Money, Inflation, and Interest Rate Policy

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May 26, 2004

What is the appropriate theoretical framework for conducting monetary policy?

Take as given that the *objective* of monetary policy is inflation targeting:

maintainance of low, stable rates of inflation.

Consider whether the *instrument* of policy should be the interest rate,

the quantity of money, or some mix of the two.

Today, most practioners prefer thinking in terms of interest rates.

Economic theorists remain attached to the quantity theory of

money (QTM), which gives only secondary role to interest rate.

Under the traditional form of the QTM, inflation rate increases one-for-one with increases in money growth rate. Only link between interest rates and inflation is Irving Fisher's formula for average behavior:

$$\underbrace{\mathsf{r}}_{\text{nominal rate}} = \underbrace{\rho}_{\text{real rate}} + \underbrace{\pi}_{\text{inflation rate}}$$

High interest rates linked to *high* inflation.

But common sense (and Keynes) tells us that withdrawing

reserves (selling bonds) should drive bond prices

down $\Leftrightarrow$ raise interest rates.

Can the QTM be reconciled with such a "liquidity effect"?

As QTM is usually stated, *no*. Need to introduce "frictions."

Plan of this talk:

- Review evidence on money and inflation, and

  interest rates and inflation.

- Present version of QTM consistent with liquidity effect:

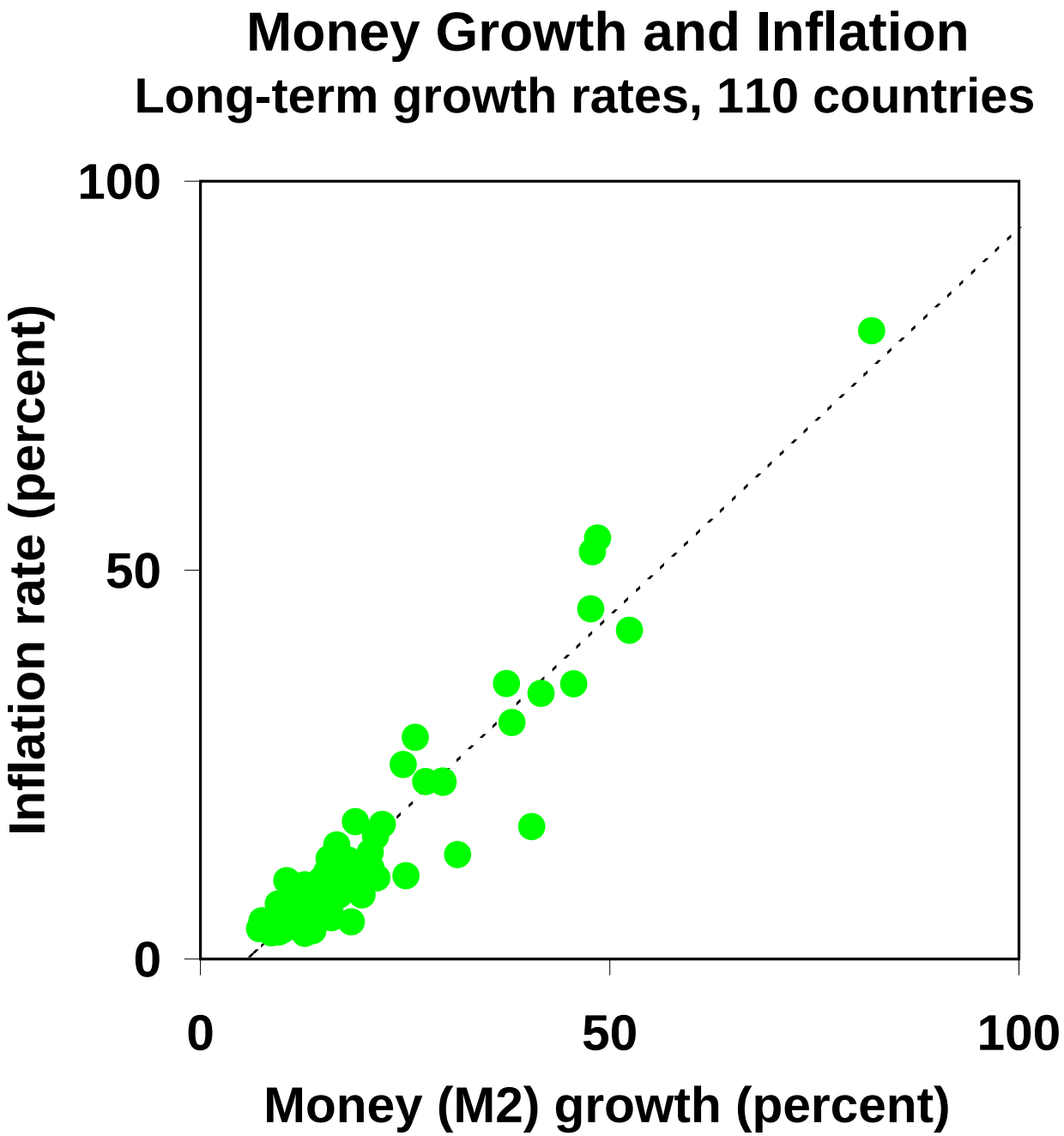
  Fernando Alvarez, Robert Lucas, and Warren Weber

  "Interest Rates and Inflation."

