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

May 15, 2017

# Homework for May 10

- Finish Chapter 20, the Monetary Economy
- 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.

Government finances expenditure, $G_t$, by printing money, issuing bonds.

$$G_t = M_{t+1} - M_t + B_{t+1} - B_t(1 + R_t)$$

$$\sigma_t \equiv \frac{M_{t+1} - M_t}{M_t}.$$

$$M_t = P_t c_t.$$

# Consumer budget constraint (Nominal terms)

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

$$\begin{aligned} c_t &= w_t l_t + r_t k_t - k_{t+1} + k_t(1-\delta_k) - b_{t+1}(1+\pi_{t+1}) + b_t(1+R_t) - \frac{M_{t+1}}{P_t} + \frac{M_t}{P_t} + \frac{G_t}{P_t}; \\ &= w_t l_t + r_t k_t - k_{t+1} + k_t(1-\delta_k) - b_{t+1}(1+\pi_{t+1}) + b_t(1+R_t) - m_{t+1}(1+\pi_{t+1}) + m_t + \frac{G_t}{P_t} \end{aligned}$$

# Use Budget Constraint to Solve for Leisure in Utility

$$l_t = \frac{c_t}{w_t} - \frac{r_t k_t - k_{t+1} + k_t(1-\delta_k)}{w_t} - \frac{-b_{t+1}(1+\pi_{t+1})}{w_t} - \frac{b_t(1+R_t)}{w_t} - \frac{-m_{t+1}(1+\pi_{t+1}) + m_t + \frac{G_t}{P_t}}{w_t};$$

$$c_t = m_t;$$

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

# Bellman Equation

$$V(k_t, b_t, m_t)$$

$$= \underset{k_{t+1}, b_{t+1}, m_{t+1}}{Max} : \ln(m_t) + \alpha \ln\Bigg[ 1 - \frac{-r_t k_t + k_{t+1} - k_t(1-\delta_k)}{w_t}$$

$$- \frac{+b_{t+1}(1+\pi_{t+1}) - b_t(1+R_t)}{w_t} - \frac{+m_{t+1}(1+\pi_{t+1}) - \frac{G_t}{P_t}}{w_t} \Bigg]$$

$$+ \beta V(k_{t+1}, b_{t+1}, m_{t+1});$$

goods-leisure margin $\frac{\alpha c_t}{x_t} = \frac{w_t}{1+R_t}$

# FOCs, ECs

- Show that the FOCs and ECs for capital and bonds give the same result as before (but with inflation in the bonds condition)
- Show that the money conditions lead to the goods leisure margin:

