Expectation Traps and Monetary Policy

by

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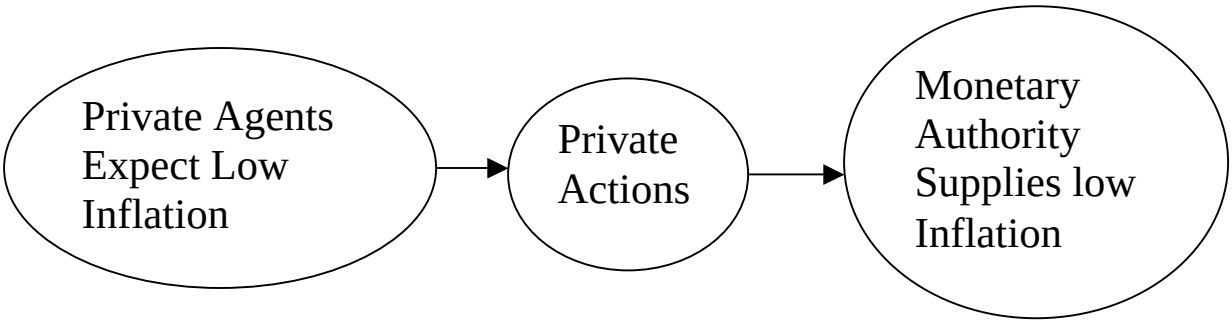
- Countries Have Experienced Destructive Periods of High and Variable Inflation (‘Great Inflation’ of 1970s).
- Can Absence of Commitment in Monetary Policy Account for This?

Absence of Commitment and Variable Inflation

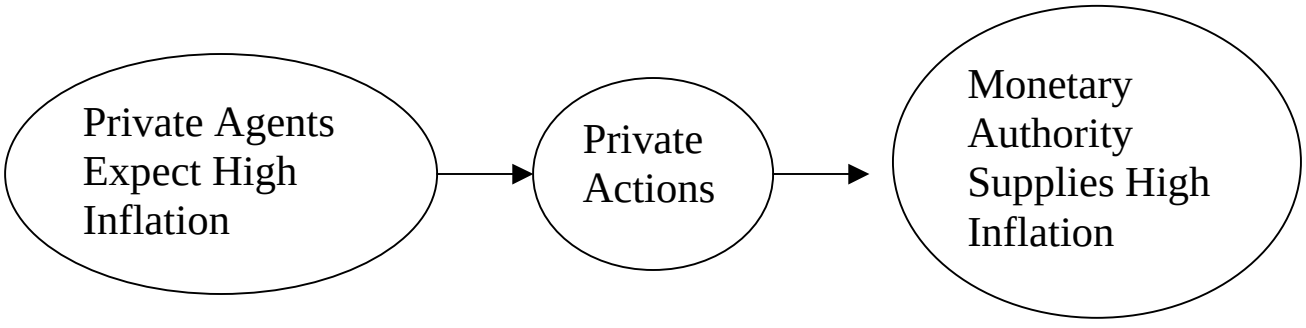
- Kydland-Prescott, Barro-Gordon:
  Variability Reflects Movements in Fundamentals
- Possibility Explored Here:
  Variability Reflects Movements in Expectations.

Expectation Traps

Low Inflation



High Inflation



Objective:

- This Paper:
  - Study the Nature of Equilibria in Standard Models
  - Are there Expectation Trap Equilibria?
- Longer-Term:
  Quantitative, Empirical Assessment of Expectation Trap Hypothesis.
- What's At Stake?
  Under Expectation Trap Hypothesis, Institutional Reform Is Needed To Prevent Recurrence of 1970s-Style Inflation.

Outline:

(1) Version of Lucas-Stokey Cash-Credit Good Model With
   - Some Preset Prices.
   - Svensson Timing ($P_c \cdot M_{i1}$).
   - Endogeneity of Cash/Credit Good Distinction.

(2) Findings

(3) Conclusion.

