Risky Business Cycles

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Motivation

Financial economists tell us that excess returns are predictable.

> *Discount-rate variation is the central organizing question of current asset-pricing research.*
> John Cochrane - 2011 Presidential Address to American Fin. Assoc.

This fact is not part of most theories of macroeconomic fluctuations.

Cycles driven by risk promising, but most models imply

- precautionary increase in savings/investment
- precautionary labor supply increase
- very hard to get comovement between Y, C, I, N (not-to-mention asset prices)

This paper

1. Empirical patterns associated with changes in expected returns
    - Strong comovement of Y, C, I and labor
    - Shifts towards part-time/flexible-contract workers
    - Small changes in safe interest rates
2. Provide theory of these patterns
    - Core idea: if safe stores are less productive, then fear $\rightarrow$ recession
    - Between markets: labor relationships more risky than capital investment
    - Within markets: long-term labor relationships more risky than part-time/contract work

Literature

- **Time-varying Risk-Premia:** Campbell and Shiller (1988), Fama and French (1989), Cochrane (2011), Martin (2017), ...
- **Risk and labor market frictions:** Petrosky-Naudau et. al. (2015), Flavilikus and Lin (2016), Leduc and Liu (2016), Hall (2017), Schaal (2017), Swanson (2019), Cacciatore and Ravenna (2020), Kehoe et al. (2020), ...
- **Uncertainty and RBC:** Bachmann and Bayer (2013), Bloom et. al. (2014), Gilchrist et al. (2014), Di Tella and Hall (2020), ...
- **Uncertainty in models with nominal frictions:** Ilut and Schneider (2014), Christiano et al. (2014), Fernandez-Villaverde, Guerron-Quintana, Kuester, and Rubio-Ramirez (2015), Basu and Bundick (2017), ...
- **Max-share empirical strategy:** Uhlig (2003), Angeletos, Collard and Dellas (2020)

Outline

1. Empirical Patterns
2. Theory: Real model with Two Labor Types
3. Quantification and Inspecting the Mechanism

Risk Premia and Business Cycles in the Data

Strategy

In aggregate data...

- VAR using standard macro series and equity/bond returns
- Identify shock which drives bulk of excess returns
- Look at comovements with real variables, labor markets, etc.

Data

Sample Period: 1985Q1 - 2018Q4

Core series: Y_t

- Real per-capita output
- Real per-capita consumption
- Real per-capita investment
- Real per-capita hours
- Real stock return (incl. dividends)
- Real bond return
- Dividend-price ratio

Auxiliary Series: S_t

- Employment (part-time vs full-time)
- Others

Empirical Approach

Statistical Model:

$$Y_t = B(L)Y_{t-1} + \underbrace{A\epsilon_t}_{\mu_t} \qquad \text{(Core)}$$

$$S_t = \Gamma(L)Y_t + v_t \qquad \text{(Aux)}$$

Risk premium definition:

$$rp_{t,t+j} \equiv [r^s_{t+1} + r^s_{t+2} + ... + r^s_{t+j}] - [r^b_{t+1} + r^b_{t+2} + ... + r^b_{t+j}]$$

Using expectation implied by VAR:

$$E_t[rp_{t,t+j}] = (e_5 - e_6)(B + B^2 + ... + B^j)(I - BL)^{-1}A\epsilon_t$$

Identification

$$E_t[rp_{t,t+j}] = (e_5 - e_6)(B + B^2 + ... + B^j)(I - BL)^{-1} A \epsilon_t$$

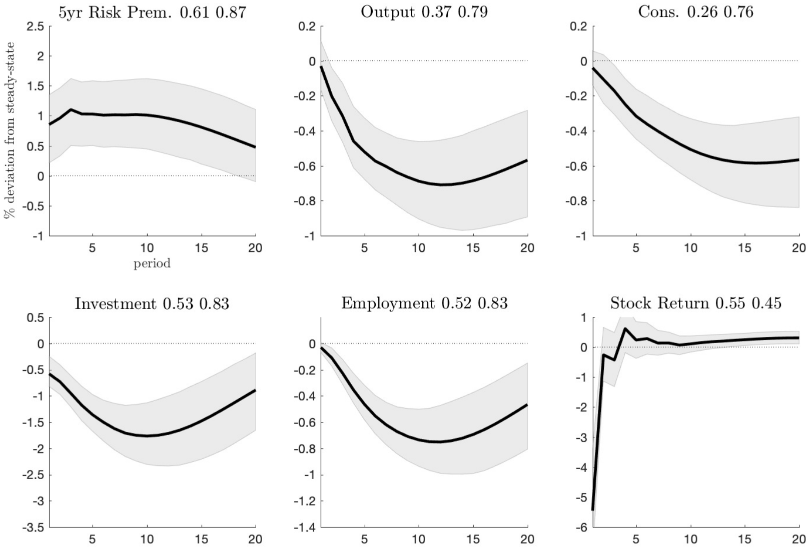
Pick A so that first shock explains most of $E_t[rp_{t,t+j}]$. (Uhlig, 2003)

Choices:

- Horizon $j \rightarrow$ choose $j = 20$, for predictability at longer horizons
- Frequency band $\rightarrow$ choose unconditional variance, robust to
    - business-cycle frequency (ACD, 2020)
    - one-period innovation

Not imposing any prior on structural interpretation of the shock.

Results I - Response to a RP shock



Results II - Driver of Covariances

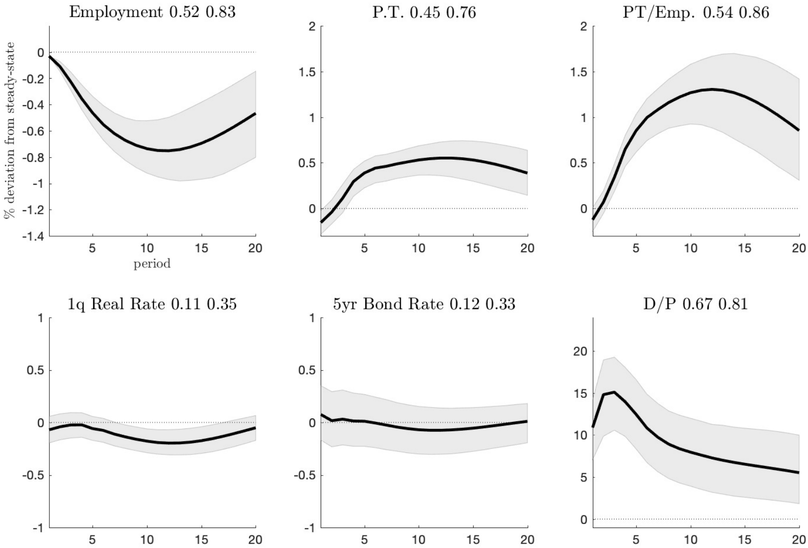
"Percent-explained" covariance:

$$1 - cov(Y_t|\epsilon_1)/cov(Y_t)$$

	Output	**Cons.**	**Investment**	**Employment**	**Stock Return**
Output	0.79				
Cons.	0.79	0.76			
Investment	0.87	0.92	0.83		
Employment	0.92	0.96	0.90	0.83	
Stock Return	1.31	1.02	1.40	0.98	0.45