$$\frac{\alpha c_t}{x_t} = \frac{w_t}{1 + R_t}$$

# From Chapter 8 AD-AS

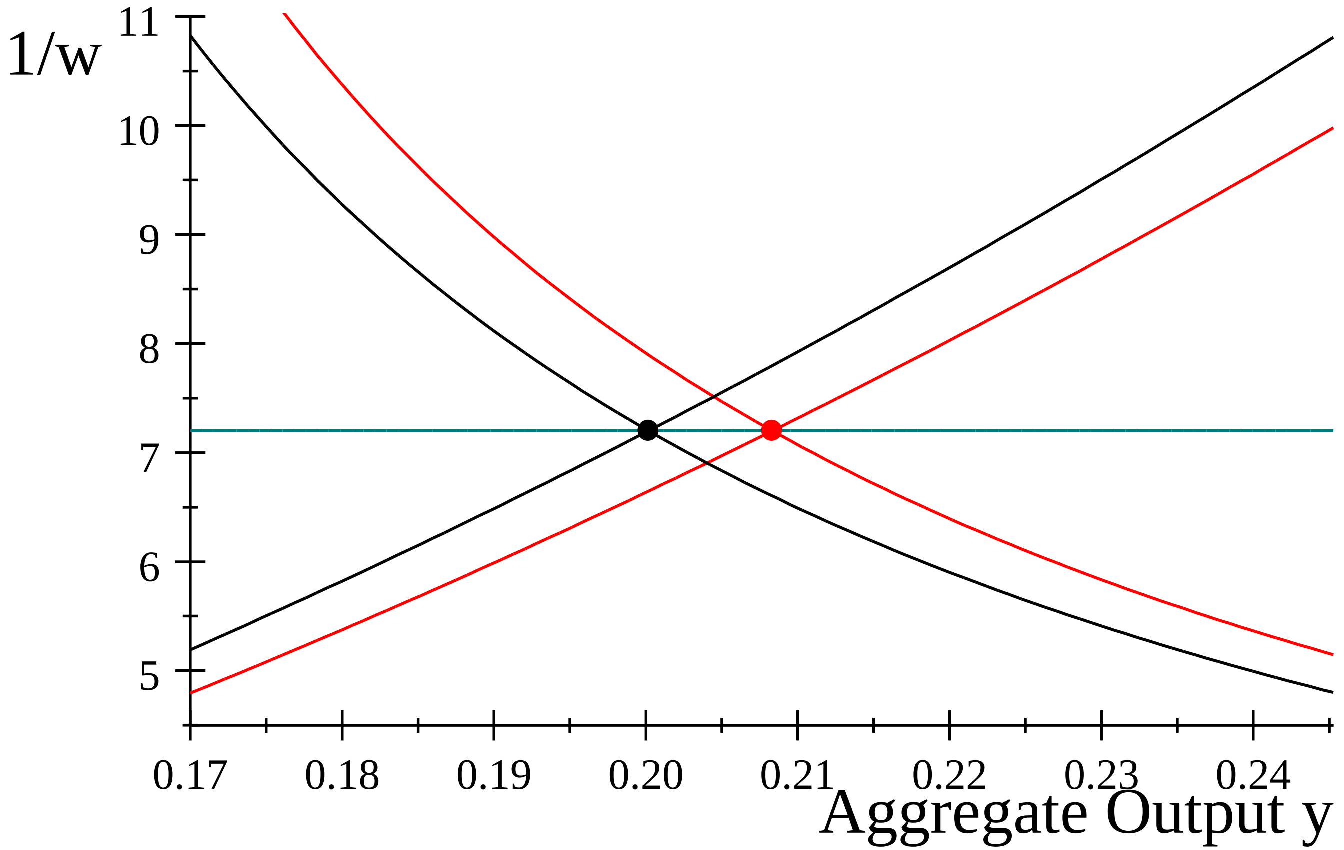
$$\frac{1}{w_t} = \frac{T}{y_t^d(1+\alpha) - k_t[\rho + (1+\alpha)\delta_k]}.$$

$$\frac{1}{w_t} = \frac{(y_t^s)^{\frac{1-\gamma}{\gamma}}}{\gamma A_G^{\frac{1}{\gamma}}(k_t)^{\frac{1-\gamma}{\gamma}}}.$$

# From Chapter 20 AD-AS

$$\frac{1}{w_t} = \frac{1}{y_t^d[1+\alpha(1+R_t)] - (\rho + \delta_k[1+\alpha(1+R_t)])k_t}.$$

Figure 20.1. Monetary Economy AS-AD with Inflation Tax (black) in Example 20.3 and No Tax (red) in Example 8.1.



