Risk Shocks

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Finding

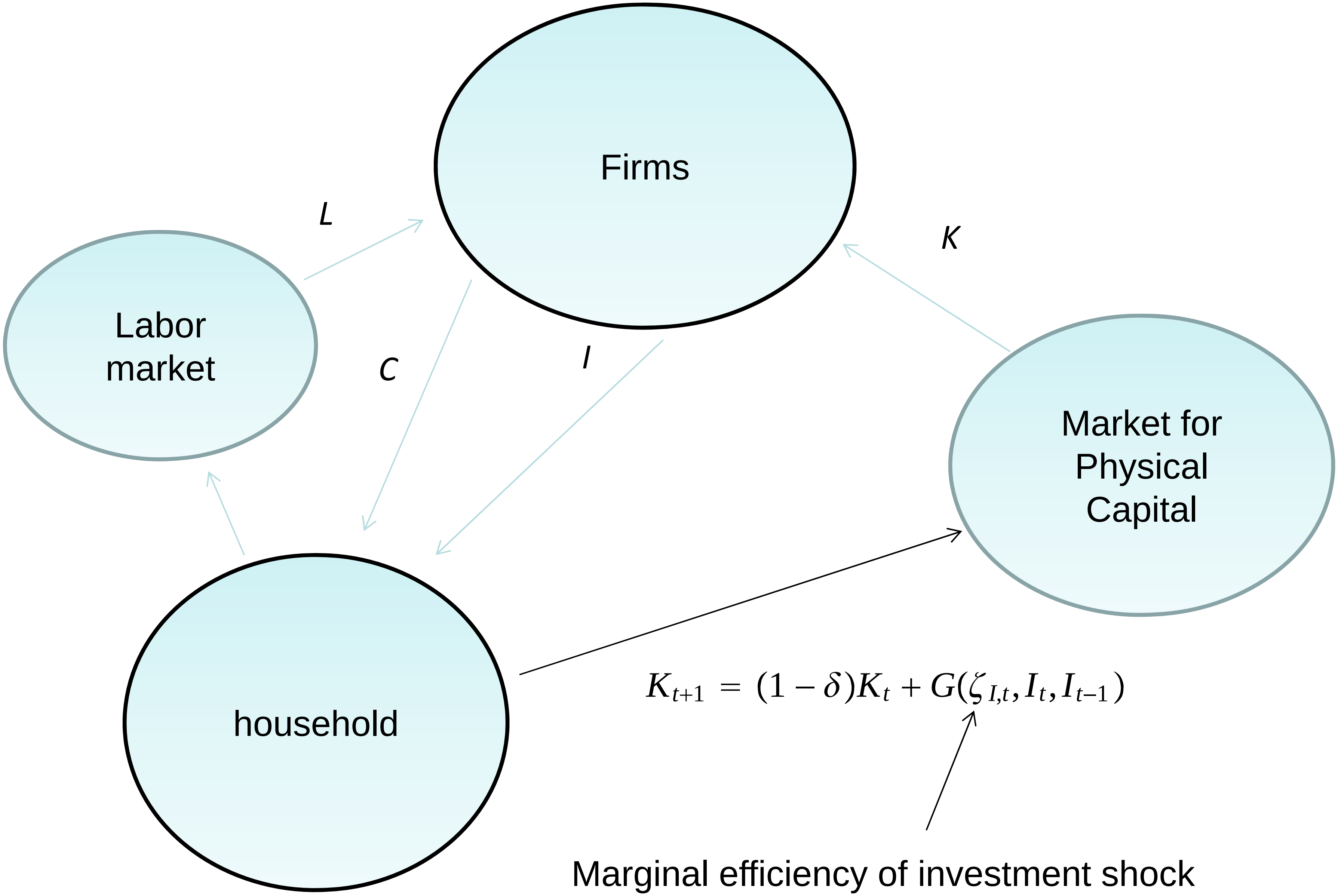
- Countercyclical fluctuations in the cross-sectional variance of a technology shock, when inserted into an otherwise standard macro model, can account for a substantial portion of economic fluctuations.
  – Complements empirical findings of Bloom (2009) and Kehrig (2011) suggesting greater cross-sectional dispersion in recessions.
  – Complements theory findings of Bloom (2009) and Bloom, Floetotto and Jaimovich (2009) which describe another way that increased cross-sectional dispersion can generate business cycles.

- 'Otherwise standard model':
  – A DSGE model, as in Christiano-Eichenbaum-Evans or Smets-Wouters
  – Financial frictions along the line suggested by BGG.

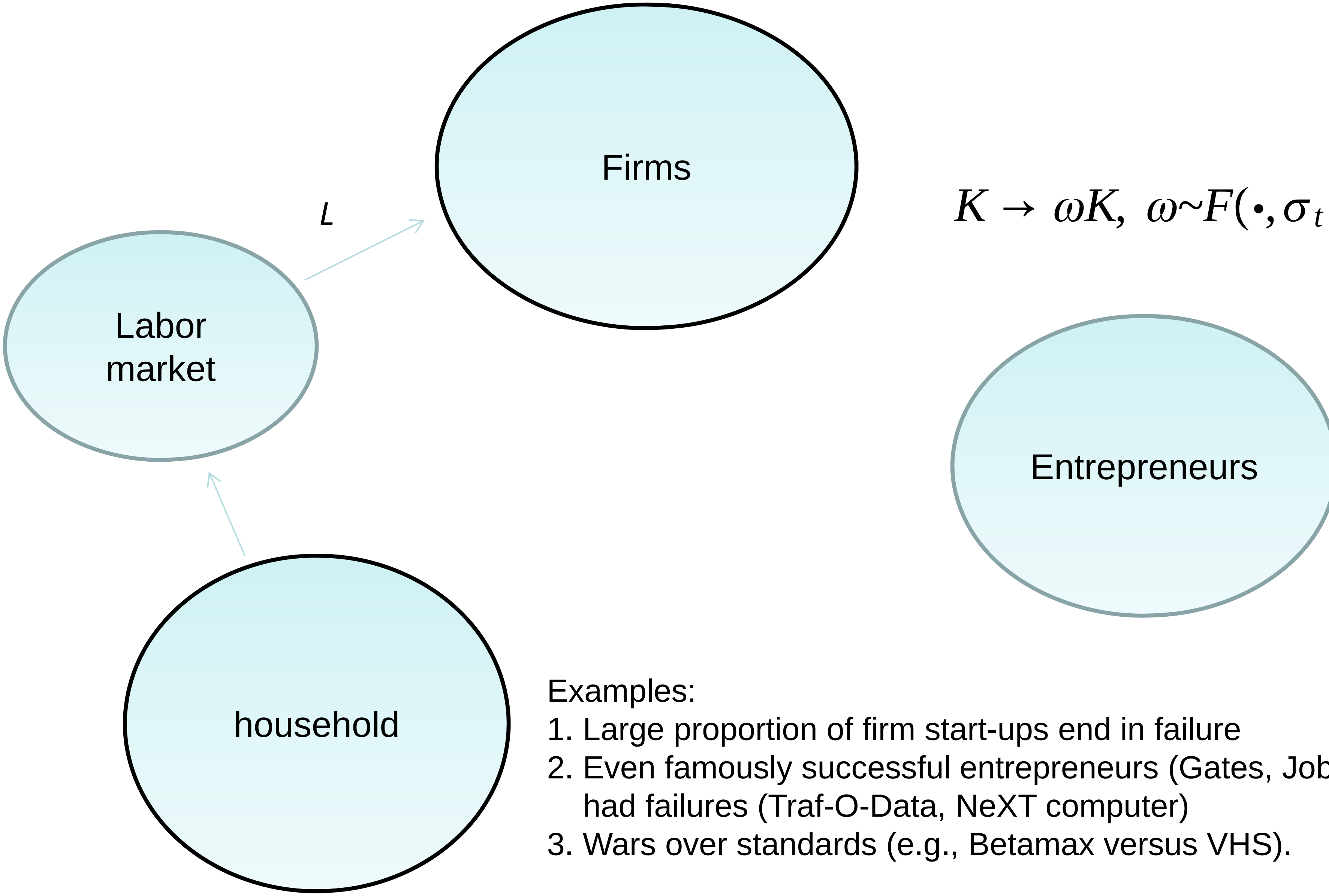
Outline

- Rough description of the model.
- Summary of Bayesian estimation of the model.
- Explanation of the basic finding of the analysis.

