

# **Adverse Selection, Uncertainty Shocks and Business Cycles**

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# What Caused the Great Recession?

## What Drives Business Cycles?

The great recession and shocks:

### ① **Financial shocks**

- Gilchrist and Zakrasjek (2010), Hall (2010).

### ② **Shocks to marginal efficiency of investment (MEI)**

- Justiniano, et al (2010).

... exogenous, unknown mechanisms.

### **Uncertainty and business cycles**

- Bloom (2009) and Bloom, et al (2010).

## A Question

What microfoundations are behind financial and MEI shocks?

**“Uncertainty shocks which change the degree of asymmetric information in financial markets”**

## What I do: Main results

- Build a dynamic model with adverse selection in financial markets.
  - Unobserved riskiness: Stiglitz and Weiss (1981).
  - Variable scale of investment.
- Uncertainty shocks emerge as financial shocks if adverse selection in the demand side of capital.
- Uncertainty shocks emerge as MEI shocks if adverse selection in the supply side of investment.
- Quantitative analysis in a real business cycle framework.

# Road Map

- ① Partial equilibrium model
- ② General equilibrium model.
  - Basic framework: Real business cycle model.
  - Model I: Adverse selection in demand side.
  - Model II: Adverse selection in supply side.
- ③ Quantitative analysis
  - Impulse responses.
  - Amplification mechanisms.
- ④ Related Literature
- ⑤ Conclusion

# **Partial Equilibrium Model**

## One Time Financing Problem

- Many risk-neutral entrepreneurs and intermediaries.
- Competitive intermediaries in lending. The cost of funds  $R^f$ .
- Entrepreneur has net worth  $N_n$ .
- Entrepreneur uses net worth and borrowing from intermediaries, and invests in project.



## One Time Financing Problem, cont'd

- Project succeeds with probability  $p$  and yields expected return  $R^e > R^f$ .
- Probability,  $p \sim \text{i.i.d.} F(p)$ , is private information.
- Fraction  $1 - \phi$  of entrepreneur's return is pledgeable to intermediaries.
- Entrepreneur is protected by limited liability.

## Timing of Events

0. Nature assigns  $p \sim F(p)$  i.i.d. among entrepreneurs.
1. An intermediary provides a schedule of contracts specifying loans and payment,  $\{B_n(p), X_n(p)\}_p$ .
2. An intermediary chooses to leave or stay in the market.
3. Entrepreneurs choose an intermediary and a pair  $\{B_n(p), X_n(p)\}$ .
4. The outcome, success or failure, is realized, and the profits are realized.

## Macro Implication of Equilibrium Contract

Only two equations summarize the aggregate relationship:

1. Aggregate loan:

$$B = \left[ \frac{(1 - \phi)R^e / R^f}{1 - (1 - \phi)R^e / R^f} \right] F(p^*)N$$
$$< \left[ \frac{(1 - \phi)R^e / R^f}{1 - (1 - \phi)R^e / R^f} \right] N$$

2. Intermediary zero profit condition: determine  $p^*$  given  $R^e / R^f$ .

# **Dynamic General Equilibrium Model**

## Basic Framework: Real Business Cycle Model

- A household as many family members: workers and entrepreneurs. (Gertler and Karadi, 2010)
- Preferences and budget constraint:

$$E_0 \sum_{t=0}^{\infty} \beta^t \left[ \log(C_t) - \psi \frac{L_t^{1+1/\nu}}{1+1/\nu} \right],$$

$$C_t + B_t = R_t B_{t-1} + w_t L_t + \Theta_t.$$

- Counter-cyclical markup in wages:

$$\lambda_{w,t} = \lambda_w \left( \frac{Y_t}{Y} \right)^{-\omega}, \quad \lambda_w > 1, \quad \omega > 0.$$

