The Business Cycle Component of US Asset Returns

David Backus (NYU), Bryan Routledge (CMU), and Stanley Zin (CMU)

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Outline

Data: cyclical properties of US asset prices and returns

Theory: numerical example ["Bansal-Yaron plus"]

Cyclical properties of US asset prices and returns

Cross correlations for financial indicators and economic growth

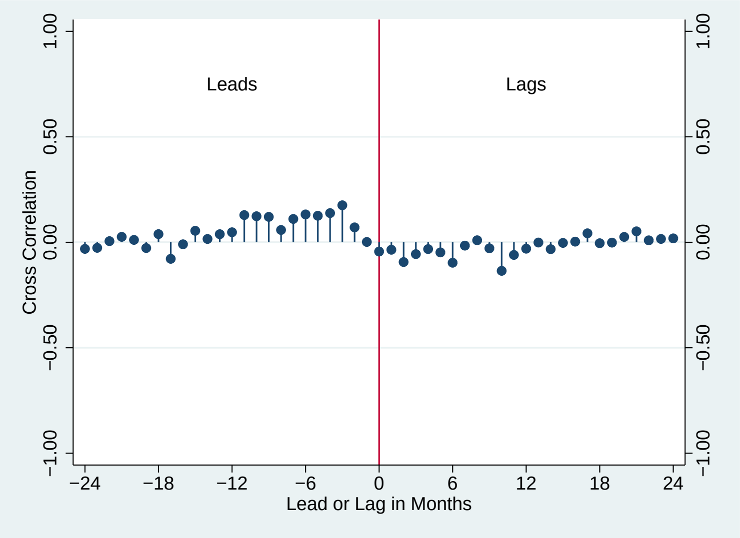
- Returns: logs of gross returns
- Excess returns: differences in logs of gross returns

Economic growth

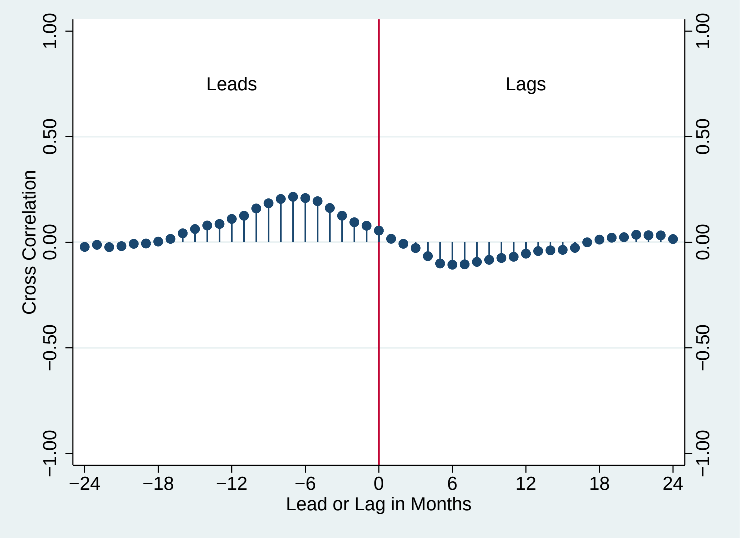
- Monthly: $\log x_t - \log x_{t-1}$
- Or year-on-year: $\log x_{t+6} - \log x_{t-6}$
- Computed from: industrial production, consumption, employment

