

# Chapters 20: Monetary Theory and Policy (pp. 842-871)

May 10, 2017

# Homework for May 10

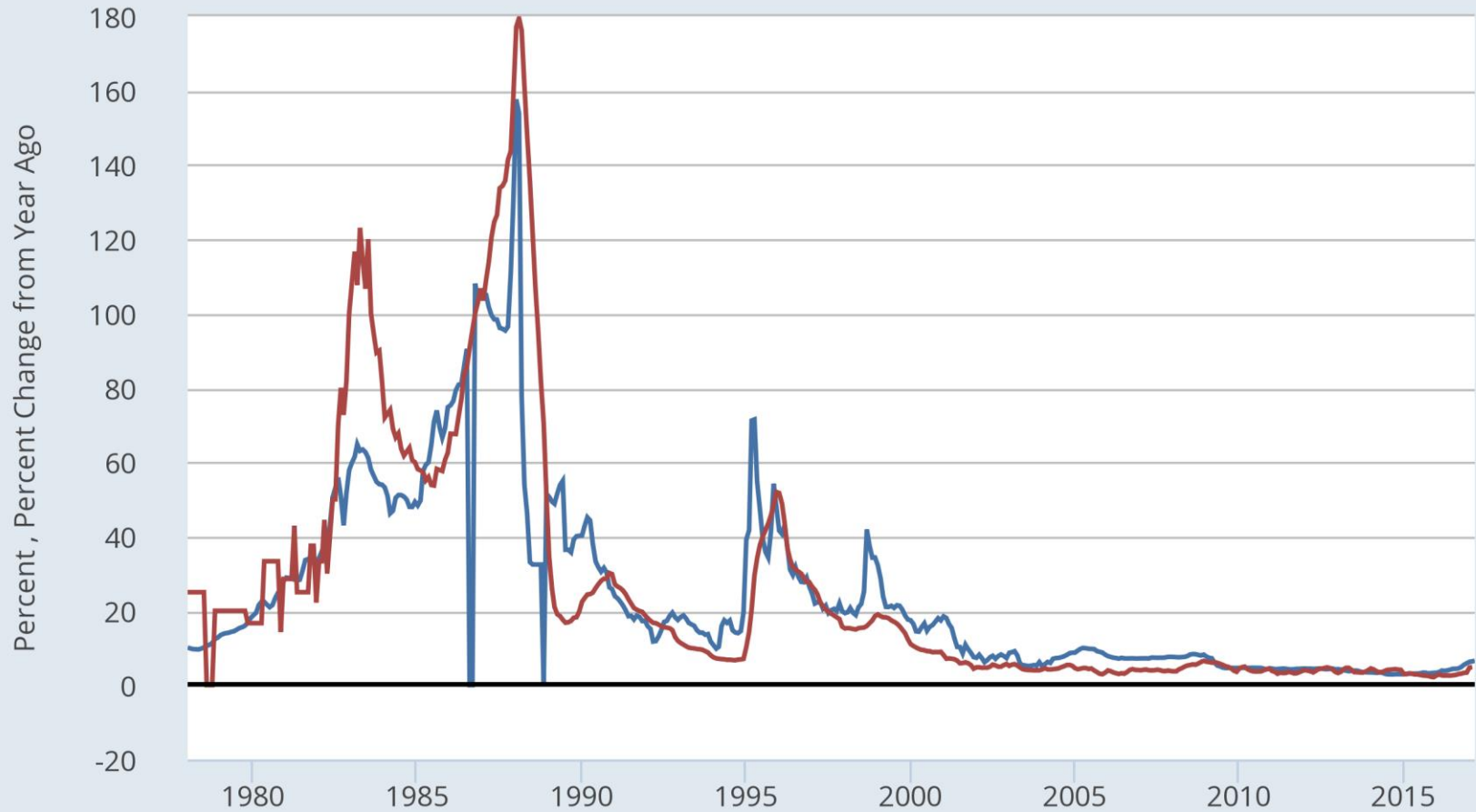
- Read Chapter 20. Monetary Theory and Policy  
First 5 sections (Pages 842-871) Finish Chapter 20 for May 15 class.
- Quiz 24
  1. Define the concepts of real and nominal interest rates.
  2. What distinguishes money from government bonds? Which one represents government debt?
  3. What is hyperinflation and what is the usual cause?
  4. What is the highest annual inflation rate in Mexico over the past 40 years? What year did it occur?
  5. Derive the Fisher Equation from the baseline model with bonds and inflation.

