Adverse Selection, Uncertainty Shocks and Business Cycles

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The views expressed in this presentation are solely the responsibility of the author and should not be interpreted as reflecting views of the Bank of Japan.
The great recession and shocks:

1. **Financial shocks**
   - Gilchrist and Zakrasjek (2010), Hall (2010).

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

... exogenous, unknown mechanisms.

**Uncertainty and business cycles**

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.
  - 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:

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

- Uncertainty shocks and distribution of riskiness of project:

$$F_t(p) = \frac{p - p \exp(v_t)}{1 - p \exp(v_t)}, \quad 0 < p < 1.$$
Balance sheet:

\[ q_t K_{t+1} = N_t + B_t. \]

Aggregate loan:

\[
B_t = \left[ \frac{(1 - \phi) E_t R^k_{t+1} / R_{t+1}}{1 - (1 - \phi) E_t R^k_{t+1} / R_{t+1}} \right] F_t(p^*_t) N_t.
\]

Uncertainty shocks emerge as financial shocks:

\[
E_t \hat{R}^k_{t+1} - \hat{R}_{t+1} = -\chi_1 \left( \hat{N}_t - \hat{q}_t - \hat{K}_{t+1} \right) - \chi_2 v_t.
\]
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:

\[ \hat{I}_t = \mu_t I_t, \]

\[ \hat{I}_t = \left( \frac{1}{\chi^3} \right) \hat{q}_t + \hat{N}_t + \left[ \left( \frac{1 + \chi^3}{\chi^3} \right) \hat{\mu}_t + \left( \frac{\chi^4}{\chi^3} \right) \nu_t \right]. \]
Quantitative Analysis
Model Parameterization

Target values:

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

Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Value</th>
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<tr>
<td>( \beta )</td>
<td>preference discount factor</td>
<td>((1.03)^{-1/4})</td>
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<tr>
<td>( \nu )</td>
<td>elasticity of labor supply</td>
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<td>( \alpha )</td>
<td>capital income share</td>
<td>0.36</td>
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<td>( \delta )</td>
<td>depreciation rate</td>
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<td>( \lambda_w )</td>
<td>markups</td>
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<tr>
<td>( \omega )</td>
<td>elasticity of markups</td>
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<td>( a''(1)/a'(1) )</td>
<td>capital utilization</td>
<td>5</td>
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<td>( \phi )</td>
<td>Moral hazard</td>
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<tr>
<td>( p )</td>
<td>Lowest support of ( F(\cdot) )</td>
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<tr>
<td>( S'' )</td>
<td>adjustment costs</td>
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</tr>
<tr>
<td>( \rho_v, \rho_\mu )</td>
<td>AR(1) coef of shocks</td>
<td>0.75</td>
</tr>
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Impulse Responses: Model I

- Output, $Y_t$ (%)
- Investment, $I_t$ (%)
- Consumption, $C_t$ (%)
- Hours, $L_t$ (%)
- Capital Utilization, $u_t$ (%)
- Price of capital, $q_t$ (%)
- Net worth, $N_t$ (%)
- External finance premium, $EFP_t$ (APR diff)
- Shock, $\nu_t$ (%)
Impulse Responses: Model II

Output, $Y_t$ (%)

Investment, $I_t$ (%)

Consumption, $C_t$ (%)

Hours, $L_t$ (%)

Capital Utilization, $u_t$ (%)

Price of capital, $q_t$ (%)

Net worth, $N_t$ (%)

External finance premium, $EFP_t$ (APR diff)

Shocks, $\nu_t$ and $\mu_t$ (%)
The Role of Counter-cyclical markup in wages: IRF to uncertainty shock

\[ \text{Markup} \left( \frac{L}{L} \right) \times \text{MRS} \left( \frac{C}{C}, \frac{L}{L} \right) = \text{MPL} \left( \frac{L}{L} \right), \]
Literature Review

- Adverse selection: partial equilibrium.

- Adverse selection: dynamic general equilibrium.

- Uncertainty shocks and risk shocks.
  - 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).