US data, monthly, 1960 to present

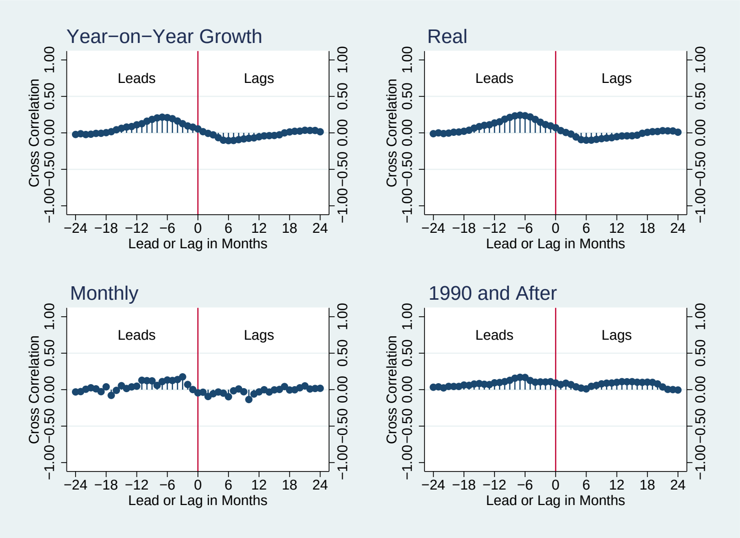
Equity returns (monthly growth)



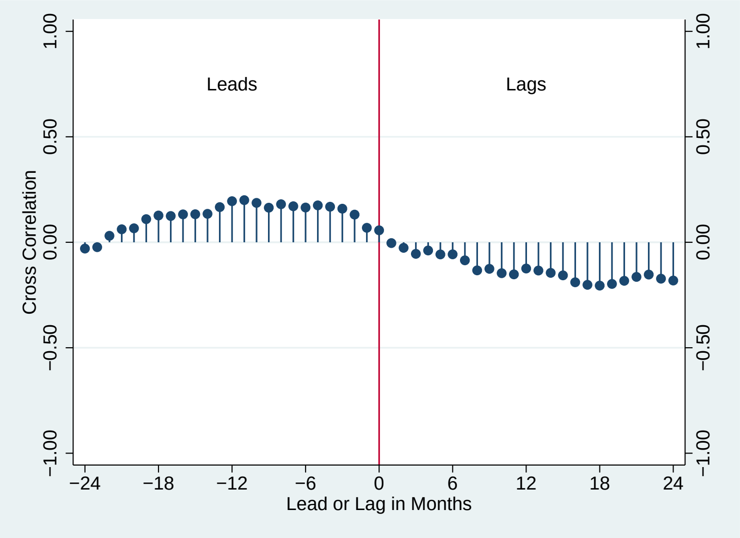
Equity returns (yoy growth)



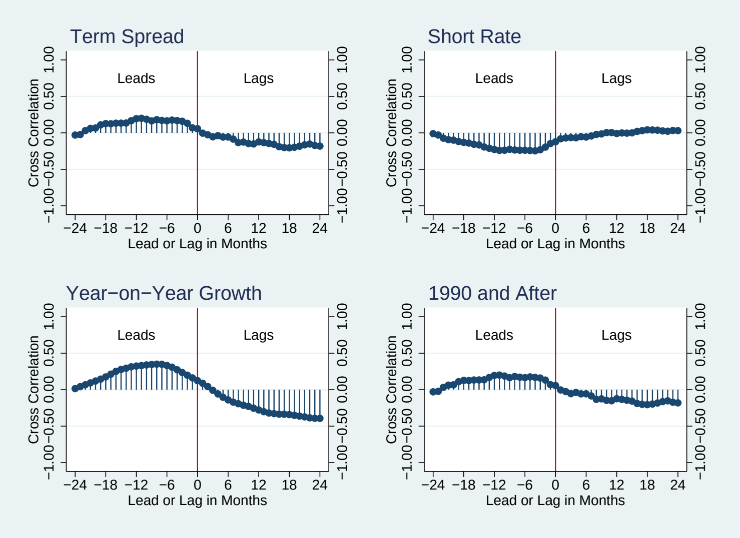
Equity returns (variations)



Term spread (monthly growth)