# Nominal versus Real Interest Rates

- What are some nominal interest rates in Mexico?
  - Credit card (40 to 60%)?
  - TIIE--interest rate target -- 6.5%
  - 3-month Treasury Bills -- 6.71%
  - Inflation protected Treasury Bonds (Udibonos)
    - 3 yr 3.11%
    - 5 yr 3.46%
    - 30 yr 3.86%
- What is the indexed bond rate in the United States?
  - 10 year, 5 year, 2 year?



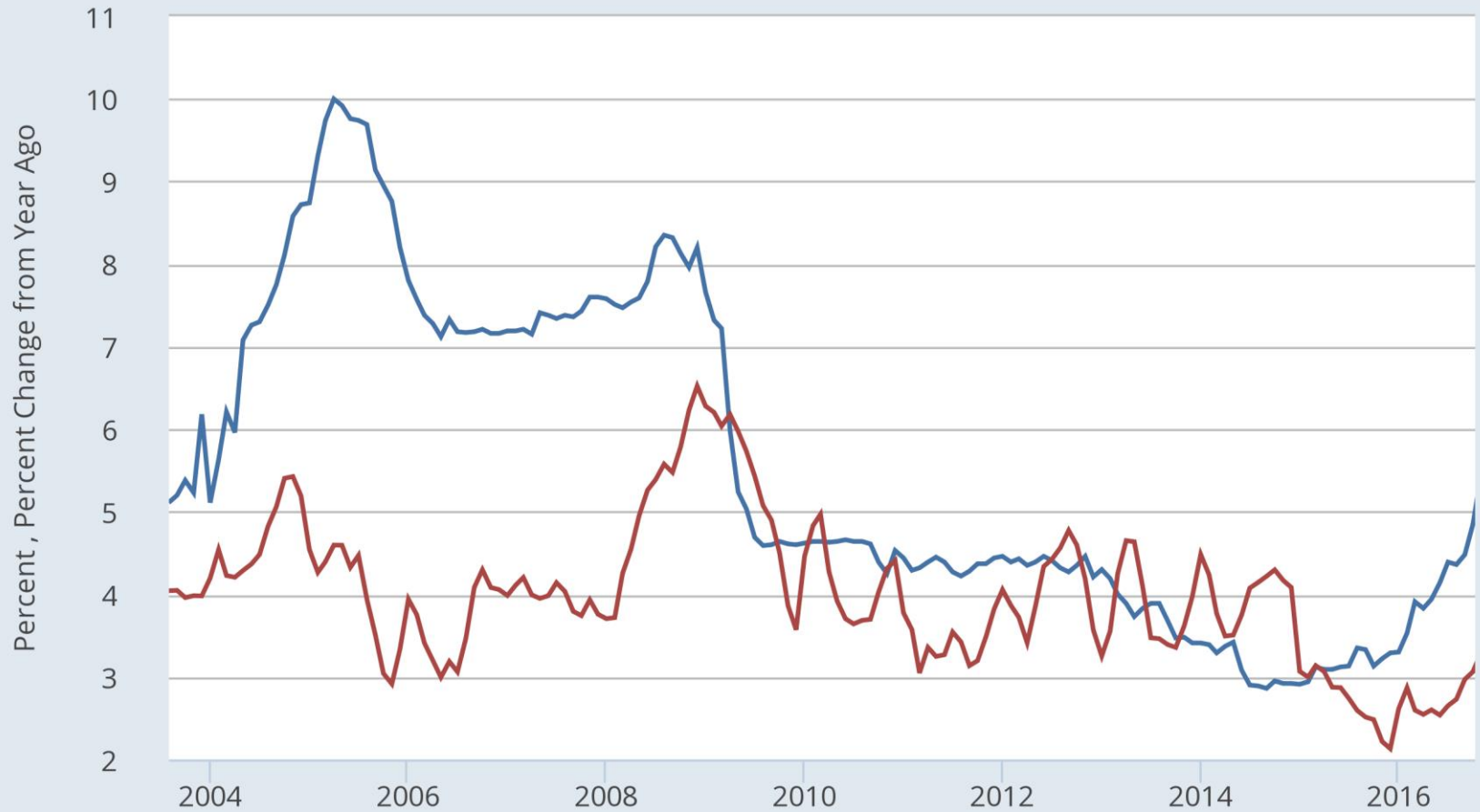
— 3-Month or 90-day Rates and Yields: Treasury Securities for Mexico©  
— Consumer Price Index: All Items for Mexico©