Standard Model



Standard Model with BGG

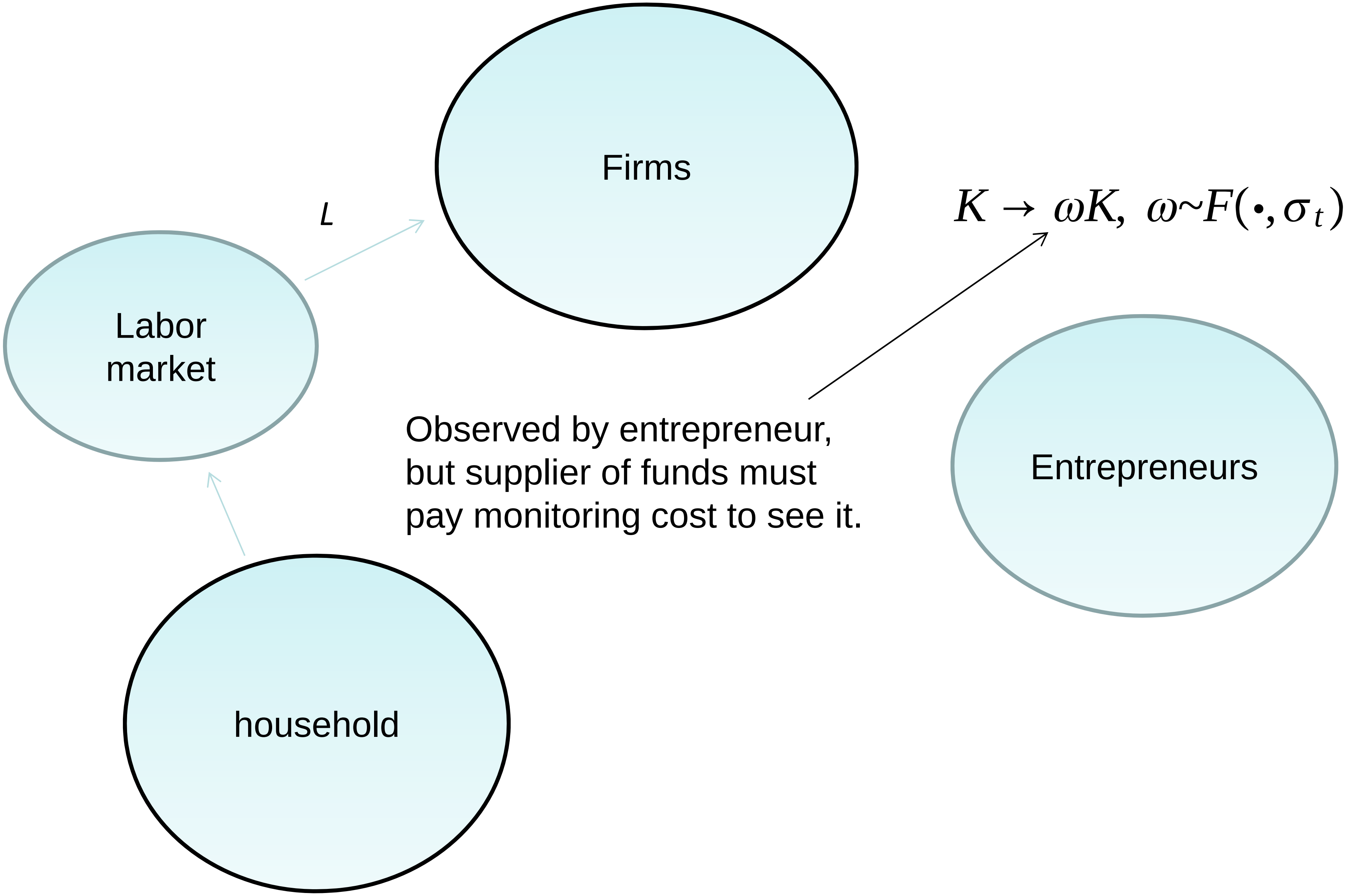


$$K \to \omega K,\ \omega \sim F(\bullet, \sigma_t)$$

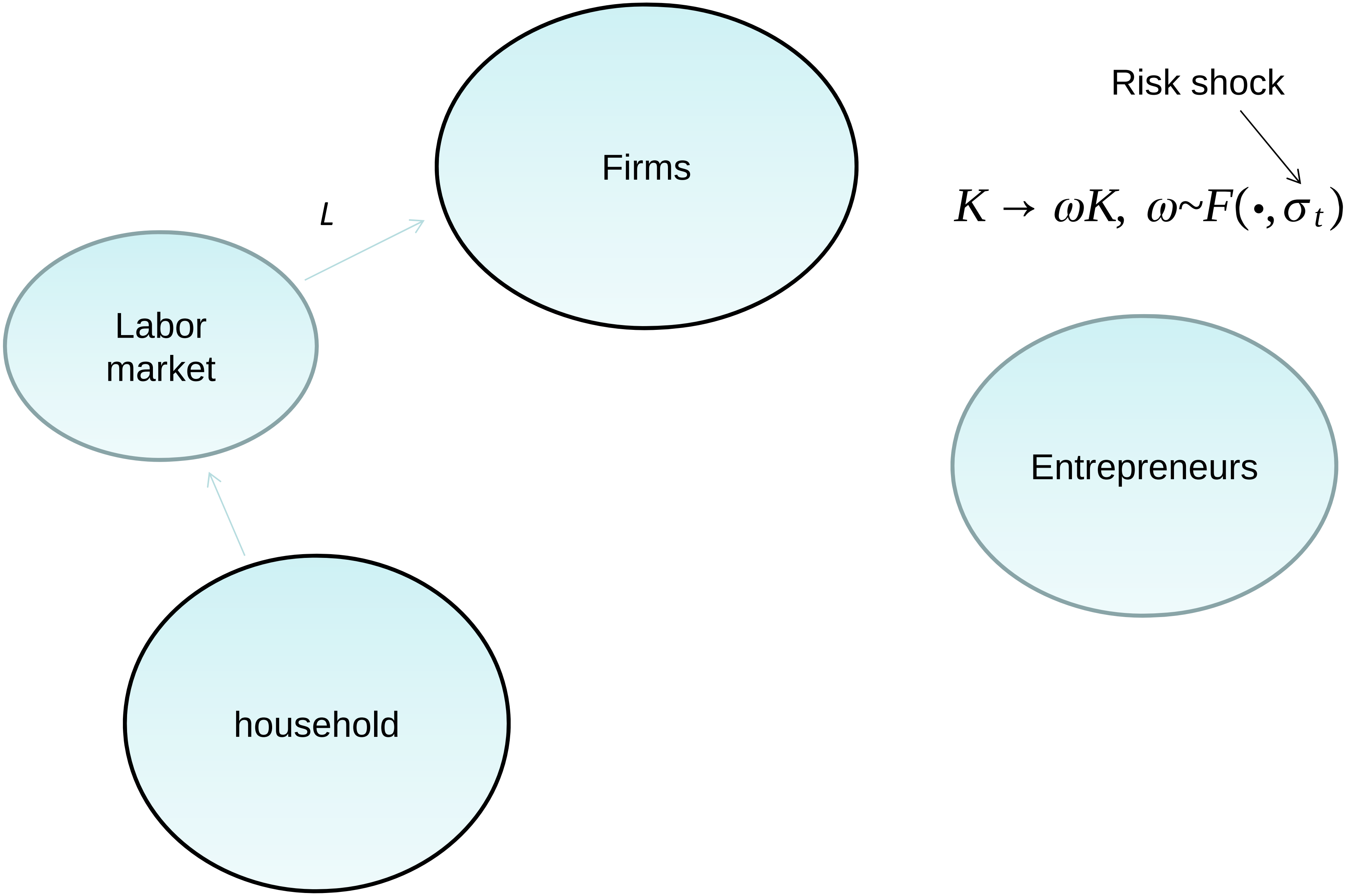
Examples:

