

Credit Crunch, Bank Lending Behaviour and
Monetary Policy:

A Model of Financial Intermediation with
Heterogeneous Projects

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Background

During the 1980s, banks risk increases,

- deregulation
- growth in off-balance-sheet activities
- increasing bank competition

The competitive inequality arises from the differences in capital regulations across countries.

The Basle Accord

1988 international bank-capital agreement among the G-10 countries

- goals:
 - minimize the risk of the international banking system
 - minimize competitive inequality arising from differences among national bank-capital regulations
- minimum capital requirement: different risk-weighting scheme
 - 8% capital backing for loans
 - 0-1.6% capital backing for government securities
- implementation:
 - phase in from the end of 1990
 - take full effect in 1992

Empirical Observation

A balance-sheet asset reallocation from loans to securities

Changes of Loan/Total Assets 1990-1992 (Wagster, 1999)

Canada	-6%
U.S.	-9%
U.K.	-6%

Is this a credit crunch?

Banks reject credit-worthy applicants despite their willingness to pay higher interest rate or post more collateral.

Empirical Works on Credit Crunches

Hypotheses

- risk-based capital requirement (Basle Accord)
- higher regulatory scrutiny (bank regulators)
- voluntary risk reduction (bank managers)

Results

- U.S.: All (Sharpe, 1995; Peek and Rosengren, 1995; Wagster, 1999)
- Canada: Basle and regulators (Wagster, 1999)
- U.K.: regulators (Wagster, 1999)
- Japan: 1997 crunch (Woo, 1999) 1997
 - near-zero nominal interest rate
 - injection of capital
 - relaxing capital adequacy requirement by accounting changes

Question

In the presence of a credit crunch, can monetary policy help?

The crunch may be caused by regulatory requirements or internal risk management practice.

Credit Channels of Monetary Policy

Channels discussed in the literature

- the lending channel (Bernanke and Blinder, 1988)
- the balance sheet channel (Bernanke and Gertler, 1995)

Quantitative Models of Credit Channels

Fuerst (1995), Fisher (1996), Bernanke, Gertler and Gilchrist (1997), Cooley and Quadrini (1998)

The question still remains.

Tasks of This Paper

- To build a heterogeneous agent model of financial intermediation
 - be more precise about the credit decision of the bank
 - its concerns: return on loan, bad loans
 - failure happens, model it
 - heterogeneity of firms/investment projects
 - endogeneity of household, firm and bank decisions
- To generate a credit crunch by conservative bank lending
- To examine the effectiveness of monetary policy

Model Components

- A household
 - endowed with projects
 - external financing necessary
 - bank screening by net worth
 - idiosyncratic shock for unemployment
- A bank
 - collects deposits
 - allocate assets to loans and government bonds
 - risk management lending policy which potentially causes conservative lending in periods of reduced profitability and financial distress.
- A central bank that determines safe return

Households / Firms

m^* minimum net worth eligible for external financing

- Employed workers ($m < m^*$)
- Unemployed workers ($m < m^*$) prob u
- Entrepreneurs ($m \geq m^*$)
- Retirees prob τ
- Death prob δ

Momentary utility function:

$$U^{oc}(c) = \frac{(\xi^{oc} c^{1-\sigma})^{1-\rho} - 1}{1-\rho}$$

$oc \in \{W, U, E, R\}$

Workers

For a worker, $V^W(m) =$

$$\begin{aligned} & \max_{\{c^W, m'\}} \{U^W(c^W) + \beta[(1 - \tau)[(1 - u)V^W(m') + \\ & \quad uV^U(m') + E_{r'}V^E(m', r')] + \tau V^R(m')]\} \\ \text{S.T.} \quad & c^W + m' = (1 + R^d)m + y, \\ & V^W(m) = 0 \text{ if } m \geq m^*. \end{aligned}$$

For an unemployed worker, $V^U(m) =$,

$$\begin{aligned} & \max_{\{c^U, m'\}} \{U^U(c^U) + \beta[(1 - \tau)[(1 - u)V^W(m') + \\ & \quad uV^U(m') + E_{r'}V^E(m', r')] + \tau V^R(m')]\} \\ \text{S.T.} \quad & c^U + m' = (1 + R^d)m + \theta y, \\ & V^U(m) = 0 \text{ if } m \geq m^*. \end{aligned}$$