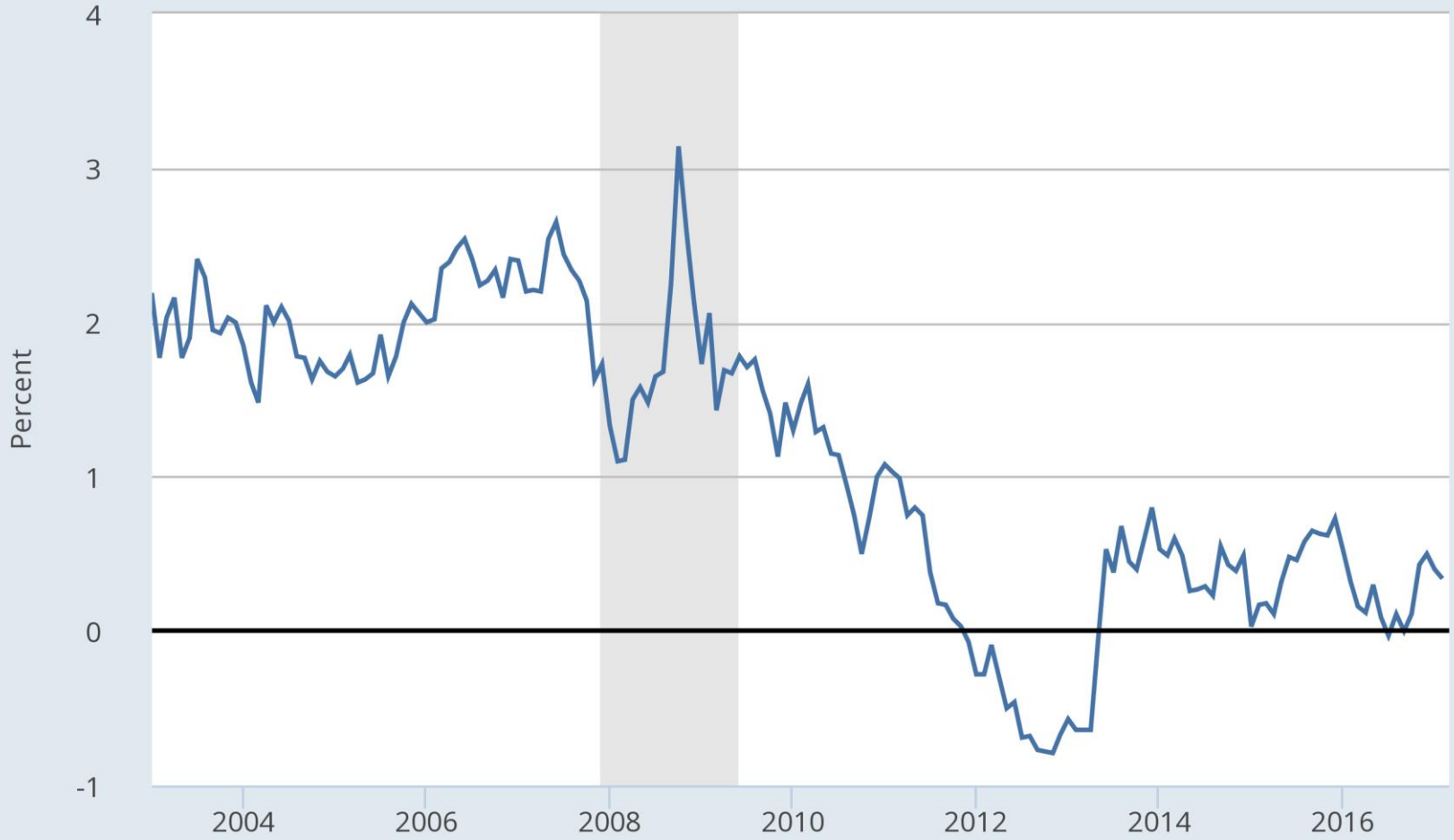
Sources: Organization for Economic Co-operation and Development  
fred.stlouisfed.org