1. Large proportion of firm start-ups end in failure
2. Even famously successful entrepreneurs (Gates, Jobs) had failures (Traf-O-Data, NeXT computer)
3. Wars over standards (e.g., Betamax versus VHS).

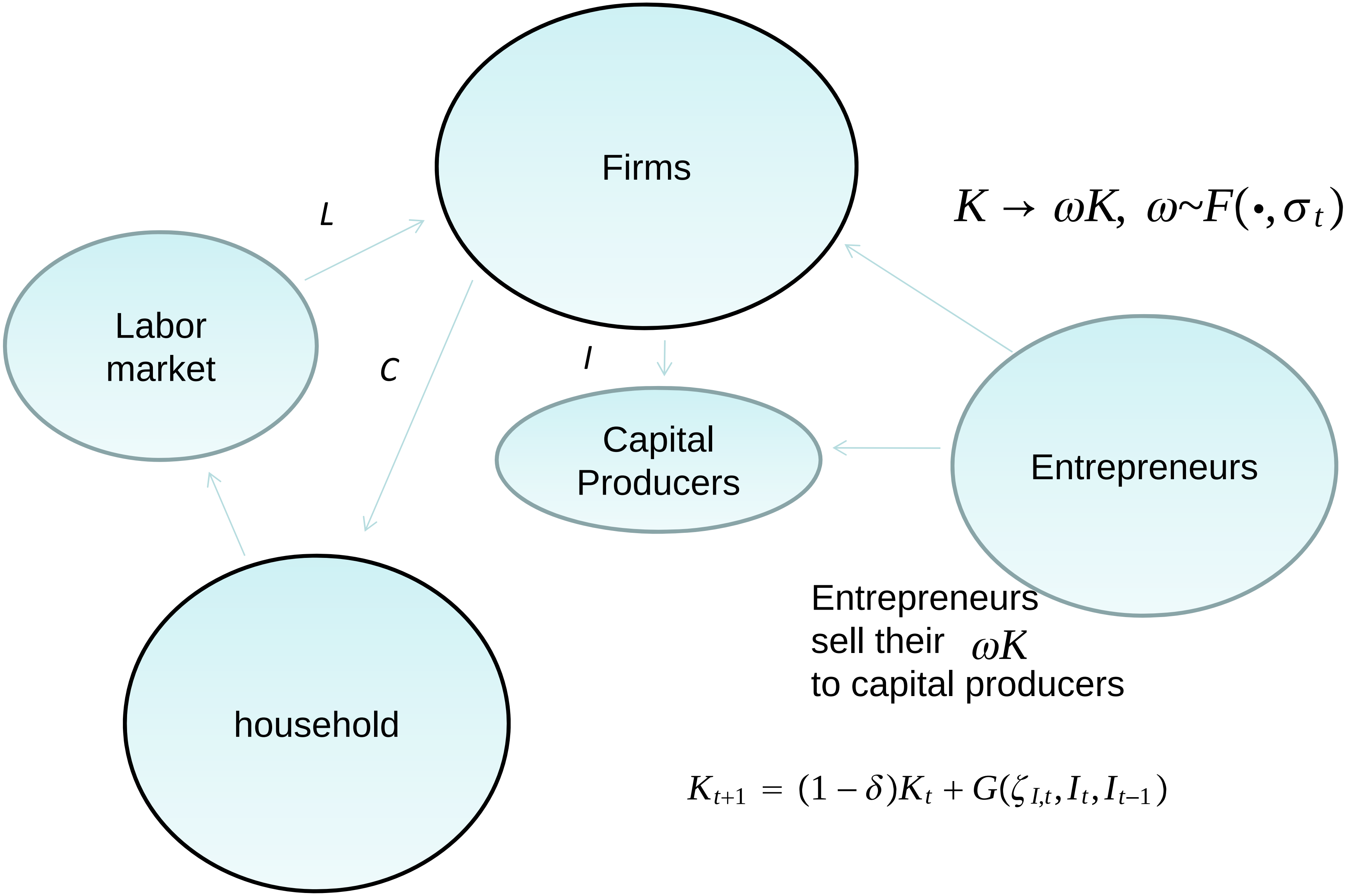
Standard Model with BGG



Standard Model with BGG

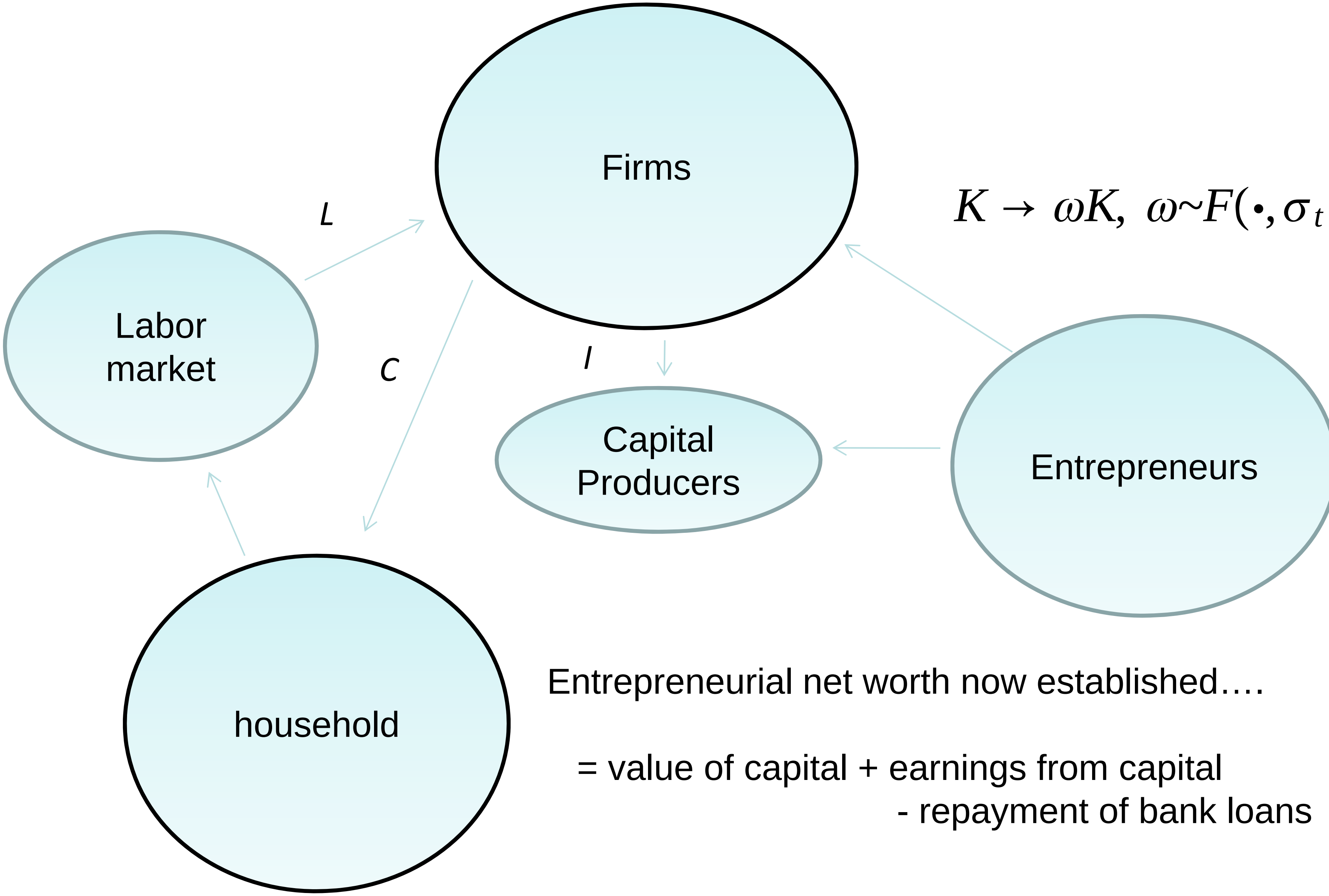


Standard Model with BGG



$$K_{t+1} = (1-\delta)K_t + G(\zeta_{I,t}, I_t, I_{t-1})$$

Standard Model with BGG

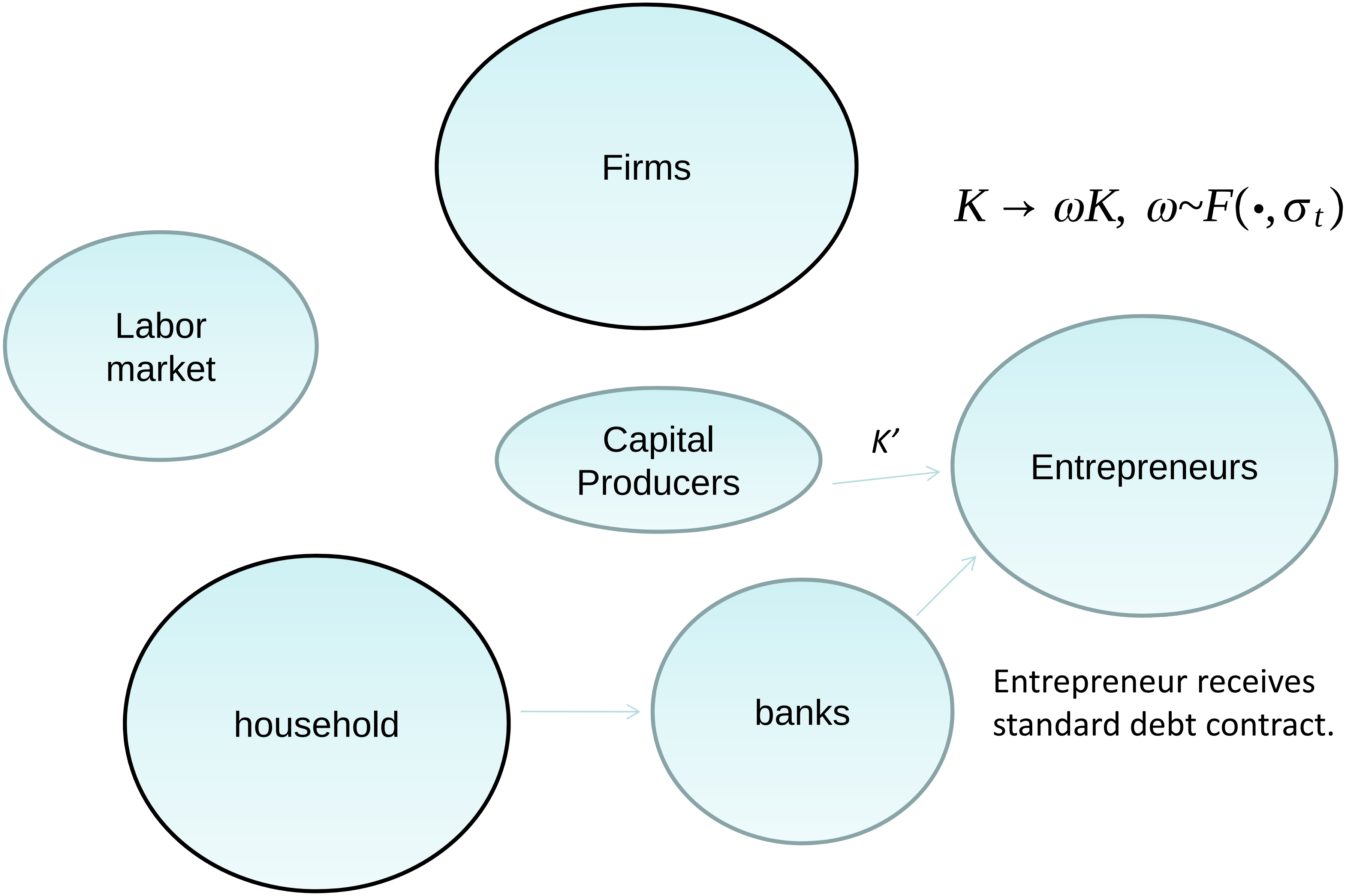


$$K \to \omega K,\ \omega \sim F(\bullet, \sigma_t)$$

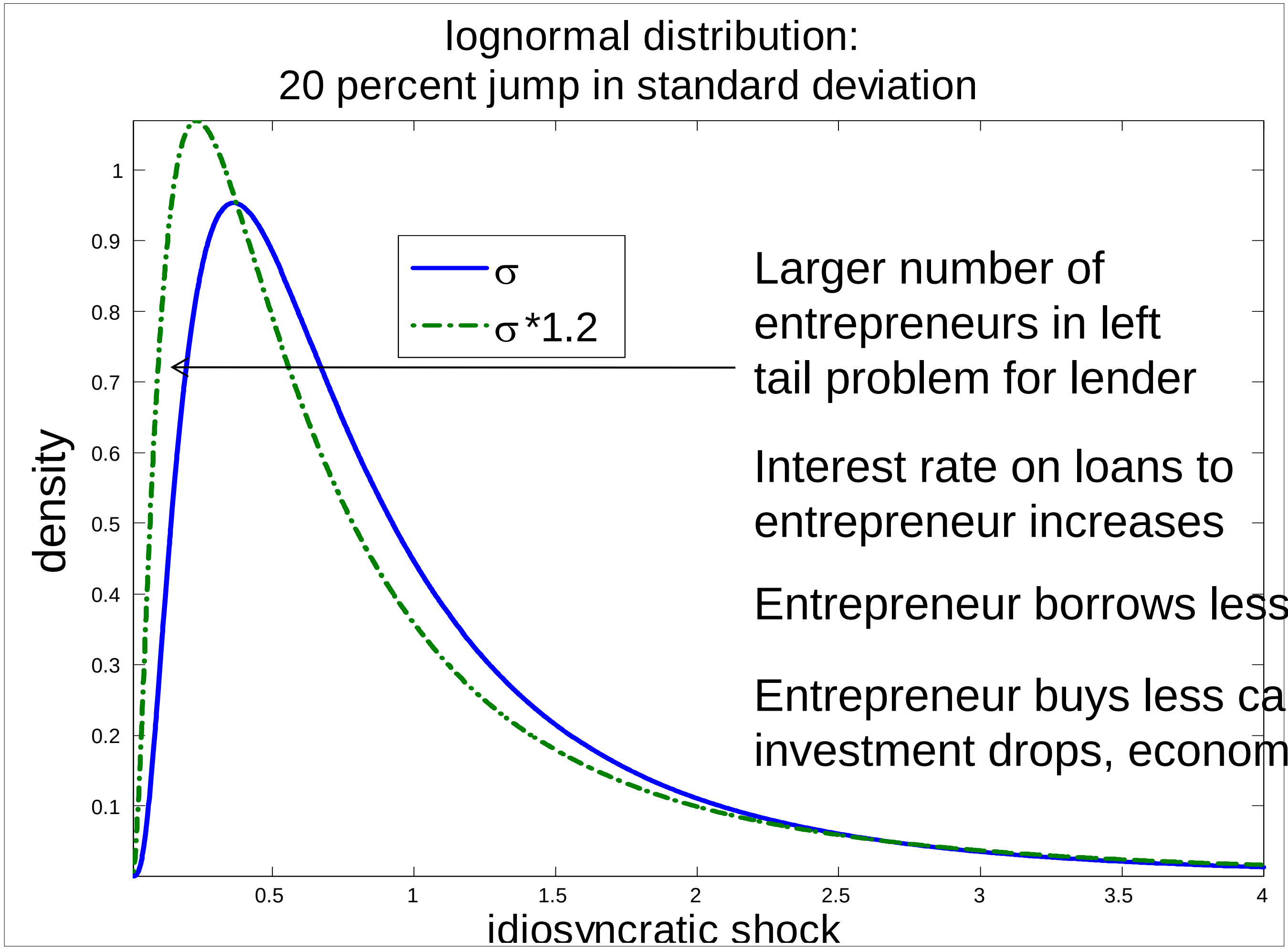
Entrepreneurial net worth now established….

= value of capital + earnings from capital
- repayment of bank loans

Standard Model with BGG



Economic Impact of Risk Shock



Larger number of entrepreneurs in left tail problem for lender

Interest rate on loans to entrepreneur increases

Entrepreneur borrows less

Entrepreneur buys less capital, investment drops, economy tanks

Five Adjustments to Standard DSGE Model for CSV Financial Frictions

- Drop: household intertemporal equation for capital.

- Add: equations that characterize the loan contract –
  - Zero profit condition for suppliers of funds.
  - Efficiency condition associated with entrepreneurial choice of contract.