Entrepreneur

Being an entrepreneur

- n projects, r^{ij} of project x^{ij} , $x^i = \sum_j x^{ij}$
- external financing, $x_t^i = \phi m_t^i$ ($\phi > 1$)
- returns are risky
- bankruptcy of a project is possible
- personal bankruptcy also

$$V^E(m, r) =$$

$$\max_{\{c, m'\}} \{U^E(c) + \beta[(1 - \tau)[(1 - u)V^W(m') + uV^U(m') + E_{r'}V^E(m', r')] + \tau V^R(m')]\},$$

$$\text{S.T.} \quad c = \max \begin{cases} c^{min}, & m + y - m' + \\ + \sum_{j=1}^n (1 + r^j)x^j - R^l(i - m) \end{cases}$$

$$\sum_{j=1}^n x^j = \phi m,$$

$$V^E(m, r) = 0 \text{ if } m < m^*.$$

The Bank

- collects deposits
- provides loans
- invests in Treasury bonds
- instruments: minimum collateral m^* , lending rate R^l
- constraint 1: interest paid = interest received - losses - costs
- constraint 2: losses/deposit ratio (α)
- constraint 3: banks cannot lend more than deposits accepted

Losses

- it is costly to liquidate
- if all projects of a household go bankrupt, the household gets minimal consumption

The Central Bank

Decides on Treasury bond interest rate (and deposit rate)

The central bank's impact

- can affect lending conditions: lending rate and minimum collateral
- side effects: savings decisions of workers also affected
- general equilibrium

Computation

- calibration to average characteristics of the Canada 1988–1992
- assume initial values for some unknown parameters
- compute optimal decisions over an asset grid using value functions
- determine invariant distribution
- assess unknown parameters
- → benchmark, observe resulting α
- change conditions, try values of m^* and R^l

Calibration

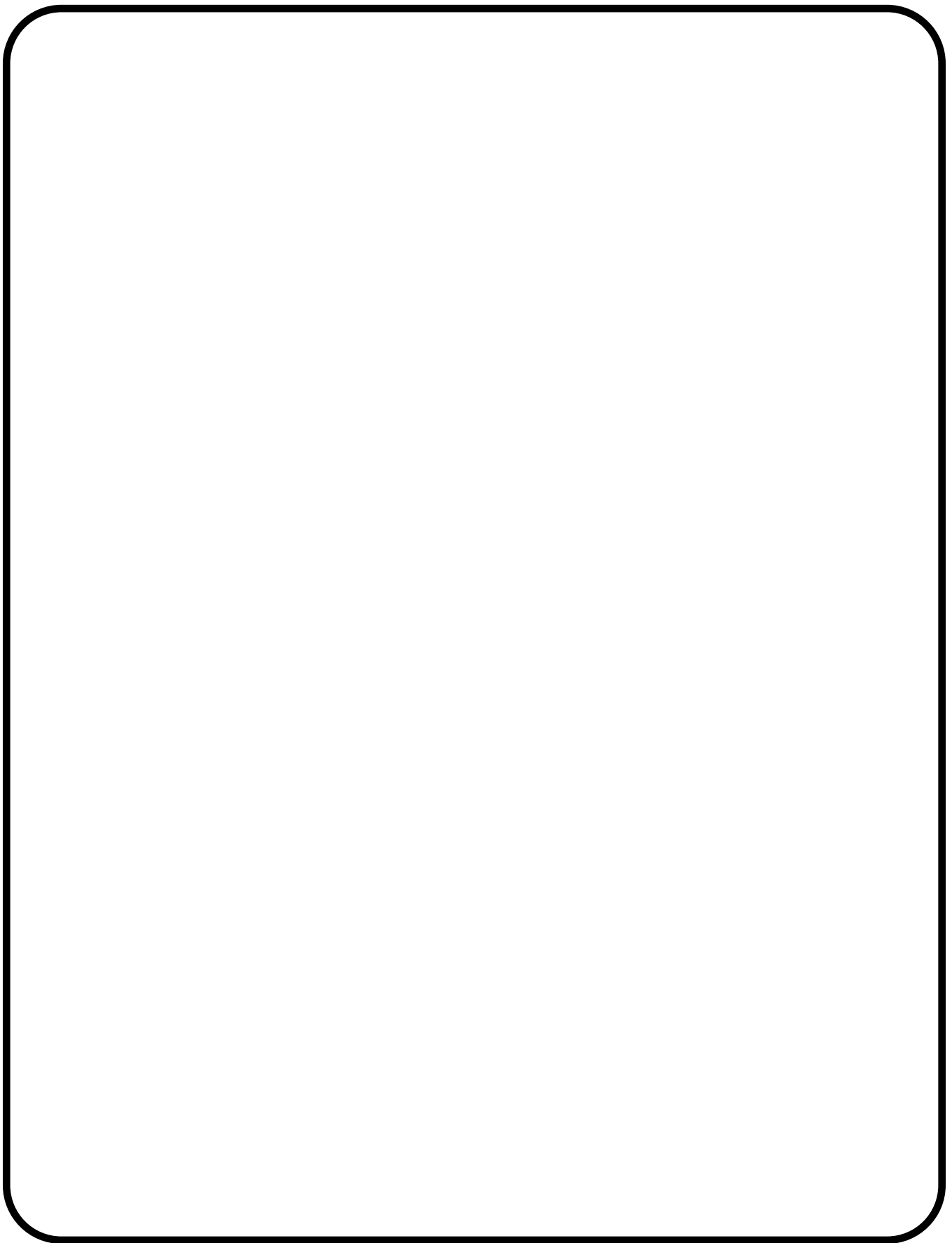
- average real deposit rate: 1% (real GIC and saving rate)
- retirement, minimum consumption and UI benefits: 30%
- $\phi=2.2$ (debt/equity ratio)
- auditing fee 6%
- distribution of returns:
-50% 4.52% 60%
0.98% 98.17% 0.85%
- 5% prob of retirement, 10% prob of death
- $n = 2$