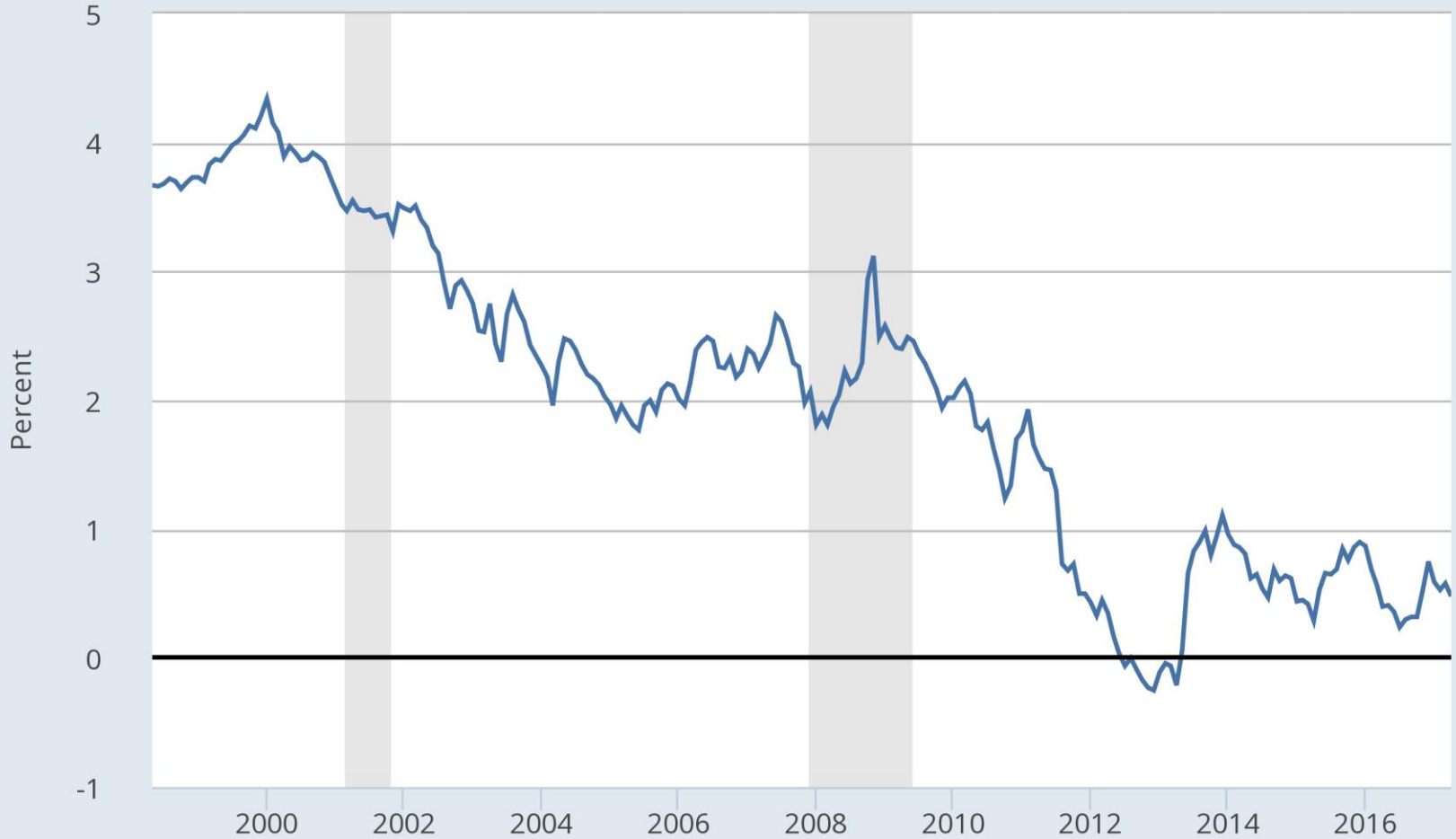
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— 3-Month or 90-day Rates and Yields: Treasury Securities for Mexico©  
— Consumer Price Index: All Items for Mexico©



— 10-Year Treasury Inflation-Indexed Security, Constant Maturity





# The Fisher Equation

- What is the Fisher equation?
- Is it a definition?
- An equilibrium condition?



Derive the Fisher equation in a model with bonds and inflation, but no money.

- In Chapter 17, we added bonds, but no inflation

$$P_t c_t = P_t w_t l_t + P_t r_t k_t - P_t k_{t+1} + P_t k_t (1 - \delta_k) \\ - B_{t+1} + B_t (1 + R_t) + P_t G_t;$$

$$c_t = w_t l_t + r_t k_t - k_{t+1} + k_t (1 - \delta_k) \\ - \frac{B_{t+1}}{P_t} + \frac{B_t}{P_t} (1 + R_t) + G_t.$$

## Inflation and the Price Level

$$\frac{P_{t+1}}{P_t} \equiv 1 + \pi_{t+1}.$$

$$\frac{B_{t+1}}{P_t} = \frac{B_{t+1}P_{t+1}}{P_{t+1}P_t} = b_{t+1}(1 + \pi_{t+1});$$

$$c_t = w_t l_t + r_t k_t - k_{t+1} + k_t(1 - \delta_k) \\ - b_{t+1}(1 + \pi_{t+1}) + b_t(1 + R_t) + G_t.$$