Fraction of Covariance Explained

Result III - Response to a RP shock

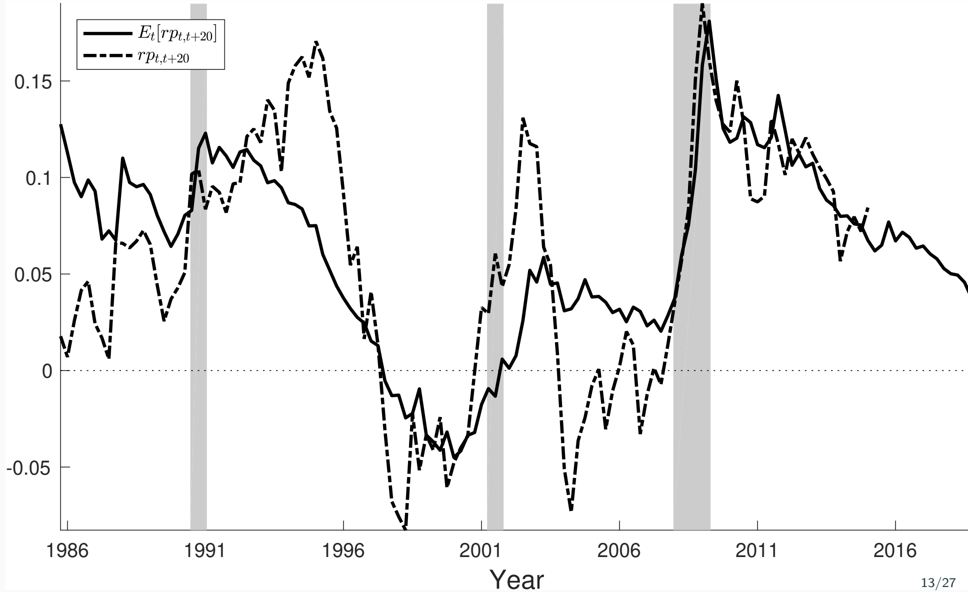


Comparison to “Main business cycle shock”

ACD (2020) identify shock that explains BC variance of e.g. *GDP*

- Shock time series strongly correlated $\rightarrow \sim$70%
- Same qualitative patterns
- Accounts for less of stock return covariances

Result IV - Time-series of RP



Theory

Model

Aggregate "RBC" model with

1. Epstein-Zin preferences
2. Capital adjustment costs
3. Variable capacity utilization
4. Labor market search
    - Two types of labor relationships: temporary and long-term

Household

$$V_t \equiv \max_{C_t, X_{t+1}, B_{t+1}} \left[(1-\beta) C_t^{1-1/\psi} + \beta \left(\mathbb{E}_t V_{t+1}^{1-\gamma_t} \right)^{\frac{1-1/\psi}{1-\gamma_t}} \right]^{\frac{1}{1-1/\psi}}$$

subject to

$$C_t + P_t^E X_{t+1} + \frac{1}{R_t^R} B_{t+1} + G_t \leq W_{1,t} N_{1,t} + W_{2,t} N_{2,t} + \left(D_t^E + P_t^E \right) X_t + B_t$$

Notes:

- Hold risk-free bonds (B_t) and equity (X_t).
- Labor supply exogenous: searchers given by

$$S_{1,t} = 1 - (1-\rho_1) N_{1,t-1} - (1-\rho_2) N_{2,t-1}$$
$$S_{2,t} = 1 - N_{1,t} - (1-\rho_2) N_{2,t-1}$$

- Successful searchers become productive within-period.

Firms

$$V_t^E(i) = \max \mathbb{E}_t \sum_{s=0}^{\infty} M_{t+s} D_{t+s}$$

subject to

$$\begin{aligned}
D_t &= Y_t - W_{1,t}N_{1,t} - W_{2,t}N_{2,t} - I_t - \gamma_{1,t}v_{1,t} - \gamma_{2,2}v_{2,t} \\
Y_t &= \left[K_t u_t\right]^{\alpha} \left[Z_t N_t\right]^{1-\alpha} \\
K_{t+1} &= \left(1 - \delta(u_t) - \frac{\phi_K}{2}\left(\frac{I_t(i)}{K_t} - \delta\right)^2\right) K_t + I_t \\
N_t &= N_{1,t}^{1-\Omega} N_{2,t}^{\Omega} \\
N_{1,t} &= (1-\rho_1)N_{1,t-1} + Q_{1,t}^m v_{1,t} \\
N_{2,t} &= (1-\rho_2)N_{2,t-1} + Q_{2,t}^m v_{2,t}
\end{aligned}$$

Labor Market

- Matching probs, P_t^m and Q_t^m, determined by CD matching function
- N1: (nearly) fixed real wage.
- N2: Nash-bargained wage.
- Vacancy posting conditions defines value of a worker

$$\mathbb{J}_{i,t} = MPL_{i,t} - W_{i,t} + \mathbb{E}_t \left\{ M_{t+1}(1-\rho_i)\mathbb{J}_{i,t+1} \right\}$$

