**Problem Set 8**

Intermediate Macroeconomics, Fall 2014
The University of Notre Dame
Professor Sims

**Instructions** You may work on this problem set in groups of up to four people. Should you choose to do so, please make sure to legibly write each group member’s name on the first page of your solutions. This problem set is due in class on Thursday November 20.

(1) **Money in the Utility Function:** Suppose that a household lives for two periods, earning an exogenous stream of real income, $Y_t$ and $Y_{t+1}$. It potentially has to pay a tax (or, if the tax is negative, receive a transfer) in period $t$ only, $T_t$. It can consume goods, save in bonds, or hold money. The money price of goods is $P_t$, which the household takes as given. The nominal return on saving in bonds is $i_t$, which the household also takes as given. Household preferences are:

$$U = \ln C_t + \ln \left( \frac{M_t}{P_t} \right) + \beta \ln C_{t+1}$$

In nominal terms the first period budget constraint is:

$$P_tC_t + P_tS_t + M_t = P_tY_t - P_tT_t$$

In nominal terms the second period budget constraint is:

$$P_{t+1}C_{t+1} = P_{t+1}Y_{t+1} + (1 + i_t)P_tS_t + M_t$$

(a) Write each period budget constraint in real terms by dividing through by the price level, and then combine the budget constraints by eliminating $S_t$.

(b) What is the Fisher relationship? Provide some intuition for it.

(c) Using your combined intertemporal budget constraint from (a), find the first order conditions characterizing an optimal solution to the household problem.

(d) Use these first order conditions to derive a demand curve for money.

(e) In words, explain how the demand for money varies with $i_t$ and with $C_t$.

There is a government that prints money, levies taxes, and does spending. It only operates in period $T_t$ (e.g. the government does nothing in period $t + 1$). Its period $t$ budget constraint in nominal terms is:

$$P_tG_t = P_tT_t + M_t$$

(f) Suppose that the government does no expenditure, $G_t = 0$. Given $M_t$, what must be true about taxes, $T_t$?
(g) Since the government’s budget is balanced by construction (since it does not operate in the second period), what must be true about household saving, $S_t$? Given this, and combining the government budget constraint with the household period $t$ flow budget constraint, what must be true about $Y_t$ and $C_t$?

(2) **Money in our Equilibrium Model:** Consider our standard equilibrium model of the economy augmented to include money as developed in class. Graphically work through the effects of an exogenous increase in expected inflation, $\pi_{t+1}^e$, on the endogenous variables of the model (the endogenous variables are $Y_t, C_t, I_t, N_t, w_t, r_t, i_t$, and $P_t$).