Two Monetary Models with Limited Information

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Models with Limited Information

Two workhorse monetary models:

- sticky price model
- limited participation model

Common feature: A subset of agents in the economy makes decisions under "limited information" with respect to the current realization of the monetary growth process.

Objective: Replicate the empirical response of various economic variables to monetary shocks.

- **Monetary shock**= Unanticipated change in the money growth rate.
  - If the money growth rate follows a known stochastic process, the monetary shock is the innovation in this process.
  - If the money growth rate is deterministic, the monetary shock can be seen as a one time unforeseen change in the money growth rate.

Sticky Price Economy

Two main assumptions:

1. Subset of firms are monopolistically competitive$\rightarrow$ they set prices to maximize profits, taking as given the demand for their product and factor prices; firms are competitive on factor markets but behave as monopolists in the product market.

Interpretation: Firms produce a special good but they are relatively small$\rightarrow$ each of these firms will have market power but their factor demand will not affect the equilibrium on factor markets.

2. Subset of the monopolistically competitive firms set their price before the current realization of monetary policy is realized.

Current version: CIA structure, Lucas-Stokey timing and no physical capital.

Agents: households, intermediate good producers, final good producers, monetary authority.

Monetary authority$\rightarrow$ prints money and transfer it to the households lump sum- monetary transfer is the only exogenous and possibly stochastic variable.

2.1 Households

Representative household:

$$\sum_{t=0}^{\infty} \beta^t u(c_t, l_t), \ u(c, l) = \log c + \gamma \log(l), \ l = 1 - n, \tag{1}$$

Timing: At the beginning of the period, the household trades in a securities market and allocates nominal assets between money and bonds. After trading in the securities market, the household supplies labor and consumes.

Asset market constraint:

$$A_t + X_t \geq M_t + Q_t B_t, \tag{2}$$

A_t = beginning-of-period t nominal assets, X_t =transfer from the monetary authority, M_t =holdings of cash, B_t =purchases of interest bearing bonds, Q_t = bond price, and A_0 is given.

CIA:

$$P_t c_t \leq M_t. \tag{3}$$

Wealth accumulation:

$$A_t = W_{t-1} n_{t-1} + (M_{t-1} - P_{t-1} c_{t-1}) + B_{t-1} + \Pi_{t-1}. \tag{4}$$

where Π_{t-1} =profits in the previous

Natural debt limit (NPG):

$$A_{t+1} \geq -\frac{1}{q_{t+1}} \sum_{j=1}^{\infty} q_{t+j+1} \left[W_{t+j} + T_{t+j-1} + \Pi_{t+j} \right], \text{ for } t = 0, 1, 2, ..., \tag{5}$$

where $q_t = \prod_{j=0}^{t-1} 1/R_j$, $q_0 \equiv 1$.

Household's problem: maximize (1) s.t. (5)-(2), n_t, c_t, $1 - n_t \geq 0$, at $R_t \geq 1$.

2.2 Monetary Authority

$X_t = x_t M_t$, M_0 is given

$M_{t+1} = (1 + x_t) M_t$

Monetary policy: $\{x_t\}_{t=0}^{\infty}$.

2.3 Firms

Variant of Blanchard and Kiyotaki (1987). Firms are static.

Final goods firms: perfectly competitive, produce consumption goods using intermediate goods.

Production function:

$$y = \left[\int_0^1 y(\omega)^\lambda d\omega \right]^{\frac{1}{\lambda}}, \tag{6}$$

where y = output, $y(\omega)$ = quantity of intermediate good of type ω used to produce good i, and $0 < \lambda < 1$.

Problem:

$$\max_{y, \{y(\omega)\}} Py - \int_0^1 P(\omega) y(\omega) d\omega.$$

FONC for $y(\omega)$:

$$Py(\omega)^{\lambda-1} \left[\int_0^1 y(\omega)^\lambda d\omega \right]^{\frac{1}{\lambda}-1} - P(\omega) = 0.$$

$\rightarrow$Demand curves for each intermediate good:

$$y(\omega) = y \left[\frac{P}{P(\omega)} \right]^{\frac{1}{1-\lambda}}. \tag{7}$$

Intermediate good firms: monopolists in the product market and competitors in the market for labor. *They set prices for their goods and are then required to supply whatever final good producers demand at those prices.*

Flex prices$\rightarrow$ prices set after the current monetary transfer is realized.