- Add: Law of motion for entrepreneurial net worth (source of accelerator and Fisher debt-deflation effects).

- Introduce: bankruptcy costs in the resource constraint.

Risk Shocks

- We assume risk has a first order autoregressive representation:

$$\hat{\sigma}_t = \rho_1 \hat{\sigma}_{t-1} + \overbrace{u_t}^{\text{iid, univariate innovation to } \hat{\sigma}_t}$$

- We assume that agents receive early information about movements in the innovation (‘news’).

Risk Shock and News

- Assume

$$\hat{\sigma}_t = \rho_1 \hat{\sigma}_{t-1} + \overbrace{u_t}^{\text{iid, univariate innovation to } \hat{\sigma}_t}$$

- Agents have advance information about pieces of u_t

'signals' or 'news'

$$u_t = \xi_t^0 + \xi_{t-1}^1 + \ldots + \xi_{t-8}^8$$

$$\xi_{t-i}^i \sim \text{iid}, E(\xi_{t-i}^i)^2 = \sigma_i^2$$

$$\xi_{t-i}^i \sim \text{piece of } u_t \text{ observed at time } t-i$$

News on Risk Shocks Versus News on Other Shocks

	Marginal likelihood
DSGE Baseline	4493.85
DSGE without Signals	4098.43
DSGE with Signals on Equity Shock (γ) and No Signals on Risk Shock (σ)	4422.46

News on Risk Shocks Versus News on Other Shocks

	Marginal likelihood
DSGE Baseline	4493.85
DSGE without Signals	4098.43
DSGE with Signals on Monetary Policy and No Signals on Risk Shock (σ)	4427.59