Benchmark

- $m^* = 6.76$, $R^l = 1.18\%$, bonds are 13% of deposits
- 9% are entrepreneurs, Gini on assets is 0.65
- $\alpha = 0.166\%$

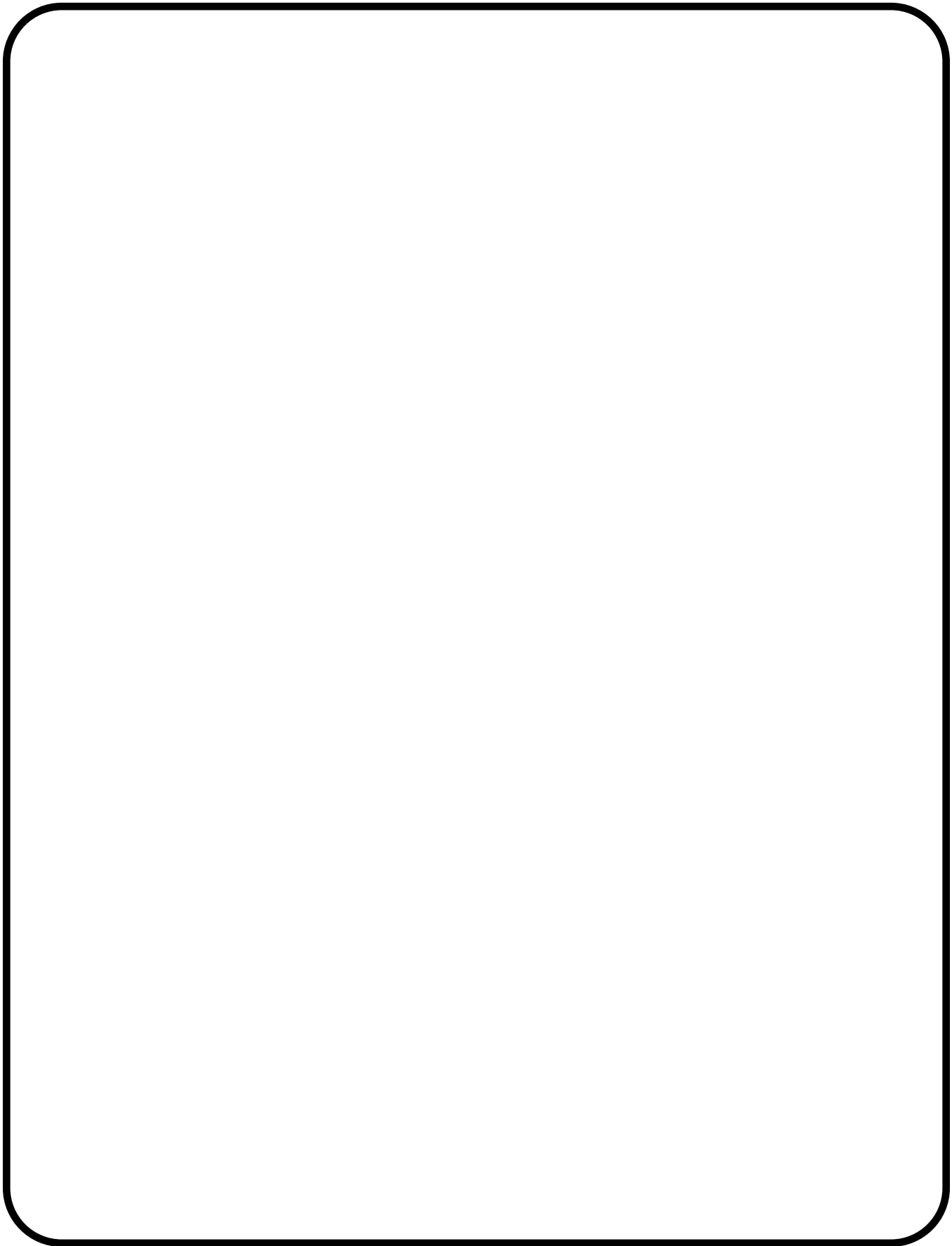
Results

- get a benchmark
- get a credit crunch
- see what monetary policy can do
- see what lending policy can do



	Benchmark	Credit Cr.	Monet. Pol.	Lending Pol.
Dep. Rate, R^d	0.0100	0.0100	0.0050	0.0100
Return Distrib.	[-0.5 0.010]	[-0.5 0.018]	[-0.5 0.018]	[-0.5 0.018]
	[0.045 0.982]	[0.026 0.974]	[0.026 0.974]	[0.026 0.974]
	[0.6 0.0085]	[0.6 0.0079]	[0.6 0.0079]	[0.6 0.0079]
Cut-off Point, m^*	6.76	6.84	6.55	6.72
Lending rate, R^l	0.0118	0.0130	0.0090	0.0140
Bonds/Dep. (%)	13	58	57	14
Loss/Deposit (%)	0.166	0.166	0.166	0.345
Total Loans	0.76	0.27	0.26	0.80
Total Deposits	0.87	0.65	0.60	0.92
Num of Workers	0.58	0.64	0.64	0.58
Num of Entrepr.	0.09	0.03	0.03	0.09
Num of Retirees	0.33	0.33	0.33	0.33
Gini Coefficient	0.65	0.62	0.62	0.64
Average Utility	-0.23	-0.26	-0.27	-0.23

Table 1: Canada, Steady State Analysis



	Benchmark	Credit Crunch
Exogenous variables		
Deposit Rate, R^d (%)	4.43	4.43
Return Distribution [return (%), probability]	$\begin{bmatrix} -29.36 & 0.0062 \\ 8.67 & 0.9833 \\ 44.60 & 0.0105 \end{bmatrix}$	$\begin{bmatrix} -0.3539 & 0.0138 \\ 0.0394 & 0.9770 \\ 0.4515 & 0.0090 \end{bmatrix}$
Unempl. Rate, u (%)	2.60	3.75