Problem:

$$\max_{y(\omega)\leq n(\omega)} P(\omega)y(\omega) - Wn(\omega), \text{ s.t. (7)}$$

W =wage rate

FONC for $P(\omega)$, after substituting (7) and technology:

$$\frac{-\lambda}{1-\lambda} P(\omega)^{\frac{-1}{1-\lambda}} P^{\frac{1}{1-\lambda}} - W\frac{-1}{1-\lambda} P(\omega)^{\left(\frac{-1}{1-\lambda}-1\right)} P^{\frac{1}{1-\lambda}} = 0,$$

$\rightarrow$

$$P(\omega) = \frac{W}{\lambda}. \tag{8}$$

$1/\lambda$ = mark-up of price over marginal cost, MC=nominal wage.

Price will be a function of the current value of x_t.

Fix prices→Prices set before the current monetary policy shock is realized
Problem:

$$\max_{y(\omega)\leq n(\omega)} P(\omega)y(\omega) - E_{-1}Wn(\omega), \text{ s.t. (7)}$$

$E_{-1}W$ = expected wage rate→ depends on state in the previous period
FONC→

$$\bar{P}(\omega) = \frac{E_{-1}W}{\lambda}, \tag{9}$$

- **Assumption**: Firms set their prices and then satisfies whatever level of demand materializes at those prices. They hire labor after their demand is realized and they will pay the going wage rate.

Sequence of markets equilibrium

Definition 1 *A Private Sector Equilibrium with flexible prices is a set of sequences,* $\{P_t, W_t, R_t, c_t, n_t, B_t, M_t, x_t\}$ *with the properties:*

1. Given the prices and the government policies the quantities solve the household problem.
2. The firm optimality conditions in (8) hold;
3. $R_t \geq 1$;
4. The various market clearing conditions hold:

$$c_t = n_t, \; B_t = 0, \; M_{t+1} = M_t \left(1 + x_t\right). \tag{10}$$

Sequence of markets equilibrium ...

Household problem:

$$
\begin{aligned}
L \;=\; & \sum_{t=0}^{\infty} \beta^t \left\{ u\left(c_t, l_t\right) - \mu_t \left(P_t c_t - M_t\right) \right. \\
& \left. -\lambda_t \left[M_t + Q_t B_t - X_t - \left(W_{t-1} n_{t-1} + \left(M_{t-1} - P_{t-1} c_{t-1}\right) + B_{t-1} + \Pi_{t-1}\right)\right] \right\},
\end{aligned}
$$

FONC:

$$
\begin{aligned}
u_{ct} &= P_t \left(\mu_t + \beta E_t \lambda_{t+1}\right), && (11) \\
\frac{u_{ct}}{u_{lt}} &= \frac{P_t \left(\mu_t + \beta E_t \lambda_{t+1}\right)}{\beta E_t \lambda_{t+1}}, && (12) \\
R_t &= 1/Q_t = \lambda_t / \beta E_t \lambda_{t+1}. && (13)
\end{aligned}
$$

3.1 Equilibrium with Flexible Prices

(8) + (12)→ equilibrium consumption, (13)→ R_t

CIA→ equilibrium prices

$$P_t = M_t^s / c_t, \; A_t = M_{t-1}^s$$

Proposition 1 *(Characterization Result) A sequence,* $\{P_t, W_t, R_t, c_t, n_t, B_t, M_t, x_t\}$, *is an equilibrium if and only if* (8)-(15) *are satisfied. Furthermore, for any* $R_t \geq 1$, *there exists a private sector equilibrium with employment and consumption allocations uniquely determined by:*

$$n_t = c_t = \frac{\lambda}{\lambda + \gamma R_t}, \text{ all } t, \quad (14)$$

$$R_t = \frac{1 + x_{t+1}}{\beta}. \quad (15)$$

Properties: Equilibrium consumption is decreasing in the mark-up $(1/\lambda)$ and in the nominal interest rate R_t

→Monopolistic competition introduces an *additional wedge* or distortion in the economy.

3.2 Equilibrium with Sticky Prices

- **Assumption**: x_t is first order Markov $\rightarrow$ can focus on stationary equilibria.
- A stationary equilibrium$\rightarrow$ all equilibrium variables are time independent and only depend on the "state".
- State: $\{x_{t-1}, x_t\}$, since intermediate good producers decide on prices based on time $t-1$ information.
  - Simplification: Only variable depending on x_{t-1} is $P_t \longrightarrow$ state: $\left\{\bar{P}_t, x_t\right\}$.
  - M_t^s does not influence real variables in equilibrium$\rightarrow$ rescale all nominal variables, e.g. $a = A/M^s$.
  - State: $s = \{\bar{p}, x\}$.

Definition 2 *A stationary equilibrium with sticky prices is a private sector equilibrium in which, in each period, the variables $\{c, w, R\}$ depend on $s = \{\bar{p}, x\}$ and $p(s) = \bar{p}$.*

3.3 Stationary Equilibrium

Final goods firms optimization $\rightarrow p(s) = \bar{p}$.