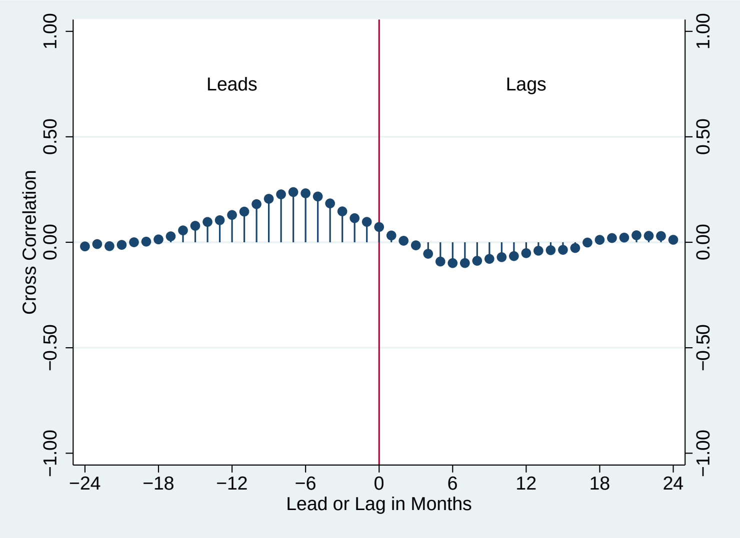


Term spread (variations)

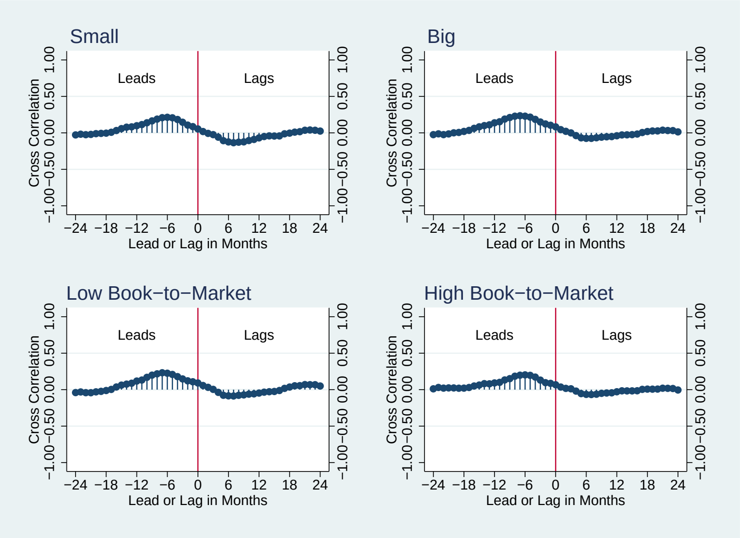


Think about this for a minute...

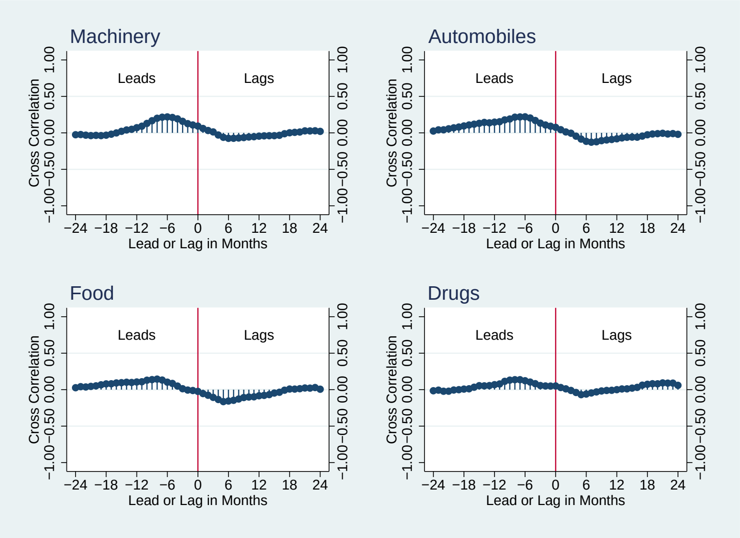
Excess returns: equity (yoy)