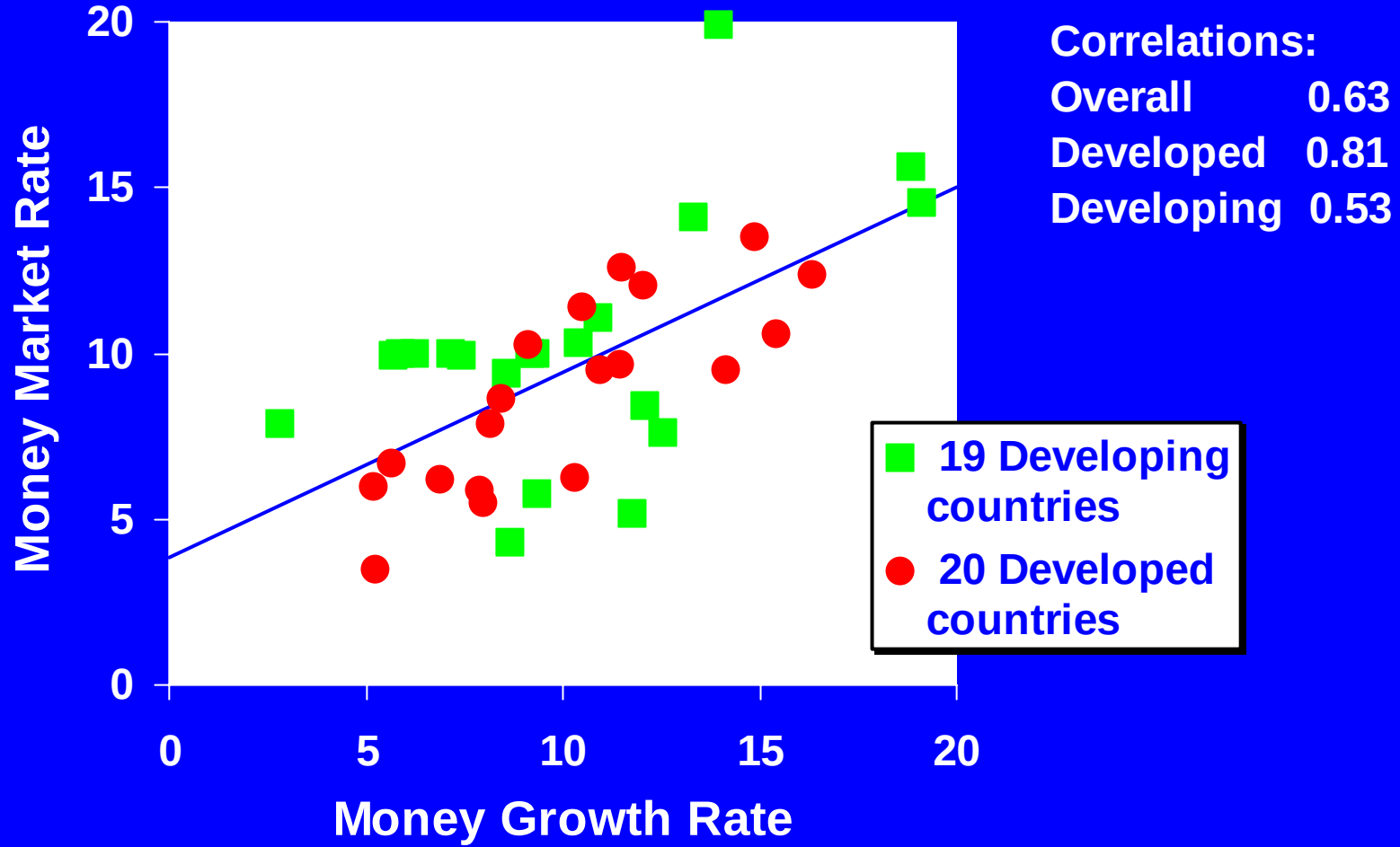
  American Economic Review, May, 2001

Cross-section evidence:

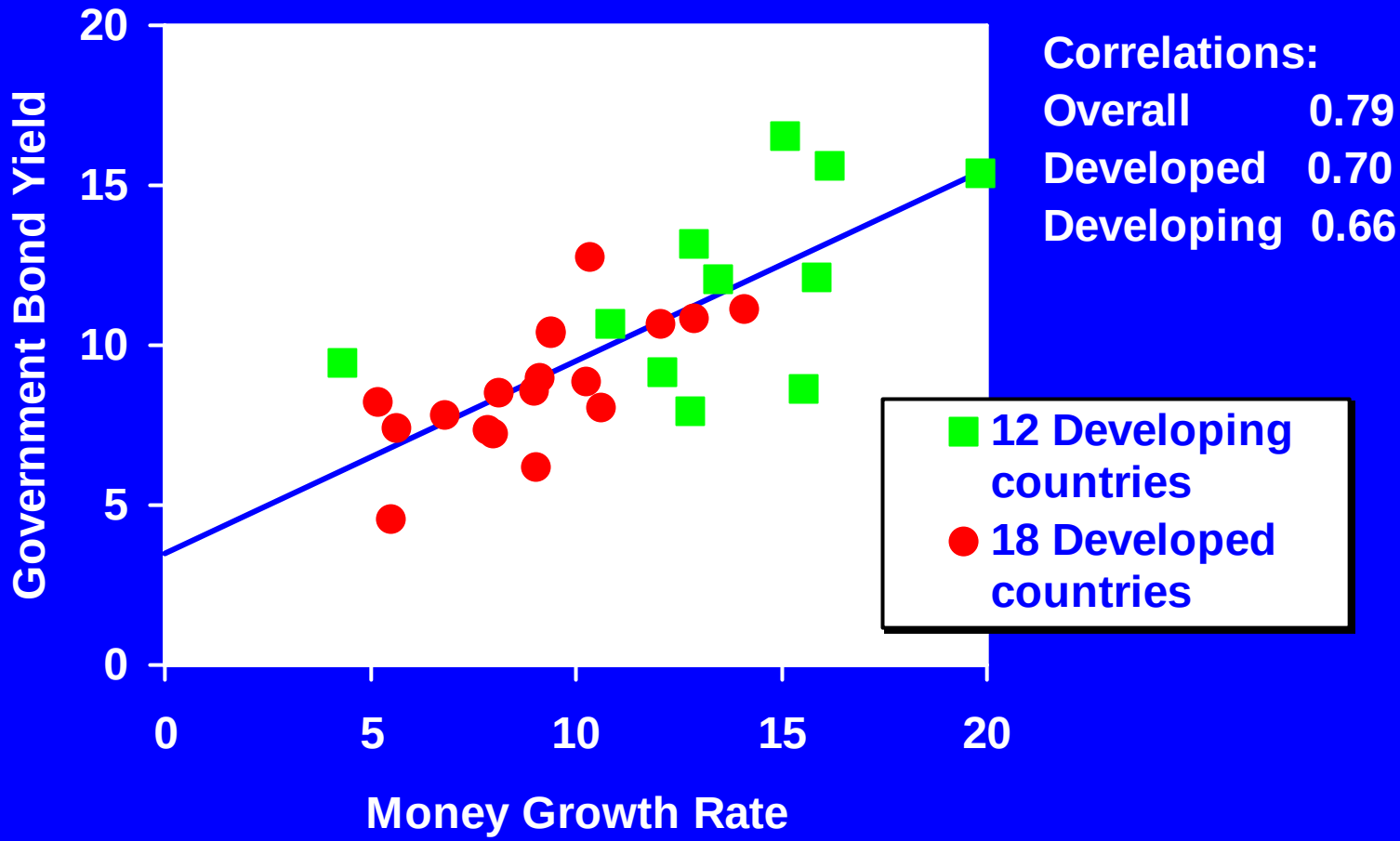
five graphs and some correlations


Money Growth and Inflation
Long-term growth rates, 110 countries
100
50
0
Inflation rate (percent)
0
50
100
Money (M2) growth (percent)

Money Market Rates and Money Growth (Long run averages, 1961 to 1998)