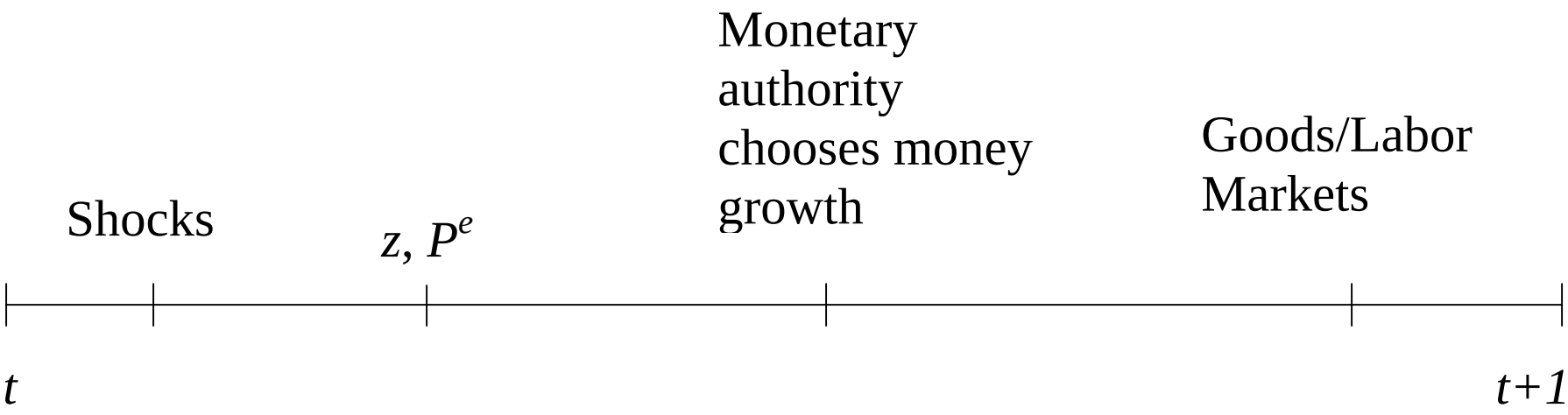
Preview of Findings

- Expectation Traps Can Occur.
- Financial Variables More Variable When Inflation is High.
- Money Demand Implications of the Model Promising.

The Model

- Households, Firms, Monetary Authority.
- Continuum of Goods.
- Infinite Horizon.

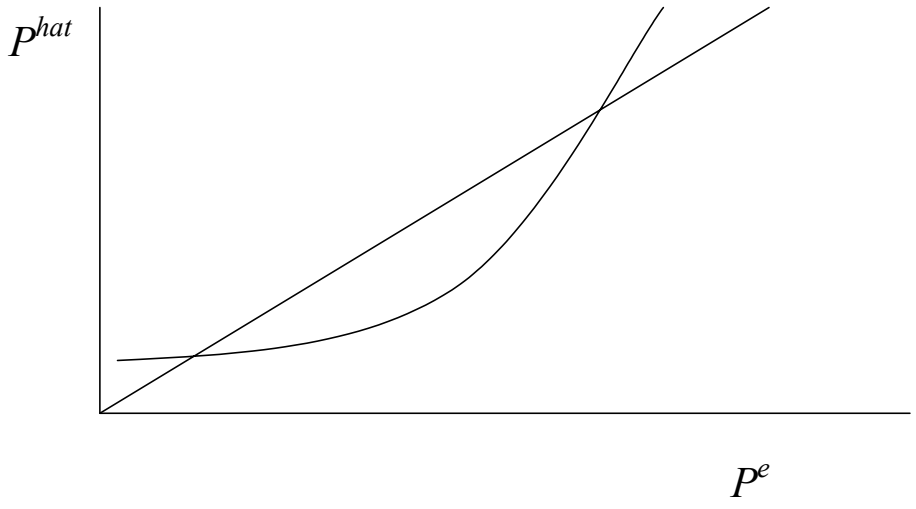
Timing



- Private Agents Expect High Inflation
  - P^e Set High
  - Number of Goods Bought With Cash Reduced
- Monetary Authority May Produce High Inflation
  - Monopoly Distortion
  - Inflation Distortion

Basic Idea

Drive Towards a 'Best Response Function'. Will Do So By Constructing a Mapping from P^e to $\hat{P}$ for each possible θ, g, z.