News on Risk Shocks Versus News on Other Shocks

	Marginal likelihood
DSGE Baseline	4493.85
DSGE without Signals	4098.43
DSGE with Signals on Exogenous Spending Shock (g) and No Signals on Risk Shock (σ)	4096.62

News on Risk Shocks Versus News on Other Shocks

	Marginal likelihood
DSGE Baseline	4493.85
DSGE without Signals	4098.43
DSGE with Signals on Technology Shocks and No Signals on Risk Shock (σ)	4334.47

Monetary Policy

- Nominal rate of interest function of:
  - Anticipated level of inflation.
  - Slowly moving inflation target.
  - Deviation of output growth from ss path.
  - Monetary policy shock.

12 Shocks

- Trend stationary and unit root technology shock.
- Marginal Efficiency of investment shock (perturbs capital accumulation equation)

$$\bar{K}_{t+1} = (1-\delta)\bar{K}_t + G(\zeta_{i,t}, I_t, I_{t-1})$$

- Monetary policy shock.
- Equity shock.
- Risk shock.
- 6 other shocks.

Estimation

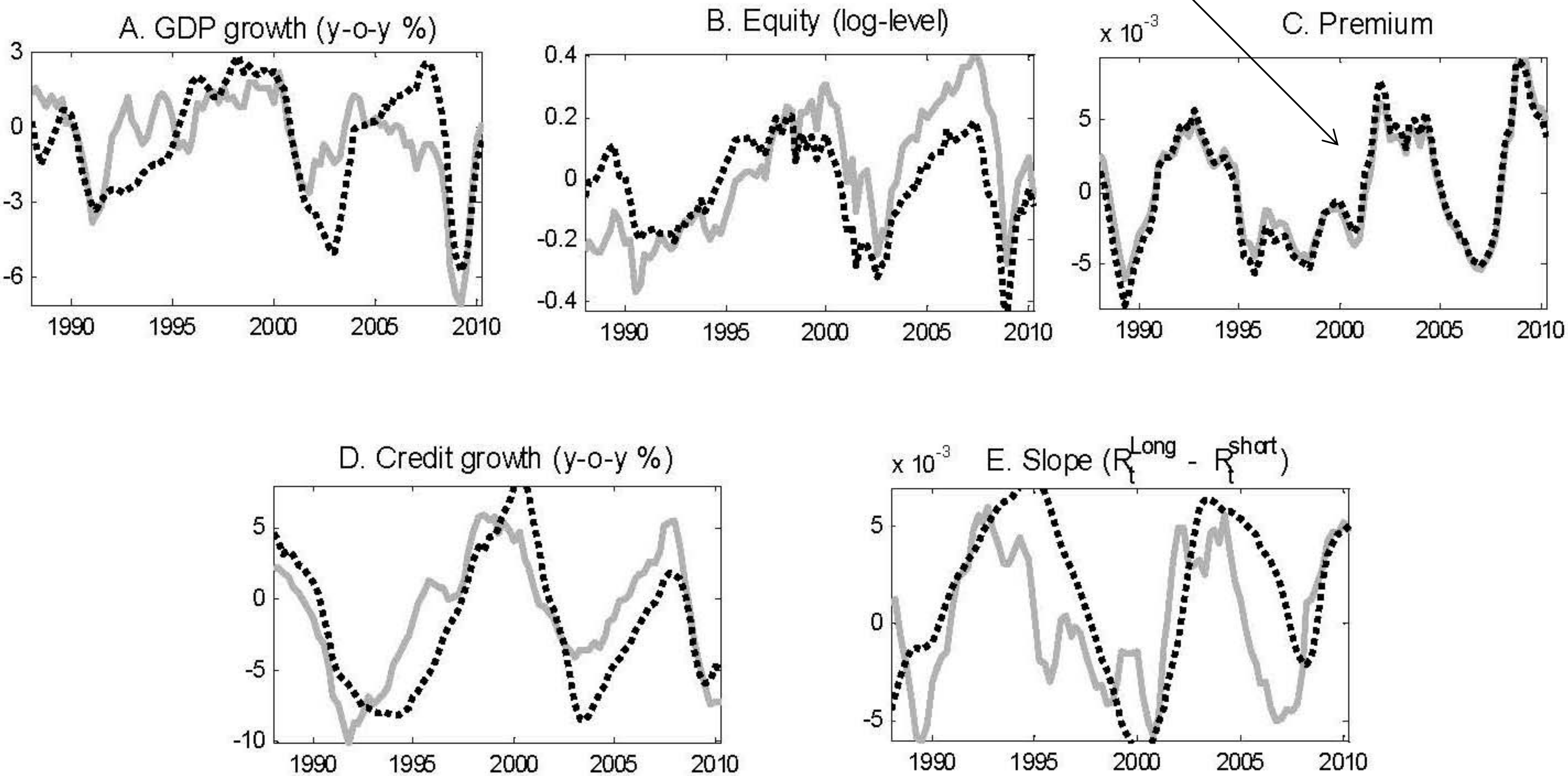
- Use standard macro data: consumption, investment, employment, inflation, GDP, price of investment goods, wages, Federal Funds Rate.
- Also some financial variables: BAA - 10 yr Tbond spreads, value of DOW, credit to nonfinancial business, 10 yr Tbond – Funds rate.
- Data: 1985Q1-2010Q2