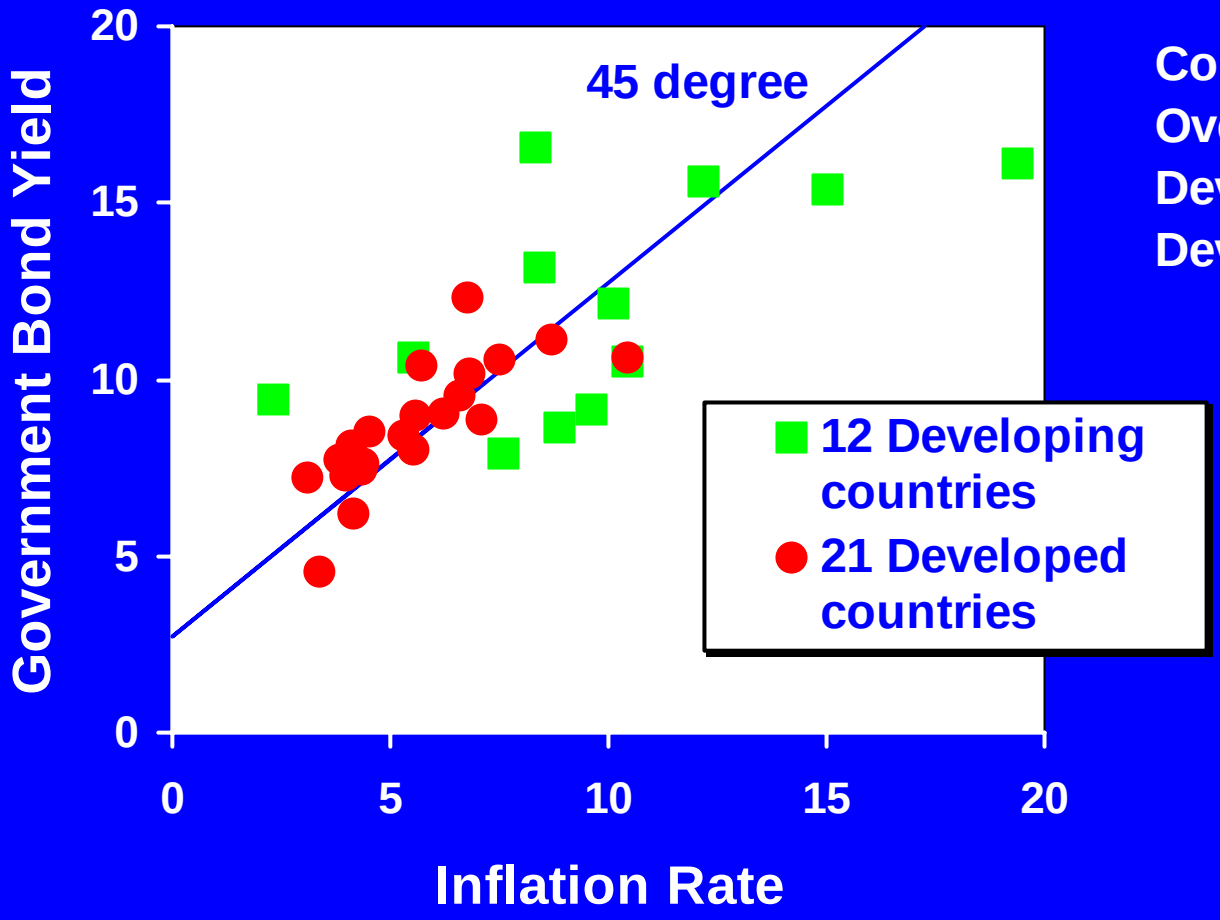
Government Bond Yields and Money Growth (Long run averages, 1961 to 1998)



Interest Rate and Money Growth Correlations

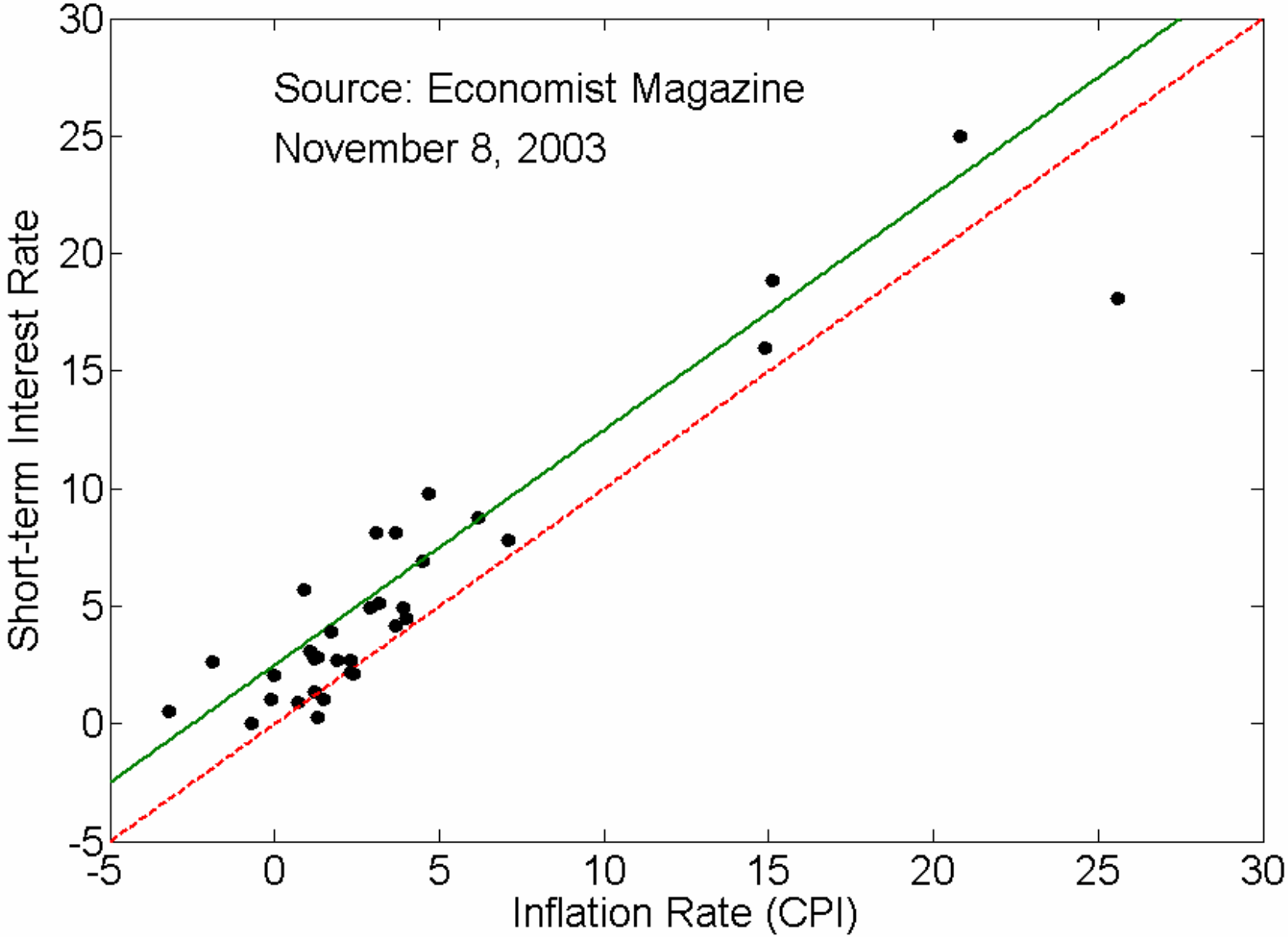
	All countries	Developed countries	Developing countries
		Money market yields	
Long run	0.63	0.81	0.53
5-year	0.36	0.52	0.23
1-year	0.20	0.22	0.16
		Government bonds	
Long run	0.79	0.70	0.66
5-year	0.59	0.50	0.53
1-year	0.34	0.26	0.30