Exogenous Processes

1. Technology:

$$\ln Z_t = \ln Z_{t-1} + \sigma_z \epsilon_t^z$$

2. Risk aversion:

$$\ln(\gamma_t/\gamma) = \rho_{1,\gamma} \ln(\gamma_{t-1}/\gamma) + \rho_{2,\gamma} \ln(\gamma_{t-2}/\gamma) + \sigma_\gamma \epsilon_t^\gamma$$

3. Cointegration of $\{\gamma_{1,t}, \gamma_{2,t}, W_{1,t}\}$: E.g.

$$W_{1,t+1} = W_{1,t}^{\omega} Z_t^{1-\omega}$$

Barro and King (1984) problem

Worried about future? $\Rightarrow$ desire to (i) save more (ii) consume less

(i) implies that investment rises

(ii) if labor supply endogenous, hours increase

$\hookrightarrow$ I,C,N cannot move together!

How our model works

Risk aversion rises $\Rightarrow$ (i) save more in safer assets (ii) consume less

(i) premium for N_1 rises most $\Rightarrow$ "savings" shifts away from N_1

(ii) if N_1 and cap. util. fall enough, then $Y \Downarrow$ causes both $C \Downarrow, I \Downarrow$

$\hookrightarrow$ I,C,N *can* move together!

Quantifying the Mechanism

Impulse Response Matching

- Solve model using 3rd-order perturbation
- Target first six impulse responses in Y_t
- Additional steady-state targets

Description	**Value**
Equity risk premium	0.064
Share of part-time	0.180
Agg. separation rate	0.100
PT sep./FT sep.	8.000
PT earn./FT earn.	0.500
Vancancy Rate	0.035
LR unemployment	0.060
Std. HP log(Emp/Pop)	0.011
Std. log(vacan.)	0.264

- Look at implication for non-targeted variables

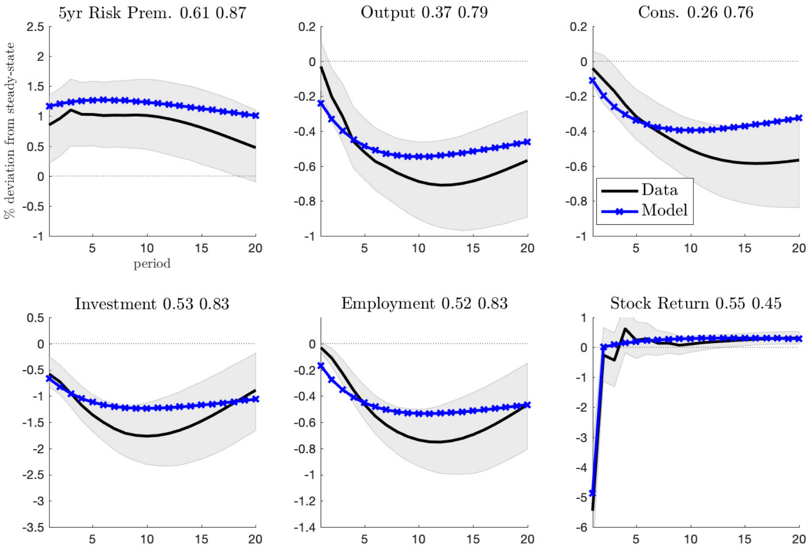
Calibrated parameters

Name	Description	Value
β	Discount rate	0.994
ψ	Intertemporal elasticity of substitution	1.500
α	Capital share	0.300
δ	Cap decpreciation rate	0.025
δ_2	Cap. util. cost $\times$ 100	0.030
$\bar{g}$	Steady-state G/Y	0.200
d	Corporate bond duration	0.975
	Labor Markets	
ρ_1	Separation Rate - FT	0.044
ρ_2	Separation Rate - PT	0.354
η_1	HH's bargaining power - FT	0.500
η_2	HH's bargaining power - PT	0.200
	Exogenous Processes	
σ_z	Std. dev. of tech shock	0.006
$\rho_{1,\gamma}$	AR(1) risk av. shock	1.802
$\rho_{2,\gamma}$	AR(2) risk av. shock	-0.806