# The Bellman Equation

$$V(k_t, b_t) = \underset{l_t, k_{t+1}, b_{t+1}}{\text{Max}}$$

$$\ln[w_t l_t - k_{t+1} + k_t(1 + r_t - \delta_k) - b_{t+1}(1 + \pi_{t+1}) + b_t(1 + R_t) + G_t] \\ + \alpha \ln(1 - l_t) + \beta V(k_{t+1}, b_{t+1});$$

# Compute FOC and Envelope Conditions

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$$V(k_t, b_t) = \underset{l_t, k_{t+1}, b_{t+1}}{\text{Max}}$$

$$\ln[w_t l_t - k_{t+1} + k_t(1 + r_t - \delta_k) - b_{t+1}(1 + \pi_{t+1}) + b_t(1 + R_t) + G_t] \\ + \alpha \ln(1 - l_t) + \beta V(k_{t+1}, b_{t+1});$$

$$\Rightarrow x_t = \frac{\alpha c_t}{w_t}, \quad \frac{c_{t+1}}{\beta c_t} = 1 + r_t - \delta_k.$$

$$\frac{1}{\beta c_t}(1 + \pi_{t+1}) = \frac{\partial V(k_{t+1}, b_{t+1})}{\partial b_{t+1}}, \quad \frac{\partial V(k_t, b_t)}{\partial b_t} = \frac{1}{c_t}(1 + R_t);$$

# Equilibrium conditions lead to Fisher Equation

$$\Rightarrow \frac{1}{\beta} \frac{1}{c_{t-1}} (1 + \pi_t) = \frac{1}{c_t} (1 + R_t) = 0,$$

$$1 + R_t = \frac{c_t}{\beta c_{t-1}} (1 + \pi_t).$$

$$1 + R_t = \frac{c_t}{\beta c_{t-1}} (1 + \pi_t) = (1 + r_t - \delta_k)(1 + \pi_t),$$

$$1 + R_t = (1 + r_t - \delta_k)(1 + \pi_t).$$

$$\ln(1 + x) \simeq x;$$

$$\Rightarrow R_t = r_t - \delta_k + \pi_t.$$

# Questions about the Fisher Equation

- What happens to the real rate if the Fed pegs the nominal rate and inflation rises?
- What happens to the inflation rate if the Fed pegs the nominal rate near zero in a recession and the economy recovers?
- What does it mean to say that the Fisher equation is an equilibrium condition?
- What does it mean to say that the Fisher equation is a definition--a tautology?
- What happens to the ex post real interest rate if there is an unexpected increase in inflation?

# Phillips Curve

- What is it? A structural relationship or a statistical relationship.
- Explain how unanticipated inflation might be associated with rising output.
- What about price contracts?
- What does the Fisher equation have to say about the Phillips curve?
- How does a central bank choose optimal policy if prices are set for multiple periods as in contracts, catalogues, etc.?



## Some 'Monetarist' Concepts (Arithmetic)

- What is the long-run association between money growth and inflation? Why are they typically not equal?
- What is the association between money growth and government spending? Suppose there is no other source of tax revenue, how much spending can be sustained with money growth?
- Another way to ask the same question: What amount of government spending can be supported with seigniorage?

$$\frac{G_t^n}{y_t} = \eta = \frac{M_{t+1} - M_t}{P_t y_t}$$

The ability of money growth to finance government expenditure depends on how much money people are willing to hold.

$$G_t^n = \frac{M_{t+1} - M_t}{P_t}.$$

$$\frac{G_t^n}{y_t} = \eta = \frac{M_{t+1} - M_t}{P_t y_t}.$$

$$\eta = \frac{M_{t+1} - M_t}{y_t} = \frac{M_{t+1} - M_t}{M_t} \frac{M_t}{P_t y_t} = \frac{\sigma_{t+1} M_t}{P_t y_t}.$$

$G_t^n$  represents real government spending supported by money growth.

# The Income Velocity of Money

- What is it?
- What was the 'monetarist' assumption?
- How is the demand for money related to velocity?
- What happens to the demand for real money balances in a hyperinflation?
- $MV = Py = Y$  (Nominal GDP).
- If velocity is a constant, then the government can control Nominal GDP by controlling the money supply.
- Monetarist policy prescription exactly that!

# Homework for May 15

- Read Chapter 20. Monetary Theory and Policy

Finish Chapter 20 for May 10 class

Quiz 25

1. Set up and solve the monetary economy model of section 20.5
2. Show how the steady state levels for output, the capital stock and labor depend on the risk-free real interest rate, given an inflation target.
3. Show how the steady state levels for output, the capital stock and labor depend on the inflation rate, given a value for the risk-free real interest rate.