Results

- Risk shock most important shock for business cycles.
- Quantitative measures of importance.
- Why are they important?
- What shock do they displace, and why?

Risk shock closely identified with interest rate premium.

Role of the Risk Shock in Macro and Financial Variables



Notes: The grey solid line represents the (two-sided) fitted data. The dotted black line is the model simulations.

Why Risk Shock is so Important

- A. Our econometric estimator 'thinks'

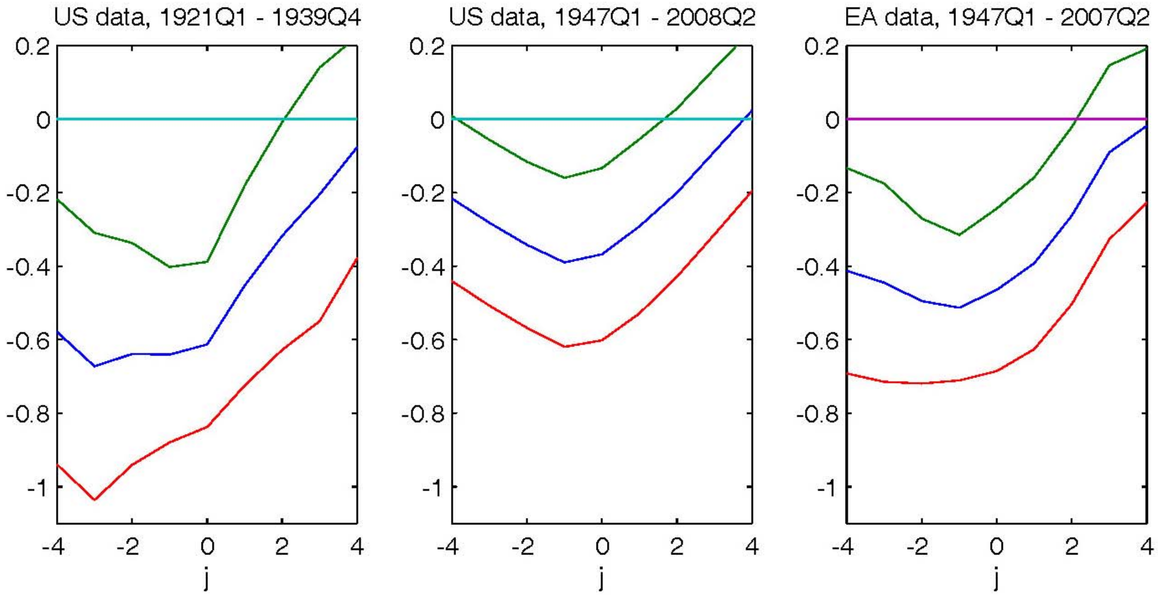
  risk spread ~ risk shock.

- B. In the data: the risk spread is strongly negatively correlated with output.

- C. In the model: bad risk shock generates a response that resembles a recession

- A+B+C suggests risk shock important.

Correlation (risk spread(t),output(t-j)), HP filtered data, 95% Confidence Interval



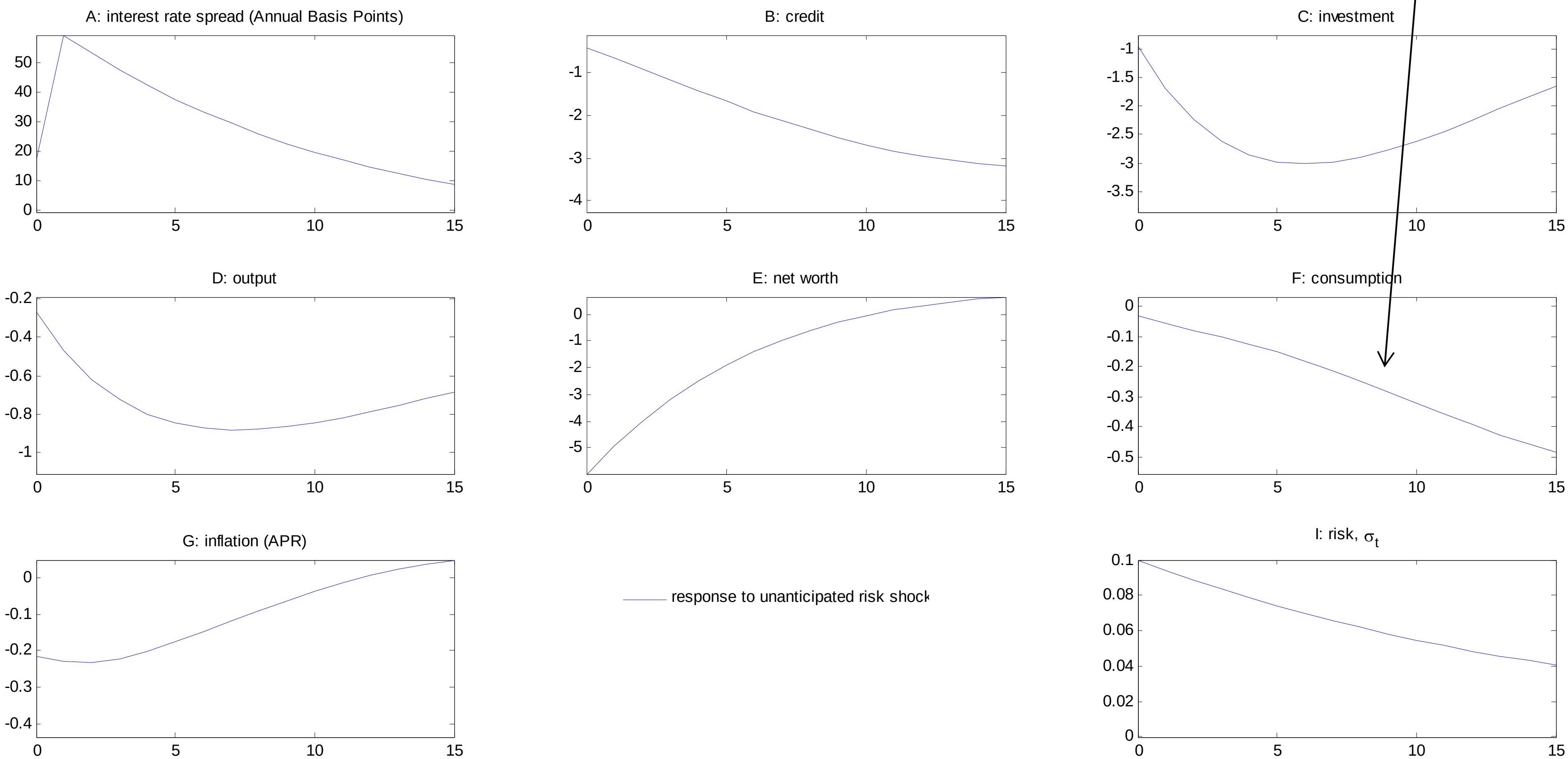
A better name for 'risk spread' would be 'credit spread'