CIA$\rightarrow$ $c\left(s\right)$:

$$c\left(s\right) = \frac{1+x}{\bar{p}}. \tag{16}$$

(12)$\rightarrow$ $w\left(s\right)$:

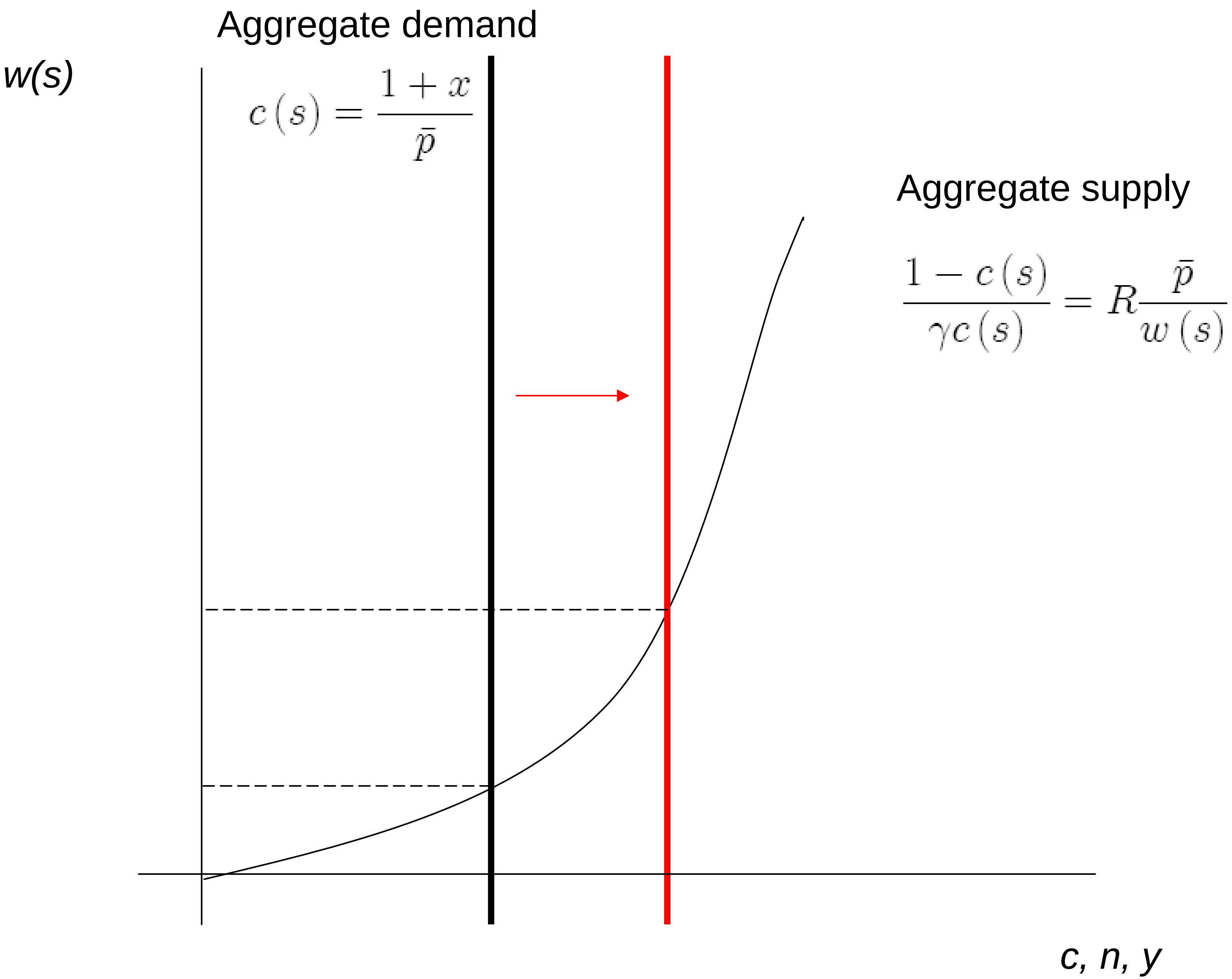
$$\frac{1-c\left(s\right)}{\gamma c\left(s\right)} = R\frac{\bar{p}}{w\left(s\right)}. \tag{17}$$

