Homework 2 (due October 9, 2017)

1. Consider the following macroeconomic model:

\[
Y = C(Y) + I(i)
\]
\[
\bar{M} = L(i, Y)
\]
\[
Y = F(N)
\]
\[
N = f\left(\frac{\bar{w}}{P}\right)
\]

Where \( f\left(\frac{\bar{w}}{P}\right) \) is the labor demand function.

a. What are the endogenous and exogenous variables?

b. Show that in this Keynesian model:

\[
0 < \frac{M}{P} \frac{dP}{dM} < 1; \quad \frac{dY}{dM} > 0; \quad \frac{di}{dM} < 0
\]

2. Suppose we write the model for the aggregate labor demand as follows:

\[
N^D = N^D\left(\frac{W}{P}, \bar{K}\right), \quad N^D_{W/P} = -\frac{1}{F_{NN}} < 0, \quad N^D_{\bar{K}} = \frac{F_{NK}}{F_{NN}} > 0
\]

\[
W / P = g(N^S), \quad g_N > 0
\]

\[
[N \equiv ] \quad N^D = N^S
\]

where \( N^D \) is the labor demand, \( W \) is the nominal wage, \( P \) is the price level, \( \bar{K} \) is the capital stock, \( N^S \) is labor supply and \( N \) is equilibrium employment. We assume that the expected price is equal to the actual price (\( P = P^e \)) and that the labor market is in equilibrium. Answer the following questions about this model. Use graphical means as much as possible.
a. What do we assume implicitly in equation (2) about the income and substitution effects in labor supply? Explain intuitively how these effects operate.

b. Assume that the government introduces a so-called payroll tax \( t_w \), i.e. a tax levied on employers which is proportional to the firm’s wage bill. This tax changes the profit function for the representative firm to:
   \[ \pi = PF(N, \bar{K}) - W(1 + t_w)N. \]
   Explain the effect of the payroll tax on the demand for labor.

c. Derive algebraically and show graphically the effects of the payroll tax on equilibrium labor and real wage.

3. Consider the following Keynesian cross model for the closed economy:

   \[ Y = C + I + G \]
   \[ C = C_0 + c(Y - T), \quad 0 < c < 1 \]
   \[ I = I_0 + \dot{Z} \]
   \[ \dot{Y} = -\gamma \dot{Z}, \quad \gamma > 0 \]

   where \( Y \) is output, \( C \) is consumption, \( I \) is actual investment, \( G \) is government spending, \( T \) is taxes, \( I_0 \) is planned investment and \( Z \) is the stock of inventories. Assume that prices are fixed and that \( G \) and \( T \) are all exogenous.

   a. Interpret the equations of the model.
   b. Show that the model is stable. Illustrate your answer graphically by developing the phase diagram for the model \( \frac{d\dot{Y}}{dY} \).
   c. Show the effects over time on output, consumption, actual investment, and inventories of a tax financed increase in government spending. (In the long run \( \dot{Y} = 0 \).)