Government Bond Yields and Inflation (Long run averages, 1961 to 1998)



Correlations:

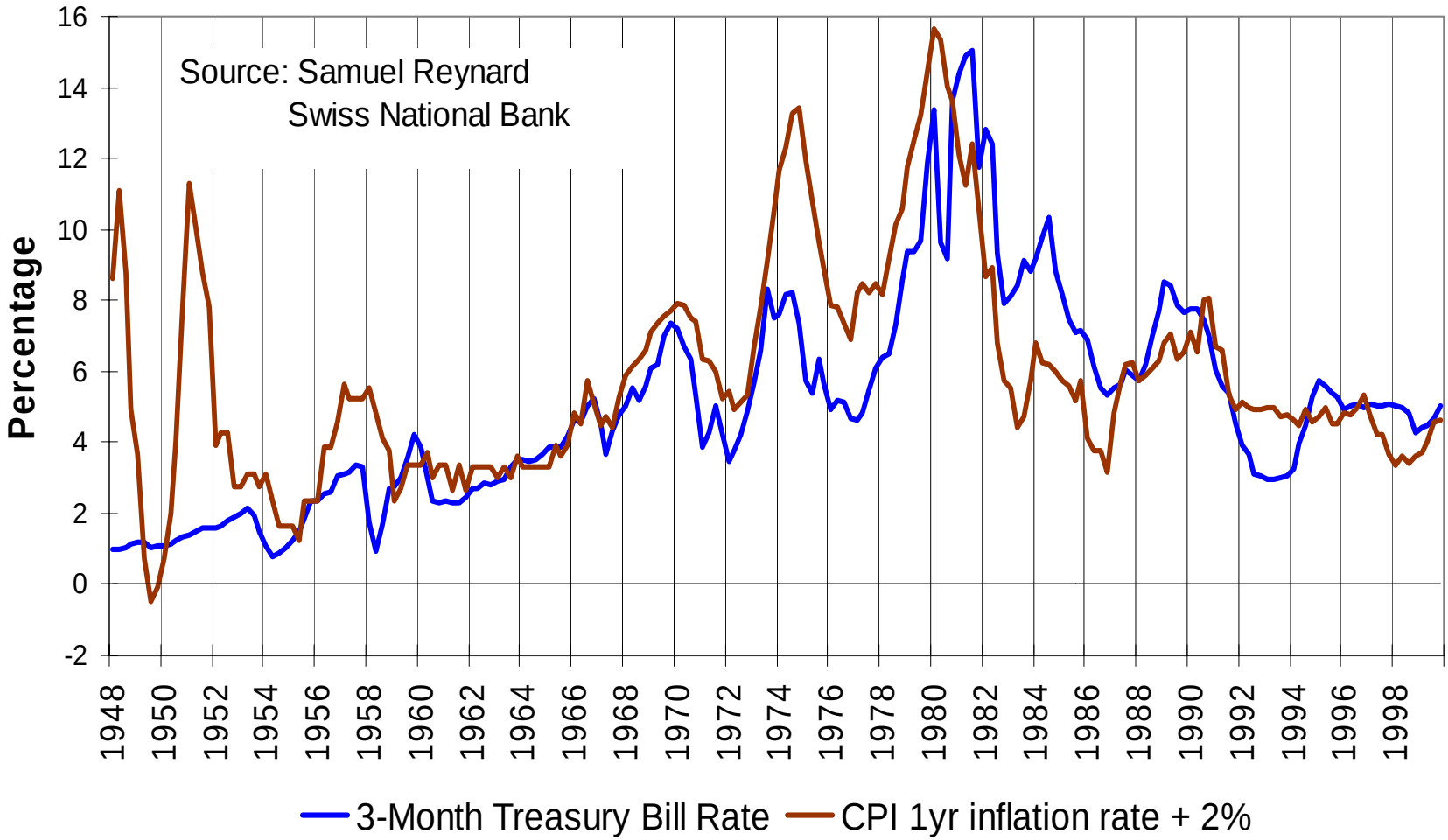
Overall	0.78
Developed	0.79
Developing	0.62