State of The Economy At Various Points in the Period

- Shocks Realized, After Which the State is:

  $$\theta, g, z$$

  (z is a 'money demand shock' which is later endogenized)

- Sticky Price Firms Select P^e. After this the State is:

  $$S = (\theta, g, z, P^e)$$

- Monetary Authority Selects Money Growth Rate, x. After this the State is:

  $$S_1 = (S, x).$$

Firms

- Each Good Produced by a Monopolist:

$$y(\omega) = \theta n(\omega), \ \omega \in (0, 1).$$

- Wage Rate:

$$W(S, x).$$

- $1 - \mu$ 'flexible price firms' set $\hat{P}(S, x)$

$$\hat{P}(S, x) = \frac{W(S, x)}{\theta \rho}, \ 0 < \rho < 1$$

- μ 'sticky price firms' set P^e Before Observing x. They 'Conjecture' $x = X(S)$

$$= \frac{P^e(\theta, g, z)}{\frac{W(\theta, g, z, P^e(\theta, g, z), X(\theta, g, z, P^e(\theta, g, z)))}{\theta \rho}}$$

Representative Household

Preferences:

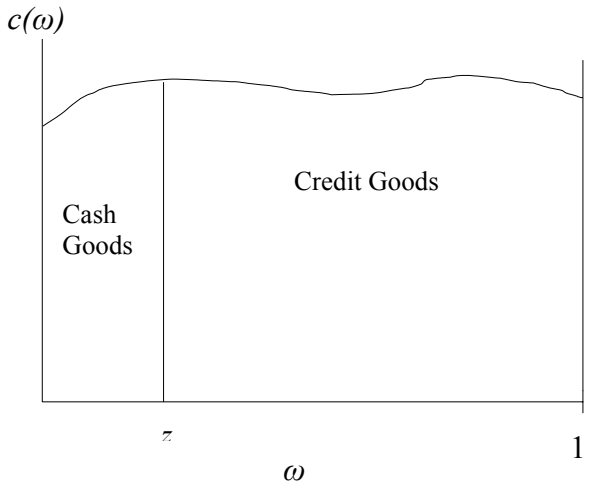
$$\sum_{t=0}^{\infty} \beta^t u(c_t, n_t), \; c_t = \left[\int_0^1 c_t(\omega)^\rho d\omega \right]^{\frac{1}{\rho}},$$

$c_t(\omega)$ ˜ consumption of type ω good

$\omega > z$ ˜ credit goods

$\omega < z$ ˜ cash goods

n_t ˜ labor time



- Asset Allocation Constraint:

$$M + B \leq A.$$

All Nominal Quantities Scaled by Aggregate Stock of Money.

- Cash In Advance Constraint:

$$M - \left[P^e \mu z c_{11} + \hat{P}(S, x)(1 - \mu) z c_{12}\right] \geq 0$$

c_{11} ˜ cash goods from sticky price producers
c_{12} ˜cash goods from flexible price producers

- Asset Evolution Equation:

$$
\begin{aligned}
0 \;\leq\; & W(S,x)n + (1 - R(S,x))M \\
& -z\left[P^e \mu c_{11} + \hat{P}(S,x)(1-\mu)c_{12}\right] \\
& -(1-z)\left[P^e \mu c_{21} + \hat{P}(S,x)(1-\mu)c_{22}\right] \\
& +R(S,x)A + (x-1) + D(S,x) - xA'.
\end{aligned}
$$

c_{21} ˜ credit goods from sticky price producers

c_{22} ˜credit goods from flexible price producers

Recursive Representation of Household Problem

$$
\begin{aligned}
& v(A, S, x) = \\
& \max_{n, M, A', c_{ij}; i,j=1,2} \{u(c, n) \\
& + \beta E_{\theta', g', z'}[v(A', S', X(S'))|\theta, g, z]\}
\end{aligned}
$$

with:

$$
\begin{aligned}
c \;=\; & [z\mu c_{11}^{\rho} + z(1-\mu)c_{12}^{\rho} \\
& + (1-z)\mu c_{21}^{\rho} + (1-z)(1-\mu)c_{22}^{\rho}]^{\frac{1}{\rho}}.
\end{aligned}
$$

$$
S' = (\theta', g', z', P^e(\theta', g', z')).
$$

Solution to Household Problem

$$n(A,S,x),\ M(A,S,x),\ v(A,S,x),$$
$$A'(A,S,x),\ c_{ij}(A,S,x),\ i,j=1,2$$

Private Sector Equilibrium

Definition: Given a monetary policy rule, $X(S)$, and a current money growth rate, x, a *Private Sector Equilibrium* is a collection of functions $P^e(\theta, g, z)$, $\hat{P}(S_1)$, $W(S_1)$, $v(A, S_1)$, $c_{ij}(A, S_1)$, $n(A, S_1)$, $M(A, S_1)$, $A'(A, S_1)$, $R(S_1)$, where $S_1 = (\theta, g, z, P^e(\theta, g, z), x)$, such that:

1. Functions v, c_{ij}, n, M, A' solve household problem,

2. Firm optimization conditions satisfied,

3. Asset markets clear:

   $A'(1, S_1) = 1$ and $M(1, S_1) = 1$,

4. Resource constraint satisfied: $\theta n(1, S_1) = g + z\left[\mu c_{11} + (1-\mu)c_{12}\right] + (1-z)\left[\mu c_{21} + (1-\mu)c_{22}\right]$.

Monetary Authority Problem

$$\max_x u(c(1,S,x),n(1,S,x)) \\ +\beta E_{\theta',g',z'}[v(1,S',X(S'))|\theta,g,z],$$

where

$$S' = (\theta', g', z', P^e(\theta', g', z'))$$

Definition A *Markov equilibrium* is a private sector equilibrium and a monetary policy rule such that $X(S)$ solves Monetary Authority's Problem.

Monetary Authority

- Problem:

$$\max_{\hat{P}} U(\hat{P}; P^e; \mu; g; z)$$

Equilibrium

- (off $R \geq 1$ corner):

$$U_{\hat{P}} = 0; \ \hat{P} = P^e,$$

$$c_{cash;preset\ price} = c_{cash;flex\ price} < c_{cash}$$

$$c_{credit;preset\ price} = c_{credit;flex\ price} < c_{credit}$$

Findings

- Equilibrium First Order Necessary Conditions Can Be Written:

$$U_{\hat{P}} \equiv \tilde{A}\left(\frac{c_{cash}}{c_{credit}}; z\right) = -\tilde{A}_{ID}\left(\frac{c_{cash}}{c_{credit}}; z\right) + \tilde{A}_{MD}\left(\frac{c_{cash}}{c_{credit}}; z\right):$$

Inflation Distortion:

$$\tilde{A}_{ID}\left(\frac{c_{cash}}{c_{credit}}; z\right) \equiv (R - 1)\frac{M}{P}$$

Monopoly Distortion:

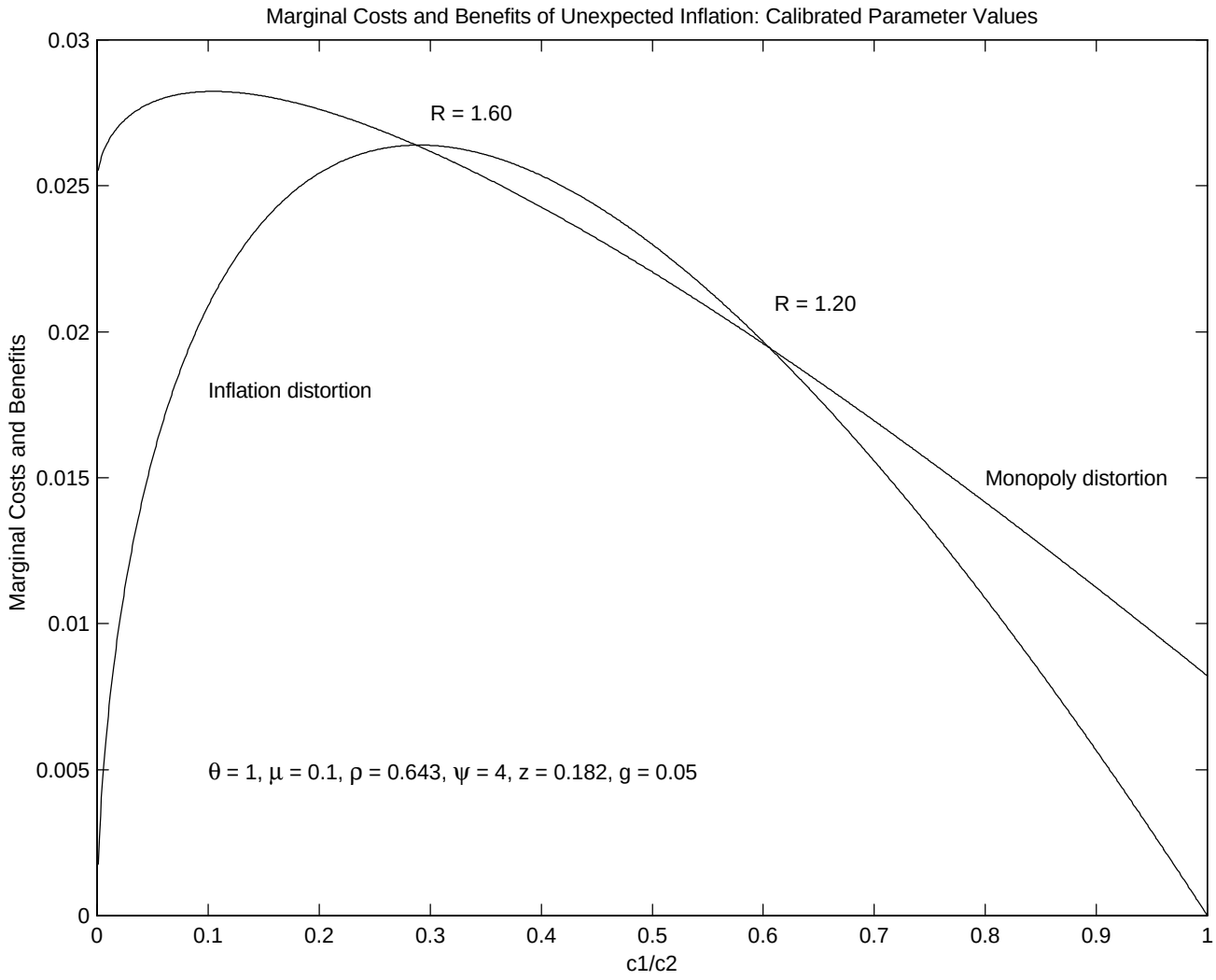
$$\tilde{A}_{MD}\left(\frac{c_{cash}}{c_{credit}}; z\right) = [u_n + \mu u_{credit}]\, n_{\hat{P}}$$

Two Examples

- Cash-Credit Distinction Exogenous
  Calibration:

‘Money Demand Regression’ » z = 0:182; ½ = 0:643;
Parks » ¹ = 0:01
Christiano-Eichenbaum » Ã = 4
μ = 1; g = 0:05
Two Markov Equilibria : R = 1:20; 1:60:

- Cash-Credit Distinction Endogenous


Marginal Costs and Benefits of Unexpected Inflation: Calibrated Parameter Values
Marginal Costs and Benefits
c1/c2
R = 1.60
R = 1.20
Inflation distortion
Monopoly distortion
θ = 1, μ = 0.1, ρ = 0.643, ψ = 4, z = 0.182, g = 0.05
0.03
0.025
0.02
0.015
0.01
0.005
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

Money Demand Implications of Endogenous z Model

Money Demand Equation ($u_1 = u_2 = R$)

$$\frac{\text{consumption}}{M/P} = 1 + \frac{1 - z}{z} R^{\frac{1}{1-\sigma}}$$

Has potential to resolve money demand puzzles:

(1) 'Short Run Elasticity of Demand Lower Than Long Run'.

(2) Money Demand Disturbances Highly Persistent.

(3) Upward Drift in Velocity.

Numerical Example

- Non-Shock Parameters:

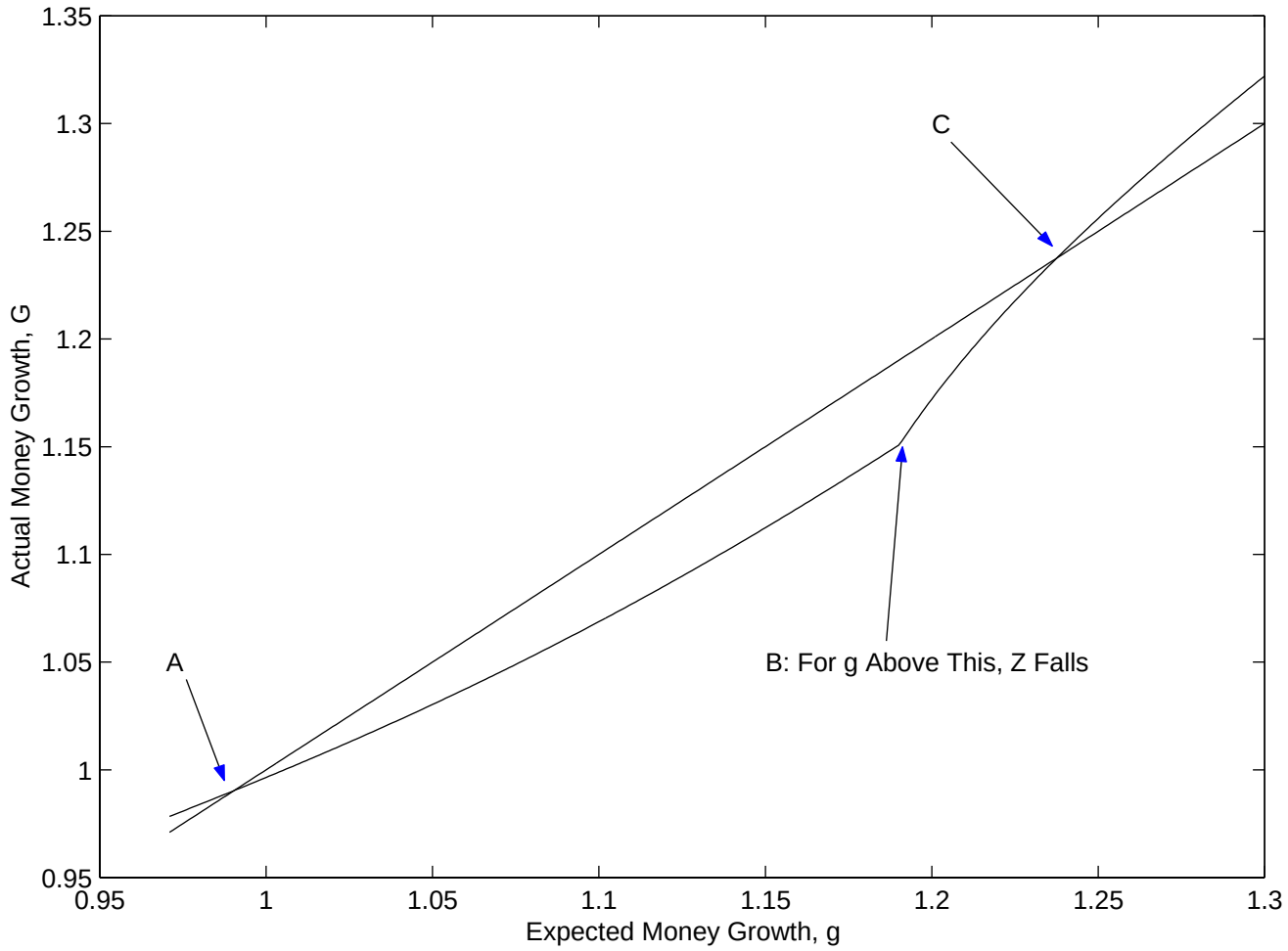
¯ = 1=1:03; ´ = :063; Ã = 1:64; ½ = :83;
¹ = 0:1; ¹z = 0:3; ¾ = 1:01:

Shock Parameters, g; μ; ´:

means : 0:55; 1; 0:01
std deviations : 0.001, 0.05, 0.0005
autocorrelations : 0.9, 0:9; 0:9:

- Simulation Results:

	High Inflation	Low Inflation.
¾y	0.020	0.020
¾n	0.003	0.003
¾R	0.002	0.00
¾¼	0.025	0.017


1.35
1.3
1.25
1.2
1.15
1.1
1.05
1
0.95
Actual Money Growth, G
0.95
1
1.05
1.1
1.15
1.2
1.25
1.3
Expected Money Growth, g
C
A
B: For g Above This, Z Falls

Conclusion

- Expectation Traps Equilibria Occur in Simple Monetary Models.
- They are More Likely, the More Elastic is Money Demand.
- There is Reason to Expect that Models with Expectation Trap Equilibria Can Account for Other Key Features of the Data:
  - Classic Money Demand Puzzles.
  - Properties of High and Low Inflation Economies.
- The Expectation Trap Hypothesis About Variable Inflation Deserves Further Consideration.