(13)$\rightarrow$ $R\left(s\right)$:

$$1 = \beta R\left(s\right) E\left(\frac{1}{1+x'}\right).$$

(16)-(17)$\rightarrow$ profits:

$$\pi(s) = \bar{p}c(s) - w(s)c(s) = (\bar{p} - w(s))c(s)$$

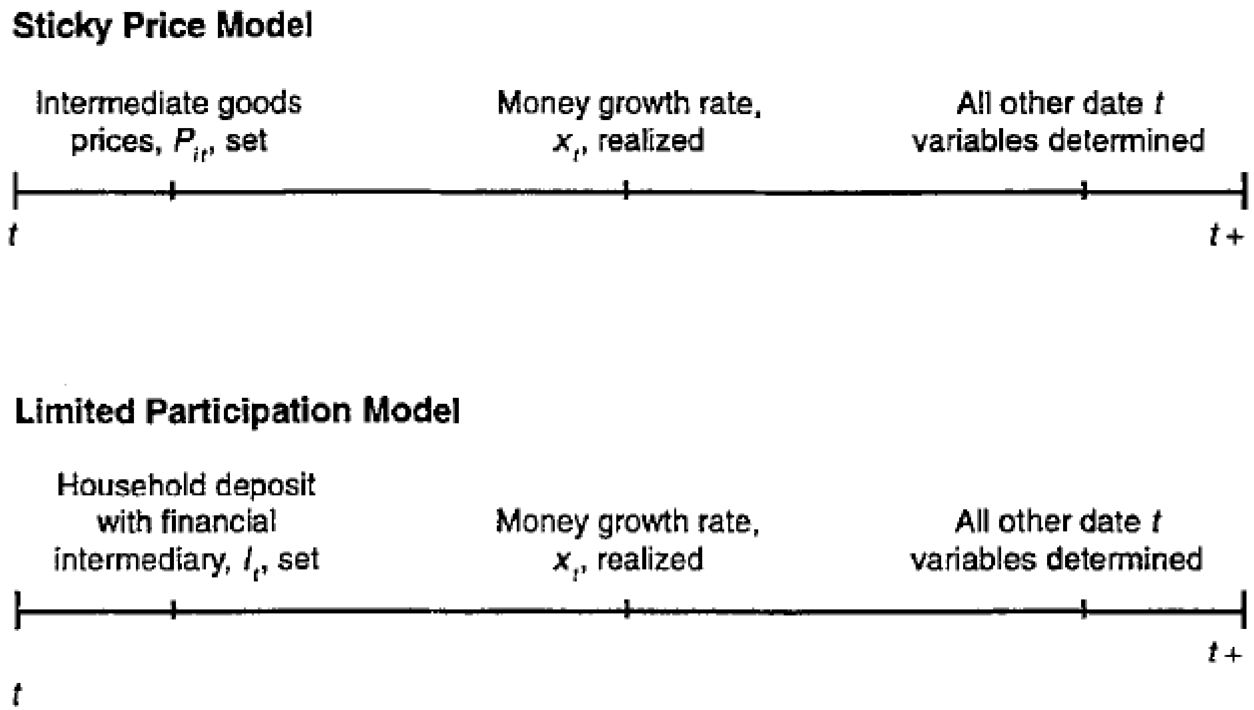


Effect of an expansionary money growth shock in the sticky price model

Limited Participation Economy

- Main features:
  - Firms need to borrow to finance purchases of working capital.
    - Working capital= Recurring factor payments→ *demand for liquidity by firms*.
  - Prices are completely flexible.
  - Households face CIA constraint and can make deposits with financial intermediaries at gross nominal rate R.
    - R= opportunity cost of cash for households and the price of liquidity for firms.
  - Financial intermediaries→ perfectly competitive- clearing house between household and the firm sector.
- Crucial assumption: Households cannot adjust their deposits to the current realization of the monetary policy process→ Limited participation.
- Result: Expansionary monetary policy shocks have a positive effect on output, real wages and profits.

  See Christiano, Eichenbaum and Evans (1997).


Sticky Price Model
Intermediate goods prices, P_{it}, set
Money growth rate, x_t, realized
All other date t variables determined
t
$t+1$
Limited Participation Model
Household deposit with financial intermediary, I_t, set
Money growth rate, x_t, realized
All other date t variables determined
$t+1$
t

5.1 Households

$$u(c,l) = \log(c) + \gamma \log(l).$$

Initial currency holdings: M_t

Deposits: D_t are subject to

$$0 \leq D_t \leq M_t. \tag{20}$$

Constraint on goods markets:

$$P_t c_t \leq W_t (1 - l_t) + M_t - D_t, \tag{21}$$

End of period wealth is given by:

$$M_{t+1} = W_t (1 - l_t) + M_t - D_t - P_t c_t + R_t (D_t + X_t) + \Pi_t, \tag{22}$$

where R_t is the return on deposits and π_t are profits.