The risk spread is significantly negatively correlated with output and leads a little.

Notes: Risk spread is measured by the difference between the yield on the lowest rated corporate bond (Baa) and the highest rated corporate bond (Aaa). Bond data were obtained from the St. Louis Fed website. GDP data were obtained from Balke and Gordon (1986). Filtered output data were scaled so that their standard deviation coincide with that of the spread data.

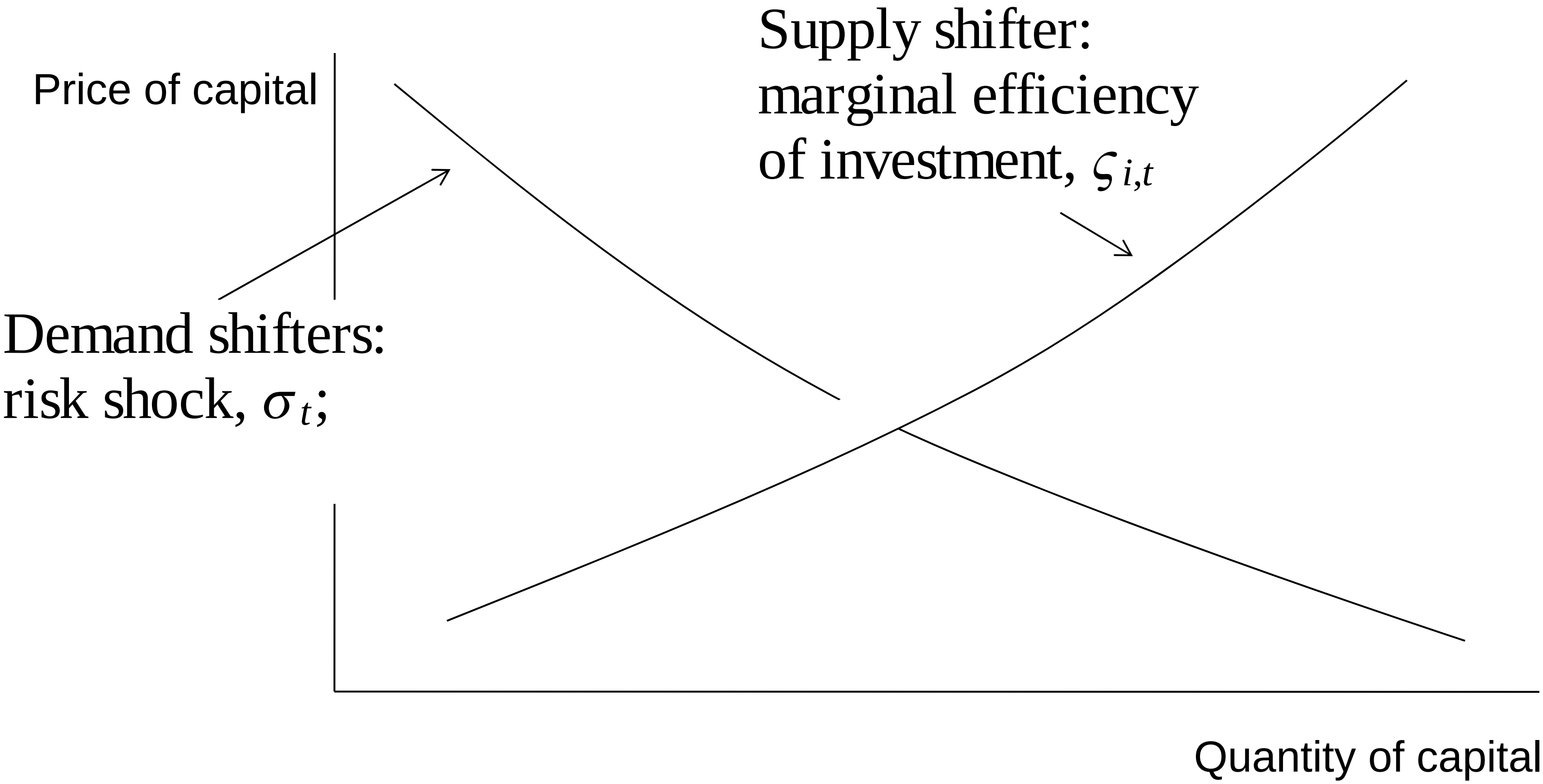
Surprising, from RBC perspective

Figure 3: Dynamic Responses to Unanticipated and Anticipated Components of Risk Shock



Looks like a business cycle

Why does Risk Crowd out Marginal Efficiency of Investment?



- Marginal efficiency of investment shock can account well for the surge in investment and output in the 1990s, *as long as the stock market is not included in the analysis.*

- When the stock market is included, then explanatory power shifts to financial market shocks.

- When we drop ‘financial data’ – slope of term structure, interest rate spread, stock market, credit growth:

  – Hard to differentiate risk shock view from marginal efficiency of investment view.

Conclusion

- Incorporating financial frictions and financial data changes inference about the sources of shocks:
  - risk shock.
- Interesting to explore mechanisms that make risk shock endogenous.
- Models with financial frictions can be used to ask interesting policy questions:
  - When there is an increase in risk spreads, how should monetary policy respond?