## Chapter 9 Labor Supply and Labor Demand

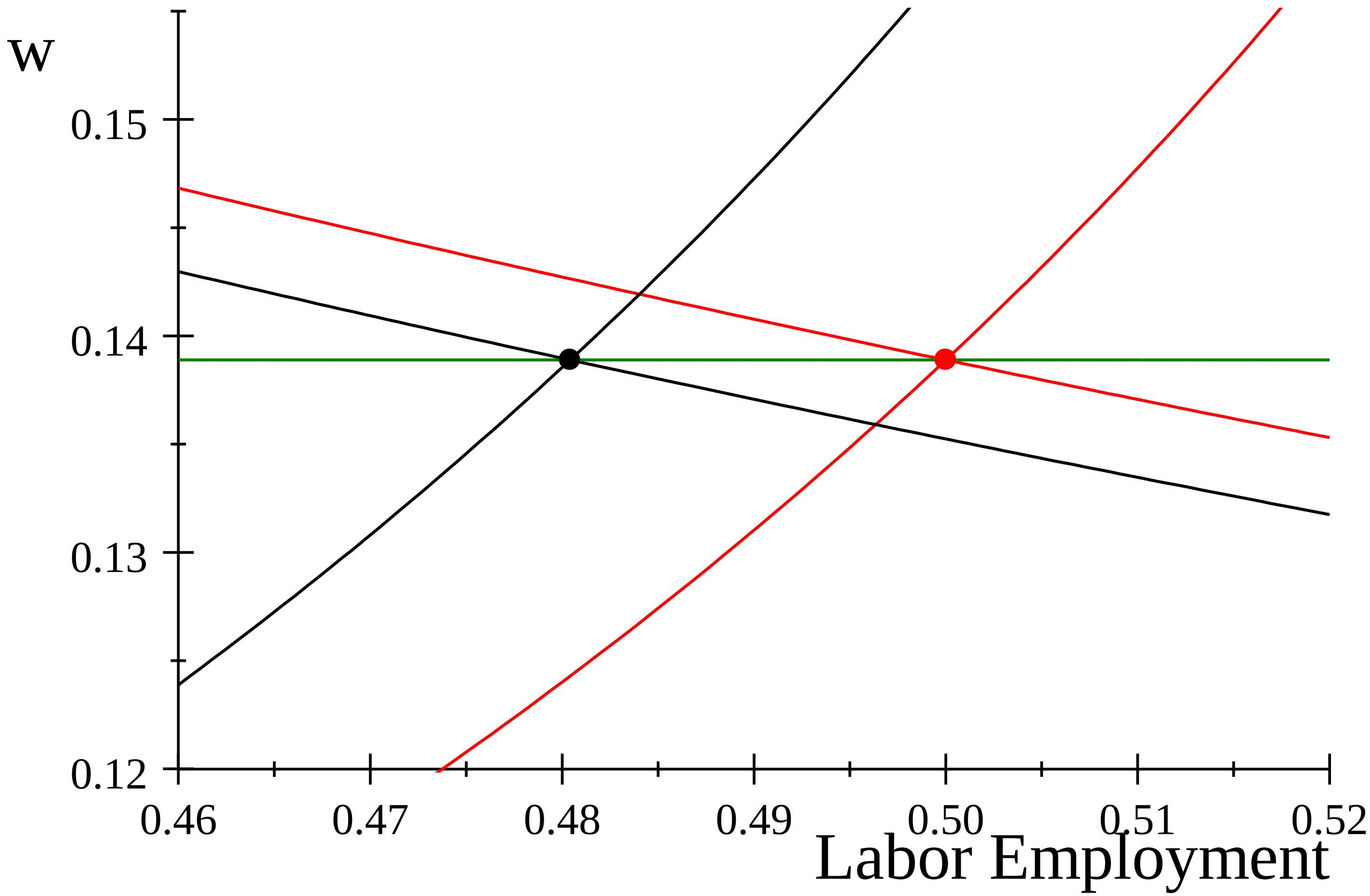
$$w_t = \frac{\alpha \rho k_t}{T - (1+\alpha) l_t^s}; \; w_t = \gamma A_G \left( \frac{k_t}{l_t^d} \right)^{1-\gamma}.$$

## Chapter 20 Labor Supply and Labor Demand

$$w_t = \frac{\alpha (1 + R_t) \rho k_t}{(1 - l_t^s)(1 + \alpha(1 + R_t)) - \alpha(1 + R_t)}$$

$$w_t = \gamma A_G \left( \frac{k_t}{l_t^d} \right)^{1-\gamma}$$

Figure 20.2. Zero Growth Equilibrium Labor Market with Inflation Tax of R=0.0815 (black) in Example 20.3 Compared to R=0 (red).]