The non-negativity constraints on M_t and D_t in effect rule out Ponzi schemes, so the intertemporal consumption set is well defined.

Limited Participation Economy

Household problem:

$$\begin{aligned}\mathcal{L}_t \;=\; & E_t \sum_{s\geq 0} \beta^s \left\{ \left[\log\left(c_{t+s}\right) + \gamma \log(1-n_{t+s}) \right] - \xi_s \left(D_{t+s} - M_{t+s}\right) \right. \\ & -\mu_{t+s}\left[P_{t+s}c_{t+s} - \left(M_{t+s} - D_{t+s} + W_{t+s}n_{t+s}\right)\right] \\ & -\eta_{t+s}\left[M_{t+s+1} - \left(M_{t+s} - D_{t+s} + W_{t+s}n_{t+s} - P_{t+s}c_{t+s}\right)\right. \\ & \left.\left. - \left(D_{t+s} + X_{t+s}\right) R_{t+s} + \Pi_{t+s}\right]\right\},\end{aligned}$$

- First order necessary and sufficient conditions:

$$\frac{1}{c_t} - (\mu_t + \eta_t) P_t = 0, \tag{1}$$

$$\frac{-\gamma}{1 - n_t} + (\mu_t + \eta_t) W_t = 0, \tag{2}$$

$$\eta_t - \beta \xi_{t+1} - \beta E_t (\mu_{t+1} + \eta_{t+1}) = 0, \tag{3}$$

$$-\xi_t + E_{t-1} [-\mu_t + \eta_t (R_t - 1)] \begin{cases} \leq 0, \\ = 0, \text{ for } D_t > 0 \end{cases}, \tag{4}$$

$$\mu_t [P_t c_t - (M_t - D_t + W_t n_t)] = 0, \mu_t \geq 0, P_t c_t \leq M_t - Q_t + W_t n_t, \tag{5}$$

$$\xi_t (M_t - D_t) = 0, \xi_t \geq 0, \ Q_t \leq M_t \tag{6}$$

$$\lim_{T \to \infty} \beta^t E_{T-1} (\eta_T M_{T+1}) = 0. \tag{7}$$

1.2 Firms

- Final good firms: As in sticky price model.
- Intermediate good firms: Monopolistically competitive as in sticky price model
  - Prices flexible
  - Need to borrow to finance working capital.
    - Working capital=Wage bill.

- Intermediate goods firms problem:

$$\pi = \max_{P(\omega),L} P(\omega)\, y(\omega) - Wy(\omega) + L - RL,$$

subject to

$$y(\omega) \leq n(\omega),$$

and:

$$Wn \leq L. \tag{8}$$

First order necessary condition:

$$P(\omega) = \frac{WR}{\lambda}. \tag{9}$$

- The need to borrow to finance wage disbursement increases the marginal cost of hiring workers.

1.3 Financial Intermediaries

- Finacial intermediaries receive deposits from households and the monetary injections from the central bank and use these funds to make loans to firms.
- They are perfectly competitive.

Financial intermediaries problem:

$$\pi^{fi} = \max_{L_t} R_t L_t + D_t + X_t - L_t - R_t \left(D_t + X_t \right),$$

subject to

$$L_t \leq D_t + X_t.$$

- If $R_t > 1$, $L_t = D_t + X_t$.
- If $R_t = 1$, f.i. are indifferent over L_t. We assume that they loan out all funds even in this case.

Equilibrium

- Timing of events is as follows:

1. Households choose D_t.
2. Monetary growth is realized.
3. The loan market clears.
4. The consumption and labor markets meet and clear.

Definition 1 *A private sector equilibrium is a price system* $\{P_t, W_t, R_t\}_{t\geq 0}$ *, an allocation* $\{c_t, n_t, y_t, L_t, D_t, M_t\}_{t\geq 0}$ *and a monetary growth rate path* $\{X_t\}_{t\geq 0}$ *such that:*

1. the allocation satisfies households', firms' and financial intermediaries' conditions for optimality given the price system and the money growth rate path;
2. $R_t \geq 1$ for all $t = 0, 1, 2, ...$
3. at the given allocation, price system and money growth rate path the following market clearing conditions hold:

$$\begin{aligned} D_t + X_t &= L_t, \\ L_t &= W_t n_t, \\ c_t &= y_t = n_t. \end{aligned}$$

2.1 Stationary Equilibrium

- Exogenous state variable: x_t.
- Economic state: $s_t = \{x_t, x_{t-1}\}$.
  - Since households choose deposits before x_t is realized, they base their choices on x_{t-1}.

Let $d = d/M$, $p \equiv P/M$, $w \equiv W/M$, and $x \equiv X/M$.

