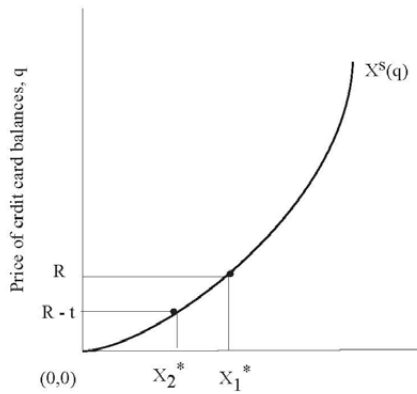


EE312 Macroeconomics, 2/2015 (Sec. 046402)
Problem Sets 6
Solution

1. The government decides that the use of credit cards is bad, and introduces a tax on credit card balances. That is, if a consumer or firm holds a credit card balance of X (in real terms), he or she is taxed tX , where t is the tax rate. Determine the effects on the equilibrium price and quantity of credit card balance, demand for money, and the price level, and explain your results.

ANSWER. A tax on credit card balances shifts the demand for credit card balances, so that demand is perfectly elastic at $q = R - t$ rather than at $q = R$. Then, for each nominal interest rate, the equilibrium quantity of credit card balances falls, and this shifts the demand for money to the right. As a result, the price level will fall. Since money is neutral, this has no effects on any other real variables.



2. Use the Closed-Economy, (Monetary) Intertemporal Model to analyze the effects of an increase in government spending on the real wage, employment, current output and the real interest rate, current consumption and price level. (If the space provided is not enough, please attach a separate paper.)

At the initial competitive equilibrium, all markets are clear. Initial wage, initial employment, initial real interest rate, initial current output and initial price level are at w_1 , N_1 , r_1 , Y_1 and P_1 respectively.

The government increases its spending (G) and **increases the present value of tax (T)**. The effect of the increase in G and the effect of the increase in T are as follows.

Step 1: $Y^d - Y^s$

- Effects on Y^s :
- The present value of the taxes rises causing a **decrease in the consumer's lifetime wealth**.
 - **Current leisure decreases** and **labor supply increases**, given the real wage.
 - **Supply of labour (N^s) shifts to the right** from $N^s(r_1)$ to $N^s(r_1)$. (See Figure 1.)
 - Output increases through the production function, $zF(K, N)$.
 - The **output supply curve shifts rightwards** from Y^s_1 to Y^s_2 . (See Figure 2.)
- Effect on Y^d :
 - Government's demand for output (G) increases.
 - Falling lifetime wealth (effect of the tax) reduces the consumer's demand for current consumption goods (C^d).
 - A small decrease in current consumption while the increase in G remains large.
 - Tax multiplier = $\frac{-MPC}{1 - MPC}$, Government spending multiplier = $\frac{1}{1 - MPC}$
 - Current demand for goods increases by the amount of $\Delta Y^d = \Delta G$; the Y^d multiplier = 1. [In other words, the balance budget multiplier is equal to 1.]
 - Keeping interest rate constant at the initial interest rate r_1 . $AD = \Delta G$.
 - Y^d **shifts to the right**. (See Figure 2.)
- Combine the two (Effects on Y^s and Effect on Y^d): (See Figure 2.)
 - The real interest rate increases as Y^d **shifts more than Y^s** because ΔG is temporary and has a **small negative effect on lifetime wealth**.
 - A small negative effect on lifetime wealth \Rightarrow a **small decrease in leisure**, and **small increases in labor supply** and output supply (small Y^s shift).
 - A small negative effect on lifetime wealth \Rightarrow a **small decrease in current consumption** while the increase in G remains large (larger Y^d shift).
 - **Output increases from Y_1 to Y_2 and real interest rate increases from r_1 to r_2 .**

Step 2: effect of Δr

- A higher r reduces leisure, current consumption and investment.
- **Leisure falls** and **labor supply increases** again.
- **Supply of labour (N^s) shifts to the right** from $N^s(r_1)$ to $N^s(r_2)$. (See Figure 1.)
- The **real wage falls** further; employment and output increase — a movement along the Y_s (From B to C).
- **Employment increases from N_1 to N_2 .**
- Investment decreases due to the higher real interest rate.
- **Current consumption falls** because of the following reasons.