- Technologies:

$$Y_t = (u_t K_t)^\alpha L_t^{1-\alpha},$$

$$K_{t+1} = (1 - \delta)K_t + \bar{I}_t,$$

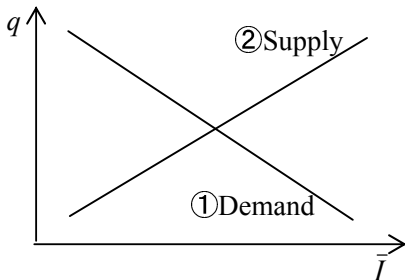
## Two Dynamic Models and Uncertainty Shocks

- Investment:

$$\underbrace{K_{t+1} - (1 - \delta)K_t}_{\text{Demand}} = \underbrace{\bar{I}_t}_{\text{Supply}}.$$

- Uncertainty shocks and distribution of riskiness of project:

$$F_t(p) = \frac{p - \underline{p} \exp(u_t)}{1 - \underline{p} \exp(u_t)}, \quad 0 < \underline{p} < 1.$$



## Model I: Adverse Selection in the Demand Side of Investment

Balance sheet:

$$q_t K_{t+1} = N_t + B_t.$$

Aggregate loan:

$$B_t = \left[ \frac{(1 - \phi) E_t R_{t+1}^k / R_{t+1}}{1 - (1 - \phi) E_t R_{t+1}^k / R_{t+1}} \right] F_t(p_t^*) N_t.$$

**Uncertainty shocks emerge as financial shocks:**

$$E_t \hat{R}_{t+1}^k - \hat{R}_{t+1} = -\chi_1 (\hat{N}_t - \hat{q}_t - \hat{K}_{t+1}) - \chi_2 v_t.$$

## Model II: Adverse Selection in the Supply Side of Investment

Balance sheet:

$$I_t = N_t + B_t^e.$$

Aggregate loan:

$$B_t^e = \left[ \frac{(1 - \phi)q_t\mu_t}{1 - (1 - \phi)q_t\mu_t} \right] F_t(p_t^*)N_t.$$

**Uncertainty shocks emerge as investment shocks:**  $\bar{I}_t = \mu_t I_t,$

$$\hat{I}_t = \left( \frac{1}{\chi_3} \right) \hat{q}_t + \hat{N}_t + \left[ \left( \frac{1 + \chi_3}{\chi_3} \right) \hat{\mu}_t + \left( \frac{\chi_4}{\chi_3} \right) v_t \right].$$



# **Quantitative Analysis**

## Model Parameterization

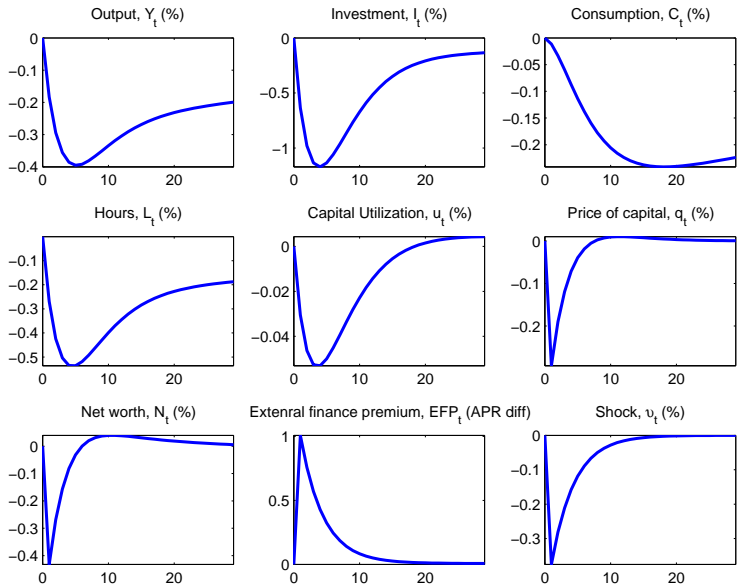
Target values:

$$\text{EFP} \equiv R^b/R \text{ (or } R^b) = 2\% \text{ (APR)}, \quad \text{leverage} \equiv qK/N = 1.5, \quad L = 1.$$