Debt/Equity, $\phi - 1$	2.67	2.69
Loss/Deposit, α (%)	0.067	0.067
Endogenous variables		
Cut-off Point, m^*	16.4	17.0
Lending rate, R^l (%)	4.52	4.70
Bonds/Deposit (%)	18.4	71.6
Total Loans	2.69	0.92
Total Deposits	3.29	3.24
Num. of Workers (%)	71	75
Num. of Entrepreneurs (%)	6	2
Wealth Gini Coefficient	0.47	0.42
Average Utility	-0.263	-0.283

Table 2: Japan, Steady State Analysis

	Interest Rate		Interest Rate		Lenient		Cash		Cash Inj. &	
	Reduction	Increase	Increase	Lending	Injection	Int. R. Red.				
Deposit Rate, R^d (%)	3.43	5.43	4.43	4.43	4.43	4.39				
Loss/Deposit, α (%)	0.191	0.066	0.191	0.065	0.067	0.067				
Cut-off Point, m^*	13.55	21.3	16.15	16.95	16.95	18.80				
Lending rate, R^l (%)	3.67	5.67	4.67	4.67	4.67	4.63				
Bonds/Deposit (%)	20.6	71.4	18.7	72.3	72.3	71.5				
Total Loans	2.03	1.26	2.71	0.98	0.98	1.00				
Total Deposits	2.55	4.39	3.34	3.55	3.55	3.51				
Num. of Workers (%)	72	75	71	75	75	75				
Num. of Entrepreneurs	5	2	6	2	2	2				
Wealth Gini Coefficient	0.48	0.45	0.48	0.42	0.42	0.42				
Average Utility	-0.293	-0.247	-0.264	-0.282	-0.282	-0.283				

Table 3: Japan, Policy Analysis

Conclusions and Future Work

- Effects of monetary policy are limited
- Implications for regulatory authorities
- Future work:
 - consider S&L crisis
 - production economy
 - market for gvt bonds
 - out-of-steady-state behavior