Definition 2 *A stationary equilibrium is a private sector equilibrium in which the allocation $\{c, n, d\}$ and the price system $\{p,\ w,\ R\}$ depend on the economic state, $s = \{x_{-1}, x\}$, only.*

- d is a function of x_{-1} only, so that $d(x_{-1})$ in a stationary equilibrium.

2.2 Characterization

1. Solve for c, n, p, w , R for a given d and x.

- – Involves the static optimization conditions and market clearing conditions.

  Loan and money market clearing $\Longrightarrow$
$$p(s)\,c(s) = 1 + x \tag{10}$$
  Households' static Euler equations and firm optimality$\Longrightarrow$
$$\frac{1 - c(s)}{\gamma c(s)} = \frac{R(s)}{\lambda} \tag{11}$$

- $c(s)$ and $R(s)$ inversely related

  Resource constraint and clearing on the labor market$\Longrightarrow$
$$c = n = 1 - l$$

Equilibrium ...

To solve for R, define:

$$\Gamma = \frac{Wn}{Pc}$$

Γ =ratio of intermediated vs total liquidity

Loan market clearing and (10)$\Longrightarrow$

$$\Gamma(s) = \frac{d+x}{1+x} \leq 1, \text{ since } d \in [0,1]$$

- Γ is increasing in x.

Resource constraint and optimality by firms$\Longrightarrow$

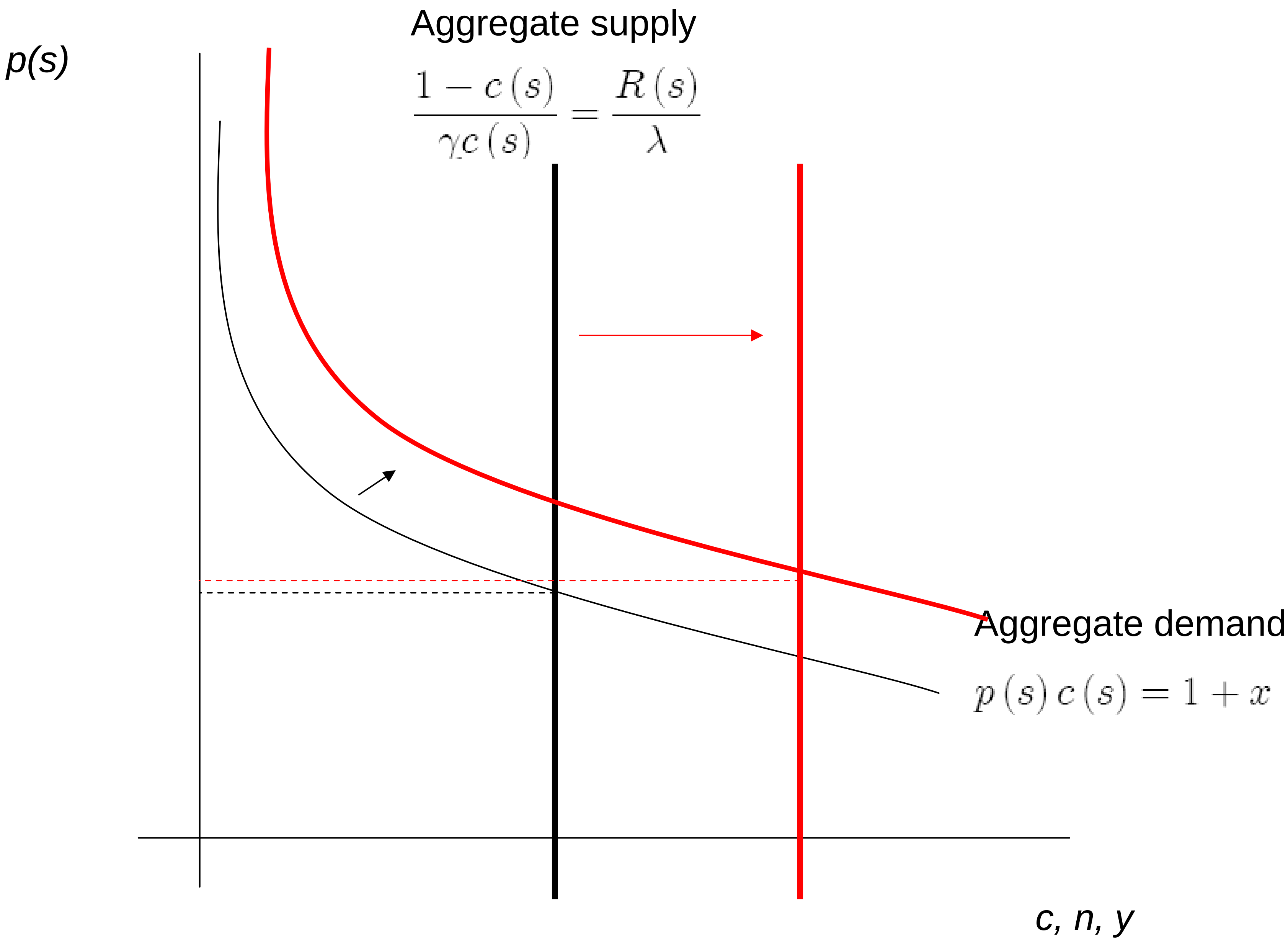
$$\Gamma = \frac{\lambda}{R} \Longrightarrow R = \lambda \frac{1+x}{d+x}, \tag{12}$$