Source: Economist Magazine
November 8, 2003
Short-term Interest Rate
Inflation Rate (CPI)
30
25
20
15
10
5
0
-5
-5
0
5
10
15
20
25
30

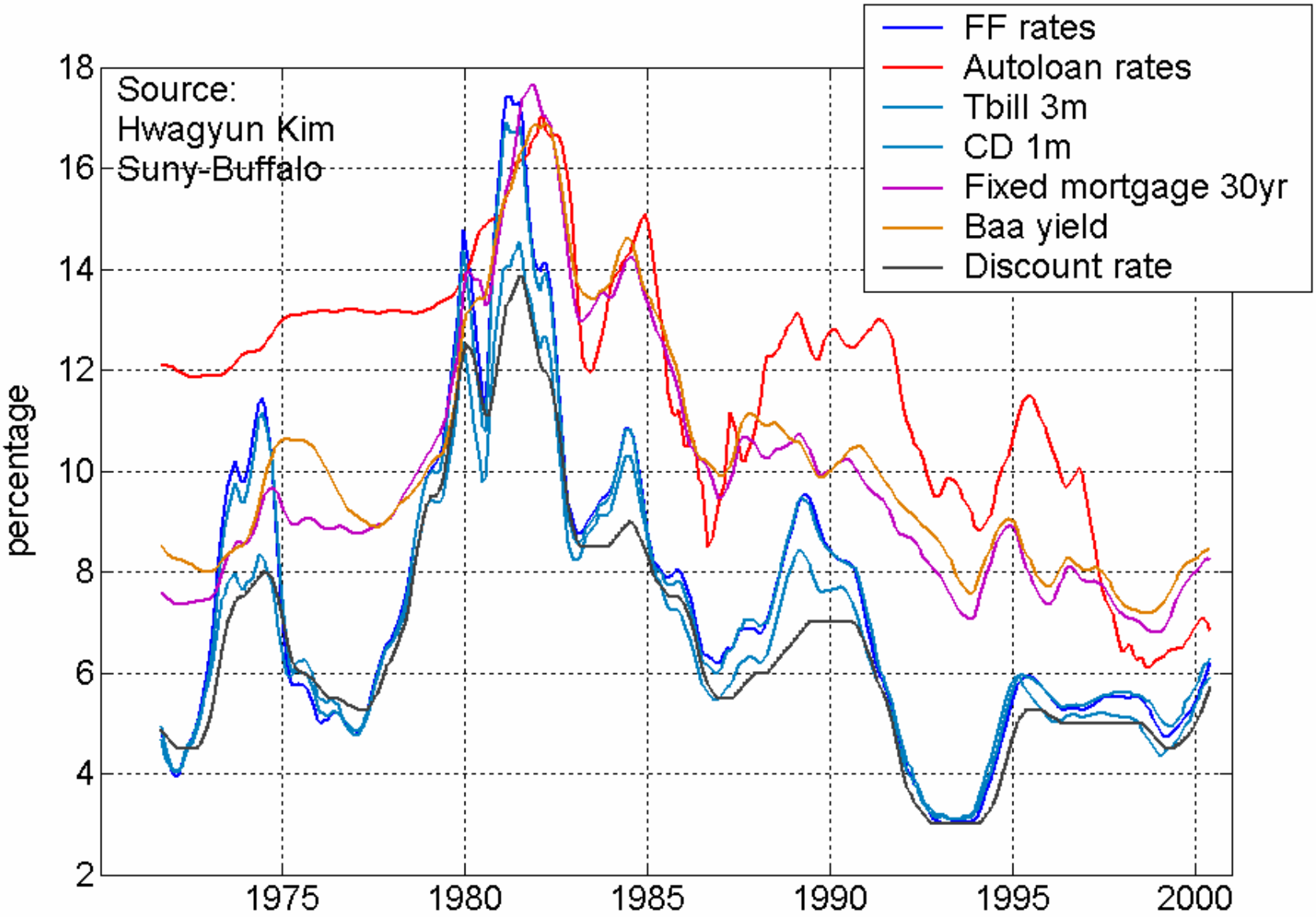
Time-series evidence:

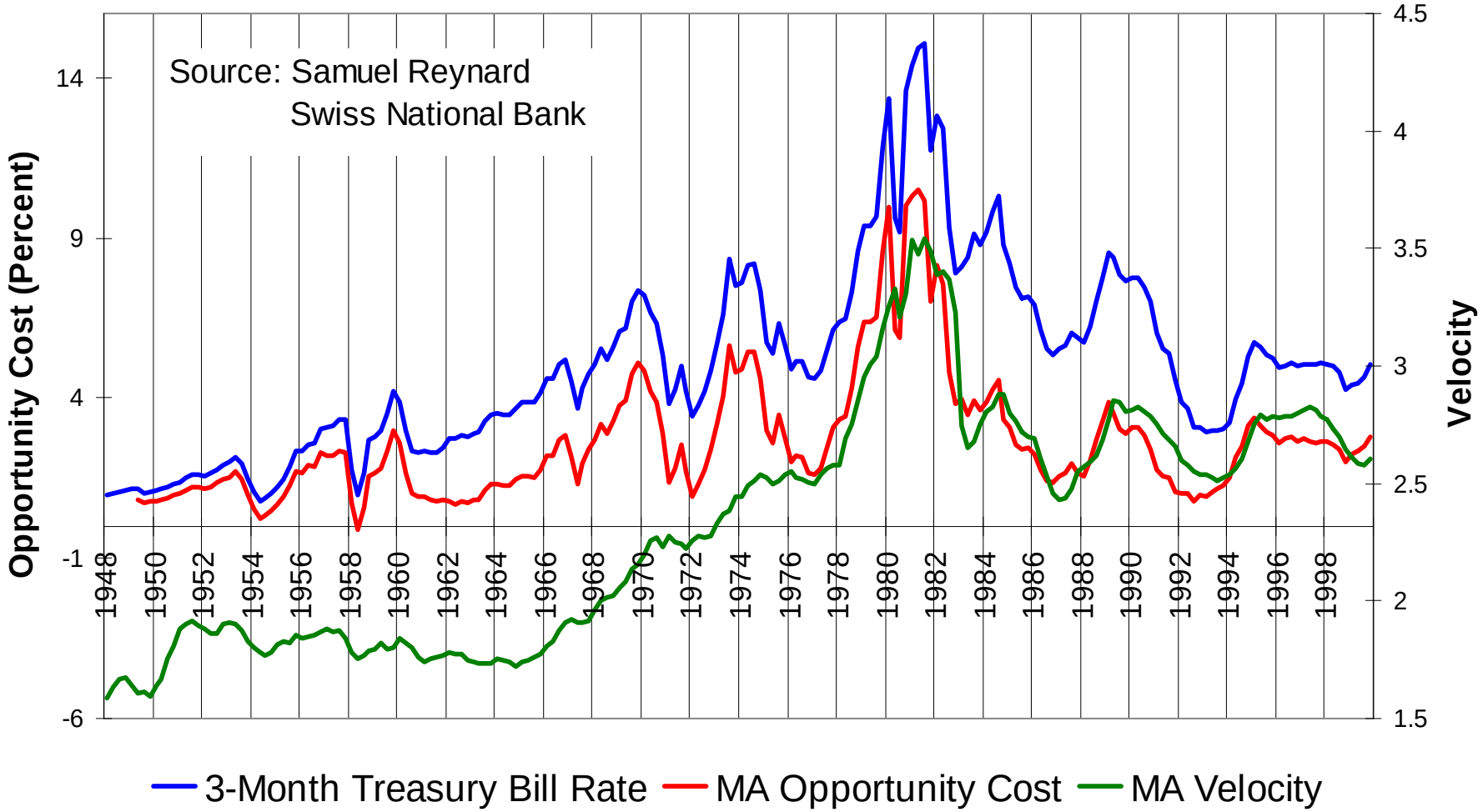
three graphs

Interest and Inflation Rates, U.S. 1948-2000



Various Monthly Yields: Low frequency only




Source: Samuel Reynard
Swiss National Bank
Opportunity Cost (Percent)
Velocity
14
9
4
-1
-6
4.5
4
3.5
3
2.5
2
1.5
1948
1950
1952
1954
1956
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
3-Month Treasury Bill Rate
MA Opportunity Cost
MA Velocity

Evidence reviewed is solid confirmation of QTM, Fisher.

New Keynesian theorists assert that their models of inflation targeting are consistent with this evidence, but this has never been shown. In common with most monetary theorists, I am deeply skeptical that it can ever be shown.