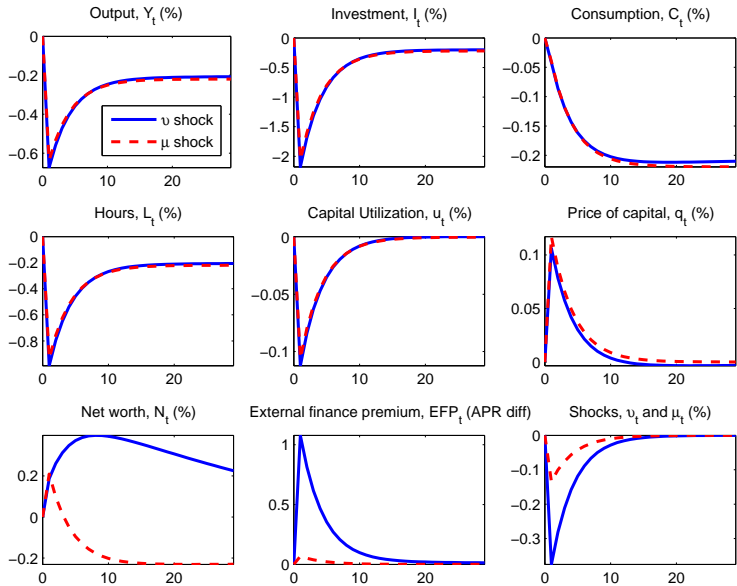
Parameters

Parameter	Description	Value
$\beta$	preference discount factor	$(1.03)^{-1/4}$
$\nu$	elasticity of labor supply	1
$\alpha$	capital income share	0.36
$\delta$	depreciation rate	0.025
$\lambda_w$	markups	1.2
$\omega$	elasticity of markups	2
$a''(1)/a'(1)$	capital utilization	5
$\phi$	Moral hazard	0.55
$\underline{p}$	Lowest support of $F(\cdot)$	0.992
$S''$	adjustment costs	1
$\rho_\nu, \rho_\mu$	AR(1) coef of shocks	0.75

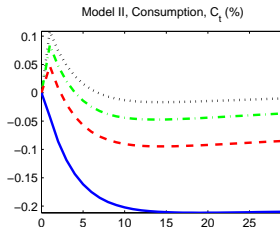
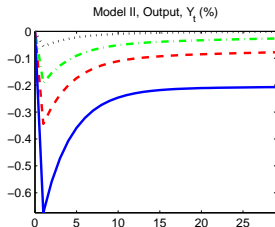
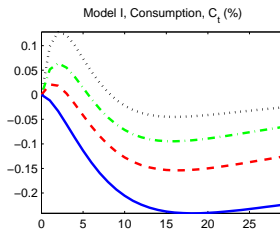
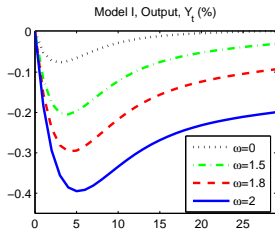
# Impulse Responses: Model I



# Impulse Responses: Model II



# The Role of Counter-cyclical markup in wages: IRF to uncertainty shock



$$\text{Markup}(\underbrace{L}_{?}) \times \text{MRS}(\underbrace{C}_{+}, \underbrace{L}_{+}) = \text{MPL}(\underbrace{L}_{-}),$$

## Literature Review

- Adverse selection: partial equilibrium.
  - Stiglitz and Weiss (1981).
- Adverse selection: dynamic general equilibrium.
  - CF(1997), BGG (1999), Eisefeldt (2004), House (2006), Kurlat (2010), Bigio (2010).
- Uncertainty shocks and risk shocks.
  - Bloom (2009) and Bloom, et al (2010).
  - Christiano, Motto and Rostagno (2010), Gilchrist and Zakrasjek (2010).

## For Future Research

- ① The role of nominal rigidities.
- ② The role of monetary policy.
- ③ Adverse selection in collateral value (Bigio, 2010).