- **Falling lifetime wealth** reduces current consumption while higher income raises it — small net effect.
- **The higher real interest rate (r)** also reduces it — dominant effect.
- (In other words, since $C = C_0 + MPC \times (Y - T)$. C_0 (Autonomous consumption) depends on real interest rate. As real interest rate increases, C_0 decreases. Since $\frac{\Delta Y}{\Delta G} < 1$; $\Delta G = \Delta T$, the increase in Y is smaller than the increase in T ($\Delta Y < \Delta T$). Hence, $(Y - T)$ is decreased causing $MPC \times (Y - T)$ to decrease.)
- A temporary increase in G **crowds out both current consumption and investment by raising the real interest rate.**
 - The **consumer works more for a lower real wage and consumes less.**
 - Lower investment means lower future capital stock and future productive capacity.

Step 3: Money Market (See Figure 3.)

- **Higher Y raises money demand but rising r decreases it.**
- **If the latter is strong, M^d shifts left (from M^{d1} to M^{d2}) and P rises from $P1$ to $P2$.**

In conclusion, an increase in government spending bring about an increase in employment, an increase in current output, an increase in interest rate, an increase in price level, a decrease in real wage, a decrease in consumption and a decrease in investment.

figure 1. Labour Market

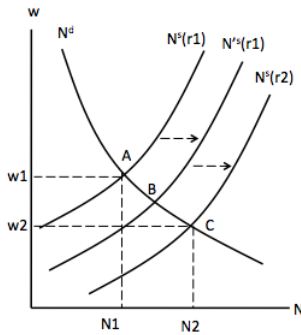


figure 2. Output Market

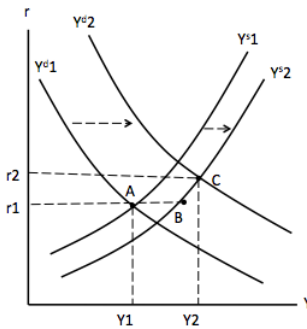
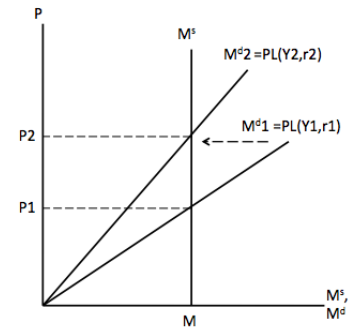


figure 3. Money Market



Note that the question asks us to analyze the effects of an increase in government spending on the real wage, employment, current output and the real interest rate, current consumption and price level. There are six variables we need to do the analysis. Make sure you do all. Attack the question. Crowding out effect should be discussed because it is an important economic intuition to the analysis. Though the question in this homework did not ask you to analyze such the impact on investment, this solution to the homework provides the analysis for you to review.

3. In the Real Business Cycle Model, analyze the effects of the increases in current total factor productivity and future total factor productivity on the real wage, employment, current output and the real interest rate, current consumption and price level. (If the space provided is not enough, please attach a separate paper.)

Real business cycle theory (RBC theory) are a class of macroeconomic models in which short-run fluctuations are mainly results of random productivity (i.e., real) shocks. At the initial competitive equilibrium, all markets are clear. Initial wage, initial employment, initial real interest rate, initial current output and initial price level are at w_1, N_1, r_1, Y_1 and P_1 respectively. A higher current z tends to be followed by a higher future z' . The effects of the increase in current total factor productivity and future total factor productivity are as follows.

Step 1.

- Effects of the increase in z on Y^s :
 - An increase in current total factor productivity (z) **raises MPN.**
 - **Labour demand and output supply shift right.**
 - Labour demand shifts to the right from N_1^d to N_2^d . (See figure 1)
 - Output supply shifts to the right from Y^s_1 to Y^s_2 . (See figure 2)
- Effects of the increase in z' on Y^d
 - Future z' is expected to rise; **future marginal product of capital (MP'_K) increases.**
 - **Investment Demand (I^d) increases causing output demand to shift to the right** (from Y^{d1} to Y^{d2} , see figure 2).
- Overall effects.
 - The effect of the increase in current z (on Y^s) occurs in the current period.
 - **The effect of the expected increase in future z' on current investment (on Y^d) is weaker than the effect of the increase in current z (on Y^s).**
 - * The increase in future real income is smaller than the increase in current real income.
 - * Consumption smoothing results in a small increase in current consumption (and Y^d).
 - The **real interest rate decreases** from r_1 to r_2 .