But evidence refers *only* to long-run averages. What does it imply for the day-to-day conduct of monetary policy?

Present model of segmented markets

- Exchange economy, one good
- Two markets: money/goods and money/bonds
- Fraction λ attend both markets ("traders")
- Fraction $1 - \lambda$ never hold bonds ("non-traders")
- All traders get non-storable endowment y

In equilibrium, goods market clears:

$$y = \lambda c_t^T + (1 - \lambda) c_t^N.$$

Cash- in-advance constraint with variable velocity applies to non-traders

$$P_t c_t^N \leq (1 - v_{t-1}) P_{t-1} y + v_t P_t y$$

and to traders

$$P_t c_t^T \leq (1 - v_{t-1}) P_{t-1} y + v_t P_t y + \frac{M_t - M_{t-1}}{\lambda}.$$

$(M_t - M_{t-1})/\lambda$ = government bond purchases from traders.

Consider *only* equilibria where cash constraints bind. Then

$$M_t \frac{1}{1 - v_t} = P_t y.$$

Equation of exchange!

Taking logs and differencing, the inflation rate is

$$\pi_t = \mu_t + v_t - v_{t-1}.$$

Inflation problem? Solved!

Interest rates?

Real rate depends on traders' consumption only:

$$c_t^T = \left(\frac{1 + \mu_t v_t + \mu_t (1 - v_t)/\lambda}{1 + \mu_t} \right) y$$

Plug into traders' FOC

$$\frac{1}{1 + r_t} = \frac{1}{1 + \rho} E_t \left(\frac{U'(c_{t+1}^T)}{U'(c_t^T)} \frac{P_t}{P_{t+1}} \right)$$

Everything on rhs already solved for.

Take logs and expand to get formula for interest rate behavior.

As in Fisher,

$$r_t = \text{ real rate } + E_t(\pi_{t+1})$$

In this model,

$$E_t(\pi_{t+1}) = E_t(\mu_{t+1}) + E_t(v_{t+1}) - v_t$$

and

$$\text{real rate } \approxeq \rho + \phi(E_t(\mu_{t+1}) - \mu_t)$$

where

$$\phi = \gamma(1 - v_0)\left(\frac{1-\lambda}{\lambda}\right) > 0$$

Let's look at some examples —

Example 1: Constant velocity and money growth

$$r = \rho + \mu$$

Example 2: Constant money growth and iid velocity shocks

Let $E(v_t) = v_0$ and $Var(v_t) = \sigma_v^2$

$$r = \rho + \mu - (v_t - v_0)$$

$$E(\pi_t) = \mu \quad \text{and} \quad Var(\pi_t) = 2\sigma_v^2$$

Example 3: Exact inflation targeting, iid velocity shocks

Set money growth at

$$\mu_t = \pi^* - v_t + v_{t-1}$$

Then $\pi_t = \pi^* \Longrightarrow Var(\pi_t) = 0$, and

$$Var(\mu_t) = 2\sigma_v^2$$

$$Var(r_t) = 5\phi\sigma_v^2$$

Need to know current velocity shock in advance to announce this policy

Example 4: Perfect interest rate smoothing, iid velocity.

The policy

$$\mu_t = \mu^* - (1/\phi)(v_t - v_0)$$

will peg interest rate at

$$r^* = \rho + \mu^*.$$

Inflation variance will be

$$\sigma_\pi^2 = \left[1 + \left(\frac{\phi - 1}{\phi}\right)^2\right] \sigma_v^2$$

Stabilizing relative to constant money growth $\Longleftrightarrow \phi > 0$

Advanced knowledge of v_t needed?

Example 5: Taylor rule

$$r_t = \rho + \pi^* + \theta(\pi_t - \pi^*)$$

When inflation exceeds target rate, raise interest above $\rho + \pi^*$.

With iid velocity, the implied behavior of money and the interest rate is

$$\mu_t - \pi^* = -\frac{\phi + \theta^2}{(\phi + \theta)^2}(v_t - v_0) + \frac{\theta}{\phi + \theta}(v_{t-1} - v_0)$$

$$r_t - \rho - \pi^* = \frac{\phi\theta(2\theta + \phi - 1)}{(\phi + \theta)^2}(v_t - v_0) = \frac{\phi\theta}{\phi + \theta}(v_{t-1} - v_0)$$

General lessons from these examples?

- Inflation targeting is hard because policy must be set for some time – week, month, quarter – before many factors relevant to inflation are known: unpredictable "velocity" in examples.

- Would like to make money growth *contingent* on value of these shocks.

- But impossible to have coherent debate or comprehensible announcements about shock-contingent monetary policy.

- Setting money-market rates in effect commits us to pretty good shock-contingent money growth policy.

- Also reduces variability in MM rates: a value in itself?

- But in long run, QTM and Fisher must be respected.