Comparison with Bloom (2009)

- Return of entrepreneur *i* at time *t*:

$$r_{i,t+1} = \log(1+R_{t+1}^{k}) + \log\omega_{it},\ \ \log\omega_{it} \sim \text{Normal with variance, } \sigma_t$$

- Go to CRSP data set, 1985 – 2010

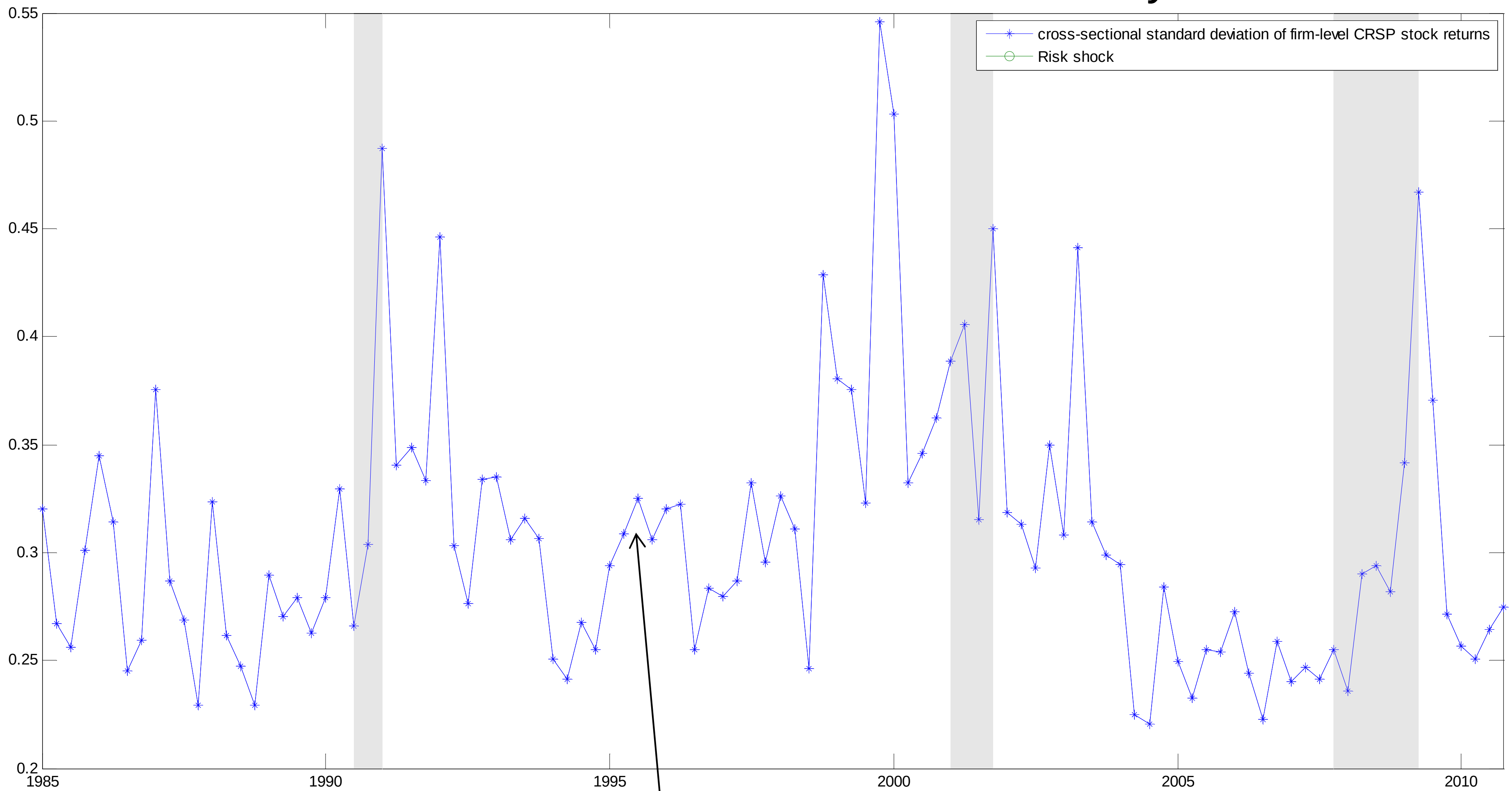
$$\hat{\sigma}_t = \left(\frac{1}{N_t}\sum_{i=0}^{N_t}[r_{it} - \log(1+R_t^k)]^2\right)^{1/2}$$

CRSP measure of uncertainty

log, idiosyncratic shock

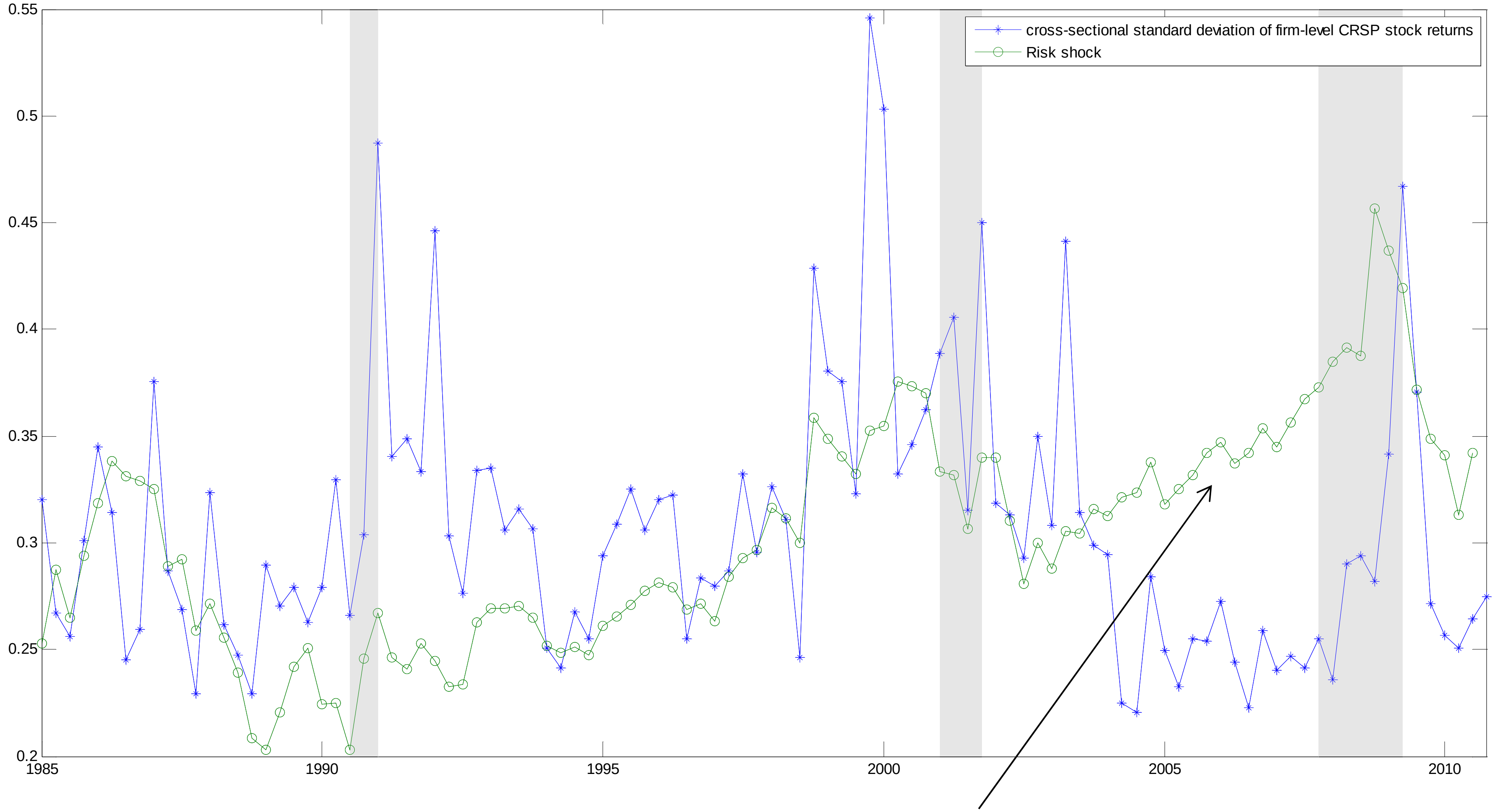
$$1 + R_t^k = \frac{1}{N_t}\sum_{i=0}^{N_t}\exp(r_{it})$$

CRSP-based Measure of Uncertainty and Risk



Cross-sectional standard deviation of CRSP stock returns, as in Bloom (2009)

CRSP-based Measure of Uncertainty and Risk



Smoothed estimate of the risk shock