Step 2. effect of falling r

- The lower real interest rate reduces labor supply.
- N^s **shifts left** (from $N^s(r_1)$ to $N^s(r_2)$) and partially offsets w and N . (See figure 1)
- Effect of r is small, so N^d dominates.
- **Employment increases** (from N_1 to N_2) **and real wage increases** (from w_1 to w_2). (See figure 1)

Step 3. effect on money market

- **Higher Y and lower r cause nominal M^d to shift right** (increase).
- Money demand shifts from $PL(Y_1, r_1)$ to $PL(Y_2, r_2)$. (See figure 3.)
- **The price level drops.**

Step 4 : effect on average productivity *

- With rising z , higher Y and N , average labor productivity ($\frac{Y}{N}$) also increases (slope $OB >$ slope OA). See figure 4.

Figure 1. Labour Market

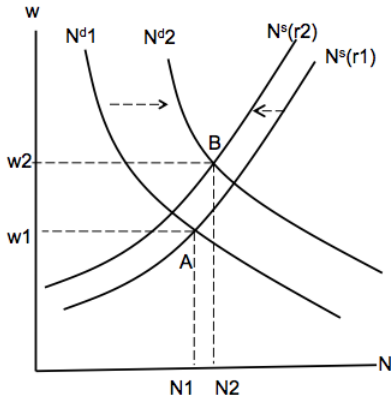


Figure 3. Money Market

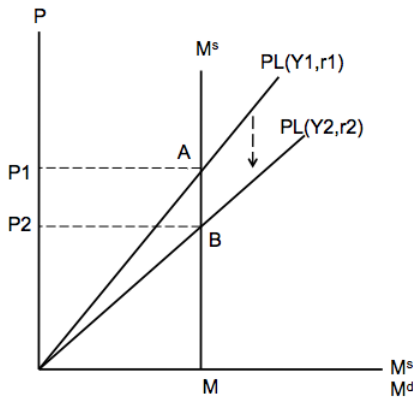


Figure 2. Good Market

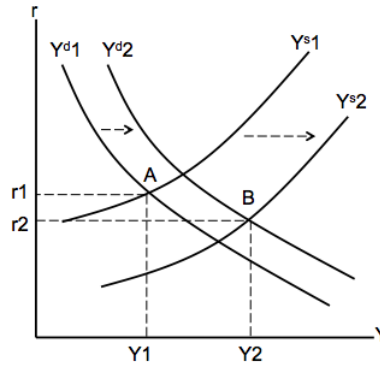
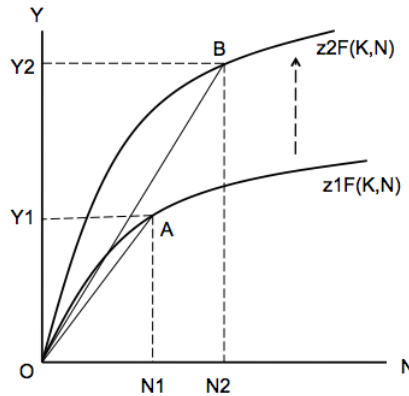


Figure 4. Production function



Comparison between the theoretical predictions and the data.**

“The real business cycle model qualitatively explain essentially all of the key business cycle regularities. Consumption, investment, employment, the real wage and average labour productivity are procyclical, and the price level is counter procyclical. ...” “ One feature of the data that the model in this form cannot replicate is the procyclicity of money supply...” “In the real business cycle model, the procyclicity of nominal money supply can be explained by way of ‘endogenous money’...”.

Note:

- You must clearly explain your graphs and your steps in the exam.
- The question did not ask you to state the main thought of RBC theory (short-run fluctuations are mainly results of random productivity (i.e., real) shocks). It is better to state it to add more economic meaning to the analysis.