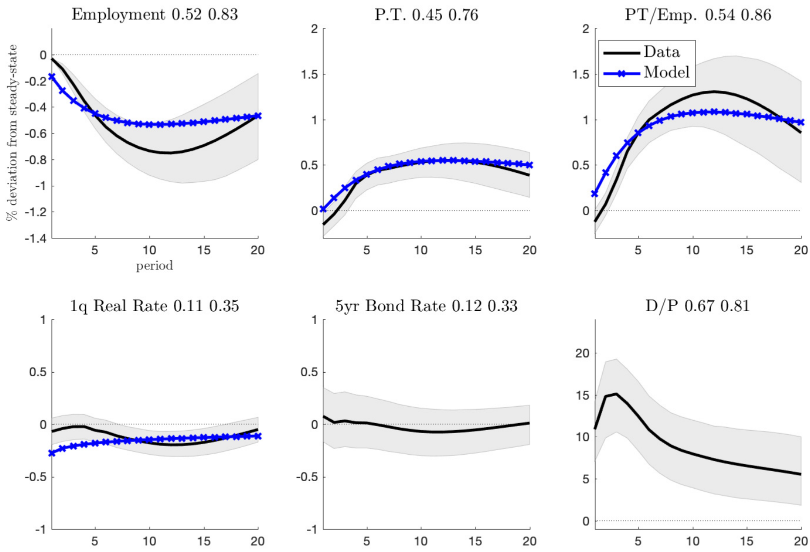
Estimated Parameters

Name	Description	Point Est.	Std Err.
γ_{ss}	Steady-state risk aversion	102.072	1.403
ϕ_k	Capital Adj. Cost	11.444	0.294
ν	Leverage Ratio	0.739	0.005
	Labor Markets		
γ_1	Vacancy posting cost - FT	3.000	0.101
γ_2	Vacancy posting cost - PT	1.050	0.027
b_1	Value if no perm posit.	1.153	0.003
b_2	Value if unemployed	0.526	0.005
Ω	Labor contrib. of PT	0.124	0.001
ϵ^1	Matching elasticity - FT	0.161	0.002
ϵ^2	Matching elasticity - PT	0.789	0.007
χ^1	Matching technology - FT	0.440	0.003
χ^2	Matching technology - PT	1.322	0.020
ω	Gradual wage adj.	0.987	0.000
	Risk Aversion Process		
σ_γ	Std. dev. of risk av. shock	0.050	0.001

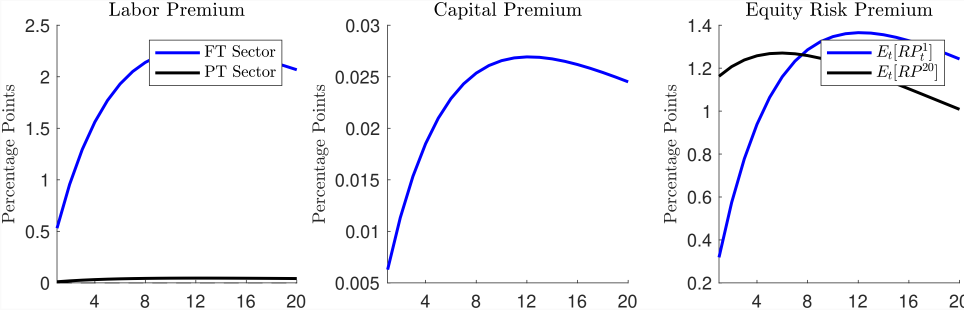
Estimation Results I



Estimation Results II



Impulse Responses: Risk Premia



Conclusions

1. Risk-premia changes strongly associated with macroeconomic flucs.
2. Theory where causality flows from premia $\Rightarrow$ macro fluctuations
3. Captures *many* qualitative features of the cycle
4. Quantitatively promising