- $R(s)$ is *decreasing* in $x \Longrightarrow c(s)$ increasing in x.

In equilibrium:

$$c(s) = \left[1 + \gamma \frac{1+x}{d+x}\right]^{-1},$$

- Properties hold independently from the properties of the stochastic process for x.



Effect of an expansionary money growth shock in the limited participation model

2. Solve for $d\left(x_{-1}\right)$.

Households' intertemporal Euler equation:

$$E_{-1}\left(\frac{1}{pc}\right)=\beta E_{-1}\left(\frac{R}{1+x}E\left(\frac{1}{p'c'}\right)\right) \tag{13}$$

- **Assumption**: d interior $\xi=0$.
  - How do we know that equilibria will be interior? Interiority holds labor earnings plus the transfer is not suffcient to finance planned consumption.

Simplifies to a functional equation in $d\left(x_{-1}\right)$:

$$E_{-1}\left(\frac{1}{1+x}\right)=\beta E_{-1}\left[\left(\lambda\frac{1+x}{d+x}\right)\frac{1}{1+x}E\left(\frac{1}{1+x'}\right)\right] \tag{14}$$

Example

- x i.i.d., with support $\{x_l, x_h\}$ and probability distribution $\{\pi_l, \pi_h\}$, $\pi_l, \pi_h > 0$ and $\pi_l + \pi_h = 1$.

  Then: $d(x_{-1}) = d$ where:

$$1 = \lambda\beta \sum_{j=l,h} \pi_j \frac{1}{d + x_j}.$$

Properties of Stationary Equilibria

- Consumption is decreasing in the nominal interest rate.
- A positive money growth shock determines a decline in $R \Longrightarrow$ "liquidity effect".
- Prices move less than one for one with money growth:
$$p\left(s\right)=\frac{1+x}{c\left(s\right)}=\left(1+x\right)\left[1+\gamma\frac{1+x}{d+x}\right]$$
- Real wages increasing in x
$$w\left(s\right)=\lambda/R\left(s\right)$$
- Equilibrium profits for intermediate good firms are increasing in x:
$$\pi\left(s\right)=\left(1-\lambda R\left(s\right)\right)p\left(s\right)c\left(s\right)$$

Qualitative Comparison between SP and LP Models

- Response to expansionary money shock:

Variable	Facts	Sticky price model	LP Model
R	$\downarrow$	constant	$\downarrow$
y, n, c	$\uparrow$	$\uparrow$	$\uparrow$
Real wages	$\uparrow$	$\uparrow$	$\uparrow$
Profits	$\uparrow$	$\downarrow$	$\uparrow$
Price level	no response initially	constant	small response if any

Quantitative Comparison between SP and LP Models

Tricky issues:

