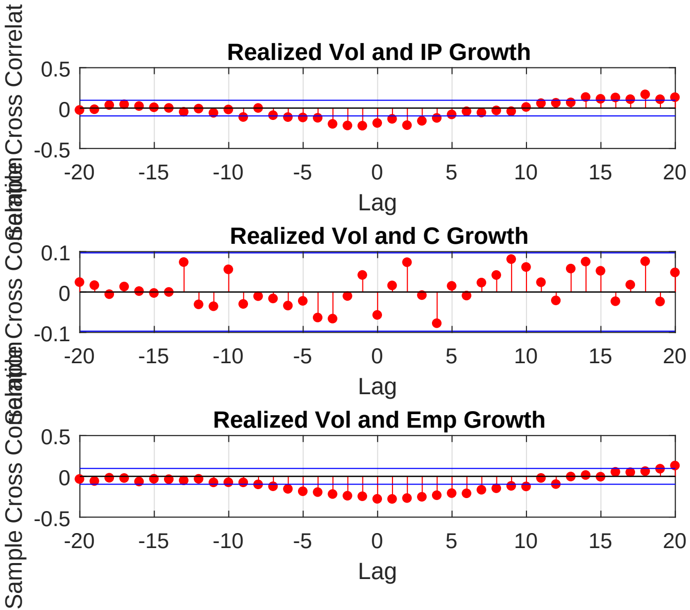
# YoY Measure May Drive Predictability



# Cross-Correlogram: YoY



# Cross-Correlogram: 1-month Macro growth rates



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- There are $n$ factors $Y$ that follow a VAR with heteroskedastic normal shocks $Z_{t+1}$ and jumps $J_{t+1}$ that occur with probability $\lambda_t$ and are i.i.d. normally distributed all with diagonal covariance matrix $\Sigma$

$$Y_{t+1} = (I - F)\bar{Y} + FY_t + G_t Z_{t+1} + J_{t+1}$$

Covariance Matrix and jump intensity are affine in factors:

$$G_t G_t' = H_0 + \sum_{k=1}^{n} H_k Y_{t,k}$$

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- Affine SDF with constant prices of risk $\Lambda$ implies that bond prices are also affine with recursive coefficients i.e. $P_t^n = A_n + B_n Y_t$. So are returns.

# Using Risk-Neutral Bond Return Volatility to Predict Macro

- Let $Y_t = (X_t, W_t)'$. $X_t$ are factors observable to the econometrician. $W_t$ are not.
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- Goal: Learn about $F_{XW}$, $\lambda_1$, $H_k$'s, etc.

# Example: What do paper's findings about macro vol predictability mean?

$$\text{Cov}_0\left(\text{Var}_t^{\mathbb{Q}}[r_{t+1}^n], (G_t G_t')_{(i,i)}\right) = (B_n^2)_i \left(H_{Y,ii}' \text{Var}_0[Y_t] H_{Y,ii} + H_{Y,ii}' \tilde{\Sigma}_\Lambda l_{1,i}'\right) > 0$$

- $H_{Y,ii}$: vector of $(i,i)$th elements of each $H_k$ matrix i.e. how does macro variable $i$'s variance load on factors
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- Banking view: Haddad and Sraer (2015), Adrian, Etula, and Muir (2014), Dreschler, Savov, and Schnabl (2016)

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- If you look at higher frequency than monthly, can YIV predict macro or FOMC announcements?

# Conclusion

- Important question: what new info can asset prices tell us about macro quantities?
- This paper: High option-implied bond volatility presages times of low macro growth and high macro volatility – "bad times"
- Need to do more to convince us that results are robust to alternative empirical specifications, particularly ones that exclude contemporaneously known info from LHS
- Which theories do these results test? A structure in mind will suggest additional tests to run to identify deep economic parameters of interest.