# Figure 20.3. Factor Market Equilibrium in Monetary Economy with R=0.0815 in Example 20.3 (darker red, blue) and R=0 (lighter red, blue)

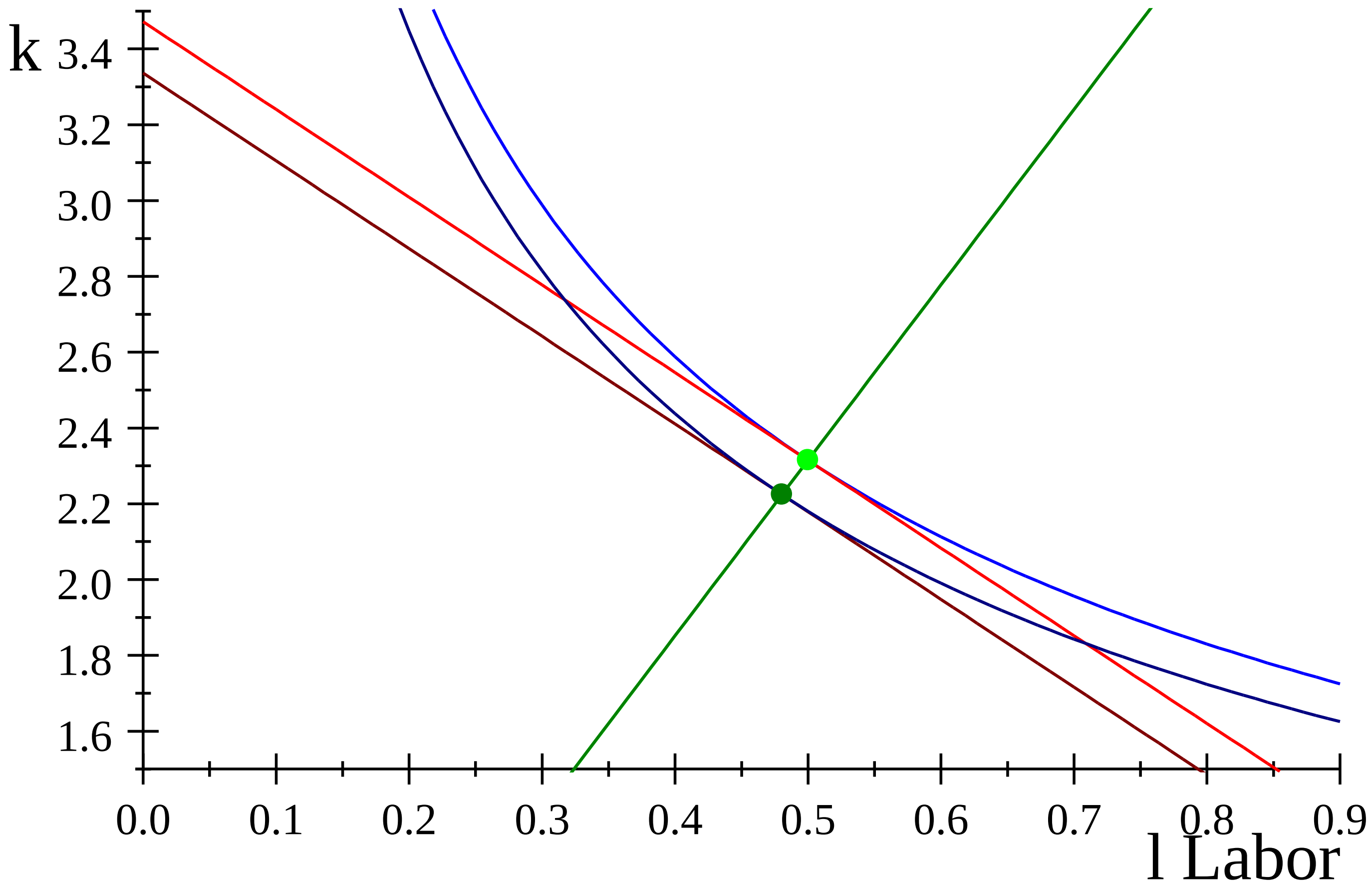
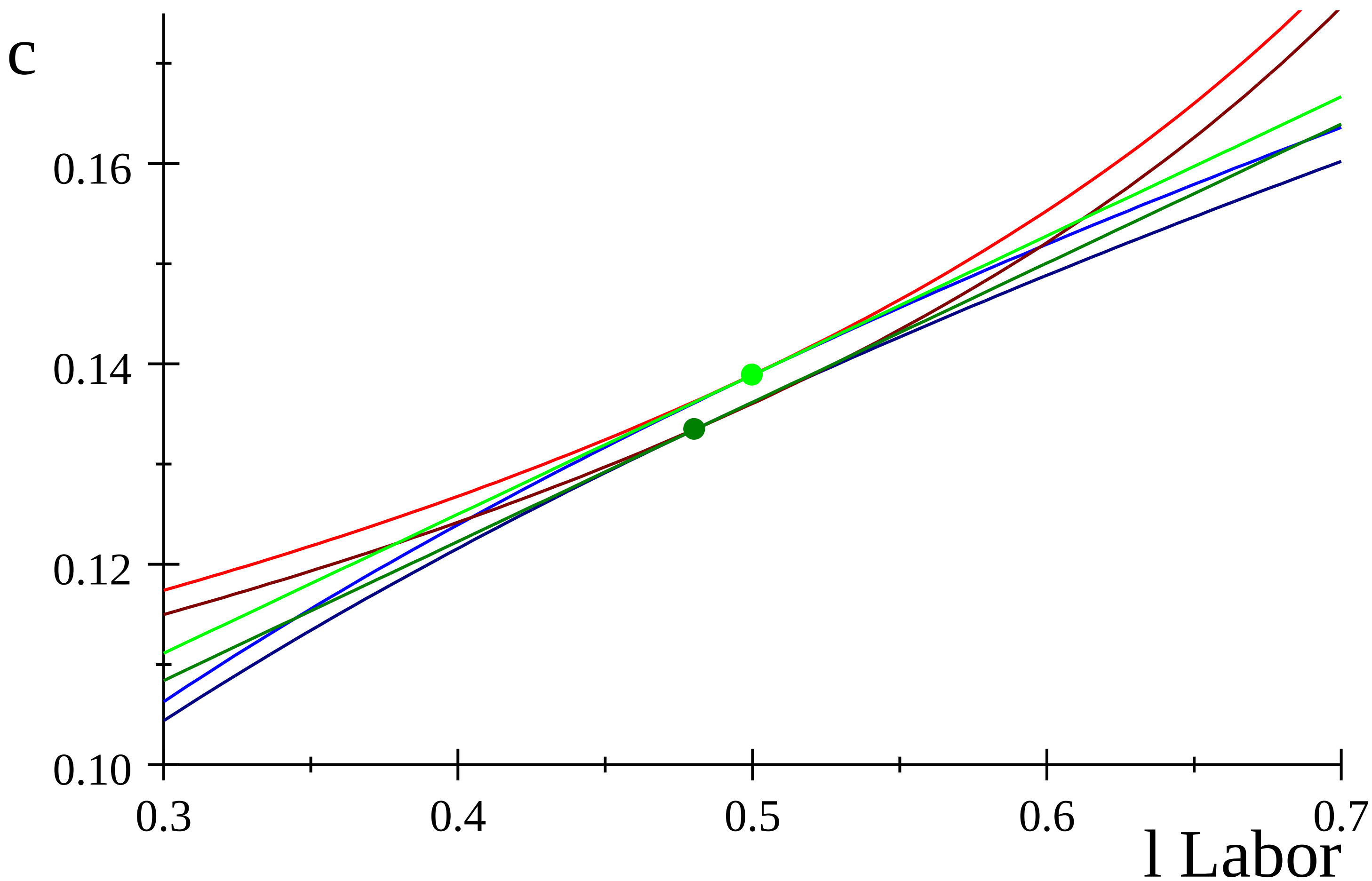


Figure 20.4. General Equilibrium Consumption and Utility Levels with Inflation Tax of R=0.0815 in Example 20.3 (darker red, blue, green), and Baseline R=0 (lighter red, blue, green).]



# Homework for May 17

- Read Cooke and Gavin (2015)
- See Gavin (why target inflation) (2004)