- Calibrating mark-ups.
- Calibrating fraction of sticky prices

Table 1
Responses to a monetary contraction-sticky price model

	dp	dc	dn	dw	dMC	dR	χ	dπ
	Panel A: Benchmark parameter values							
	0.00	−1.00	−1.30	−1.30	−2.54	−0.79	1.26	2.95
	Panel B: Different labor supply elasticities							
$1/\psi = 0.1$	0.00	−1.00	−1.30	−12.99	−14.20	−0.75	1.64	15.94
$1/\psi = 0.5$	0.00	−1.00	−1.30	−2.60	−3.85	−.080	1.30	4.91
$1/\psi = 5$	0.00	−1.00	−1.30	−0.26	−1.44	−0.73	1.24	1.19
$1/\psi = 10$	0.00	−1.00	−1.30	−0.13	−1.29	−0.71	1.23	0.94
	Panel C: Different markup values							
$\mu = 1.01$	0.00	−1.00	−1.55	−1.55	−3.02	−0.93	1.07	3.92
$\mu = 1.20$	0.00	−1.00	−1.30	−1.30	−2.54	−0.79	1.26	2.95
$\mu = 1.40$	0.00	−1.00	−1.11	−1.11	−2.23	−0.73	1.46	2.26
$\mu = 2.00$	0.00	−1.00	−0.78	−0.78	−1.75	−0.71	2.07	1.15
	Panel D: Different markup values, benchmark ϕ							
$\mu = 1.01$	0.00	−1.00	−1.30	−1.30	−2.70	−0.95	1.07	6.25
$\mu = 1.40$	0.00	−1.00	−1.30	−1.30	−2.43	−0.68	1.47	1.61
$\mu = 2.00$	0.00	−1.00	−1.30	−1.30	−2.25	−0.50	2.09	0.26
	Panel E: Miscellaneous							
$\alpha = 0$	0.00	−1.00	−0.83	−0.83	−1.56	−0.74	1.24	198.61
$\alpha = 0$	0.00	−1.00	−1.56	−1.56	−2.85	−0.74	1.27	2.06
Modified preferences, $\gamma = 1$	0.00	−1.00	−1.30	−2.30	−2.77	0.00	1.27	3.30
Modified preferences, $\gamma = 2$	0.00	−1.00	−1.30	−3.30	−2.77	1.04	1.27	3.30
Modified preferences, $\gamma = 2$ (Persistent shocks)	0.00	−1.00	−1.30	−3.30	−2.77	1.04	1.27	3.30
	Panel F: Partial price setting							
80% Price setters	−0.40	−0.60	−0.72	−0.72	−1.86	−0.48	1.24	1.25
20% Price setters	−0.91	−0.09	−0.10	−0.10	−1.12	−0.08	1.21	−0.67

Table 2
Responses to a monetary contraction: limited participation model

	dp	dc	dn	dw	dMC	dR	$d\pi$
	Panel A: Benchmark parameter values						
	−0.62	−0.38	−0.50	−0.50	−0.62	0.70	−1.11
	Panel B: Different labor supply elasticities						
$1/\psi = 0.1$	−0.95	−0.05	−0.06	−0.60	−0.95	0.64	−1.01
$1/\psi = 0.5$	−0.79	−0.21	−0.28	−0.55	−0.79	0.67	−1.06
$1/\psi = 5$	0.10	−1.10	−1.43	−0.29	0.10	0.83	−1.33
$1/\psi = 10$	0.43	−1.43	−1.86	−0.19	0.43	0.89	−1.43
	Panel C: Different markup values						
$\mu = 1.01$	−0.71	−0.29	0.45	0.45	−0.71	0.64	−1.01
$\mu = 1.20$	−0.62	−0.38	−0.50	−0.50	−0.62	0.70	−1.11
$\mu = 1.40$	−0.50	−0.50	−0.56	−0.56	−0.50	0.78	−1.26
$\mu = 1.40,\ 1/\psi = 2$	−0.08	−0.92	−1.02	−0.51	−0.08	0.91	−1.47
$\mu = 2.00$	0.11	−1.11	−0.86	−0.86	0.11	1.22	−2.00
$\mu = 2.00,\ 1/\psi = 0.5$	−0.54	−0.46	−0.36	−0.72	−0.54	0.87	−1.41
	Panel D: Different markup values, benchmark ϕ						
$\mu = 1.01$	−0.78	−0.22	−0.29	−0.28	−0.78	0.40	−1.12
$\mu = 1.40$	−0.45	−0.55	−0.72	−0.72	−0.45	1.02	−1.11
$\mu = 2.00$	0.07	−1.07	−1.40	−1.40	0.07	1.98	−1.00
	Panel E: Miscellaneous						
$\alpha = 0$	−0.96	−0.04	−0.03	−0.03	−0.96	0.04	24.44
$\phi = 0$	−0.56	−0.44	−0.69	−0.69	−0.56	0.98	−1.00
Modified preferences, $\gamma = 1$	−0.76	−0.24	−0.31	−0.54	−0.76	0.68	−1.07
Modified preferences, $\gamma = 2$	−0.83	−0.17	−0.22	−0.56	−0.83	0.66	−1.05
Modified preferences, $\gamma = 2$ (Persistent shocks)	−0.83	−0.17	−0.22	−0.56	−0.83	0.66	−1.05
	Panel F: Partial price setting						
80% Price setters	−0.48	−0.52	−0.57	−0.57	−2.06	−0.81	1.35
20% Price setters	−0.61	−0.39	−0.50	−0.50	−0.75	0.56	−0.87
	Panel G: Limited intersectoral mobility						
20% Price setters	−0.53	−0.47	−0.59	−0.50	[a]	−0.64	0.14

[a] Marginal cost responses are not reported because they differ across the fixed and flexible price firms.