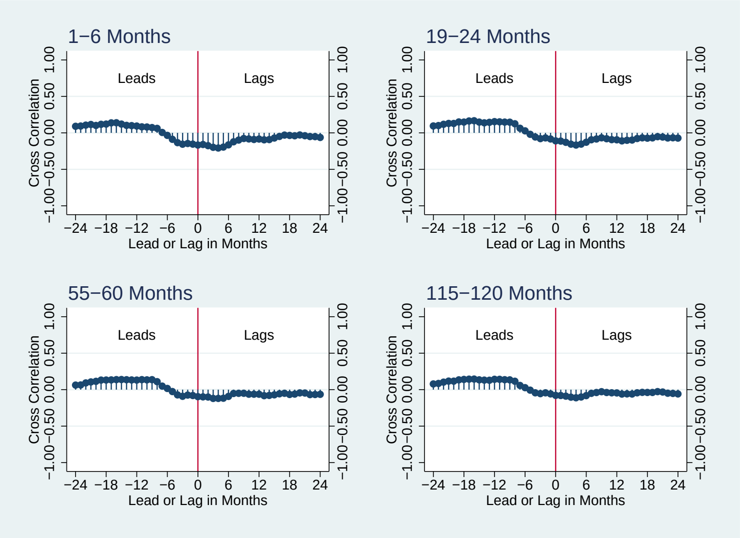
Excess returns: Fama-French portfolios (yoy)



Excess returns: industries (yoy)



Excess returns: bonds (yoy)



Theoretical economy

Take a breath

What do we need?

- Variation in risk and/or price of risk
- ... tied to economic growth

Bansal-Yaron plus

- Representative agent exchange economy
- Recursive preferences (Kreps-Porteus/Epstein-Zin/Weil)
- Loglinear process for consumption growth
- Stochastic volatility
- **Interaction between growth and volatility**

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Kreps-Porteus preferences

Equations

$$\begin{aligned} U_t &= \left[(1-\beta)c_t^{\rho} + \beta\mu_t(U_{t+1})^{\rho}\right]^{1/\rho} \\ \mu_t(U_{t+1}) &= \left(E_t U_{t+1}^{\alpha}\right)^{1/\alpha} \\ & \alpha, \rho \leq 1 \end{aligned}$$

Interpretation

$$\begin{aligned} IES &= 1/(1-\rho) \\ CRRA &= 1-\alpha \\ \alpha &= \rho \quad \Rightarrow \quad \text{additive preferences} \end{aligned}$$

Consumption growth

Consumption growth follows from

$$\begin{aligned}
\log g_t &= g + e^\top x_t \\
x_{t+1} &= A x_t + a(v_t - v) + v_t^{1/2} B w_{t+1} \\
v_{t+1} &= (1-\varphi_v) v + \varphi_v v_t + b w_{t+1}
\end{aligned}$$

Note

- A generates predictable component
- v_t is stochastic
- a generates interaction

Kreps-Porteus pricing kernel

Marginal rate of substitution

$$m_{t+1} \;=\; \beta \left(\frac{c_{t+1}}{c_t}\right)^{\rho-1} \left(\frac{U_{t+1}}{\mu_t(U_{t+1})}\right)^{\alpha-\rho}$$

If $\alpha = \rho$

- Second term disappears
- No roles for volatility or predictable consumption growth

Expectations and certainty equivalents

Example: let $\log x \sim \mathrm{N}(u_t, v_t)$

Expectations and certainty equivalents for lognormals

$$\begin{aligned} E(x) &= \exp(u_t + v_t/2) \\ E(x^\alpha) &= \exp(\alpha u_t + \alpha^2 v_t/2) \\ \mu(x) &= [E(x^\alpha)]^{1/\alpha} \;=\; \exp(u_t + \alpha v_t/2). \end{aligned}$$

Effect of risk is multiplicative — additive in logs

Role of recursive preferences I

Suppose consumption growth is

$$\log x_t = \log x + \sum_{j=0}^{\infty} \chi_j w_{t-j}$$

Pricing kernel

$$\begin{aligned}\log m_{t+1} &= \text{constant} + [(\rho-1)\chi_0 + (\alpha-\rho)(\chi_0 + X_1)]w_{t+1} \\ &\quad + (\rho-1)\sum_{j=0}^{\infty} \chi_{j+1} w_{t-j} \\ X_1 &= \sum_{j=1}^{\infty} \beta^j \chi_j \quad \text{(predictable component)}\end{aligned}$$

Role of recursive preferences II

Suppose

$$\log U_{t+1} \quad = \quad u_t + v_t^{1/2} w_{t+1}$$

Pricing kernel gets new terms

$$\begin{aligned}\log m_{t+1} \quad &= \quad \log \beta + (\rho - 1) \log(c_{t+1}/c_t) \\ & \quad\quad + [(\rho - \alpha)/2]\alpha v_t + (\alpha - \rho) v_t^{1/2} w_{t+1}\end{aligned}$$

Theoretical excess returns

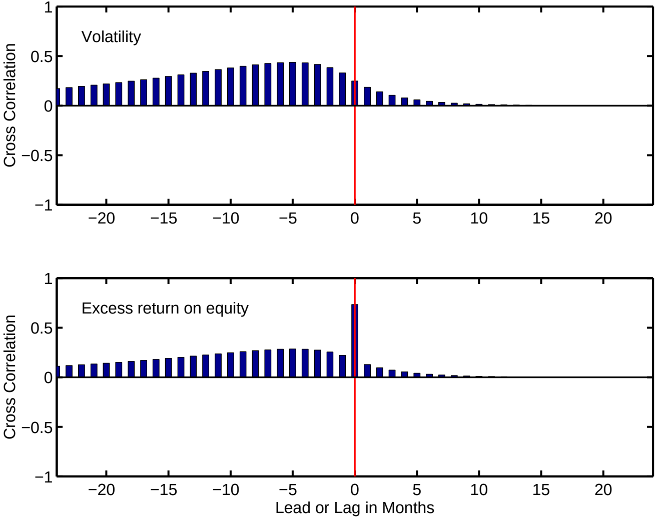
Transparent loglinear solution

- We love this, but won't bore you with the details

Excess returns depend on

- Volatility (v_t)
- Innovations in consumption growth and volatility (w_{t+1})
- **Not:** expected future consumption growth (x_t)!

Excess returns: numerical example



Summary and extensions

Summary

- Data: excess returns correlated with future growth
- Model: ditto via stochastic volatility

Fixups and extensions

- Model dividends explicitly
- Production economies: volatility acts like shock to discount factor, affects consumption and labor supply

Related work (some of it)

Evidence on financial indicators of business cycles

- Ang-Piazzesi-Wei, Estrella-Hardouvelis, King-Watson, Rouwenhorst, Stock-Watson

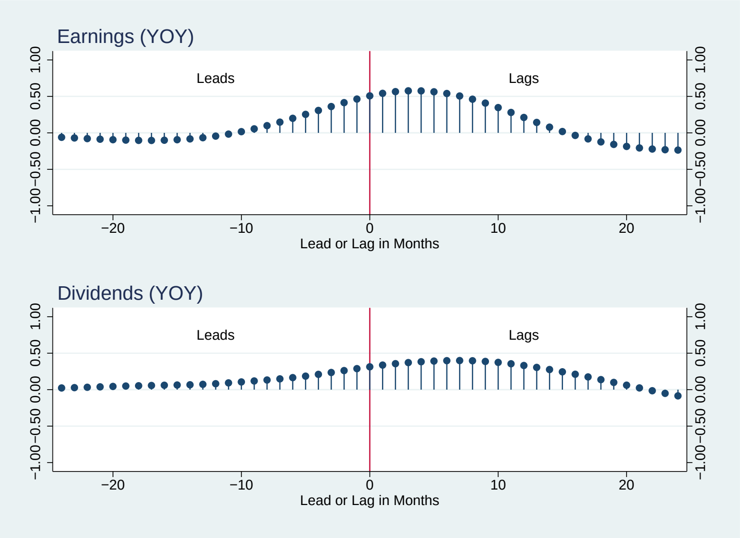
Kreps-Porteus pricing kernel

- Hansen-Heaton-Li, Weil

Stochastic volatility and returns

- Atkeson-Kehoe, Gallmeyer-Hollifield-Zin, Naik, Primiceri-Schaumburg-Tambalotti

Earnings and dividends (yoy)



Growth: several flavors (yoy)