Suggested Solutions to EC2102 Macroeconomic Analysis I
Tutorial 8, Week 11, March 29-April 2, 2010

Question 1

(i) Suppose there is a persistent increase in current and all future TFP, so $z_1 \nearrow$, $z_2 \nearrow$, $z_3 \nearrow$, $z_4 \nearrow$,..., (see "figure 11.2" of your lecture notes)

An increase in z_1 means $\nearrow$ in MPL so N_1^d shifts right to $\widetilde{N}_1^d$, because more labour is demanded at every wage rate. But increases in future TFP also imply that wages in the future $\nearrow$, so lifetime wealth $\nearrow$, and you choose to work less at every wage rate, so $N_1^S(r_1^*)$ shifts to the left to $\widehat{N}_1^S(r_1^*)$. It turns out that the leftward shift of labour supply curve today is smaller than the righward shift of labour demand curve, so overall current employment rises in the labour market. That the leftward shift of labour supply curve is smaller than the rightward shift of labour demand can be thought to be due to the the latter being the direct result of z_1 changing, which happens in this current period, whereas the former is the result of anticipated changes, whose effects on lifetime wealth are not that large. In any case, this overall increase in current employment causes Y_1^s to shift to the right to $\widetilde{Y}_1^s$.

But increases in future z imply that for the representative firm, future $MPK \nearrow$, so $I_1 \nearrow$, so investment component of Y_1^d rises.

And for the representative consumer, increases in future TFP also imply that wages in the future $\nearrow$, so lifetime wealth $\nearrow$, so $C_1 \nearrow$. Hence, consumption component of Y_1^d increases.

Hence, Y_1^d shifts to the right to $\widetilde{Y}_1^d$.

Rightward shifts of both Y^d and Y^s imply that aggregate output has risen unambiguously

Shift of Y_1^s is likely to be larger than shift of Y_1^d, because the former is the direct effect of increasing $TFPs$ whereas latter is a response to an anticipated effect of higher $TFPs$. Further, the representative consumer knows that a bad shock can hit the economy later on, so the wealth effect (in affecting labour supply and consumption today) is small.

Hence, at the original real rate of interest r_1^*, output supplied exceeds output demand. To boost demand, interest rates are going to fall to encourage consumer to consume more today because $(1+r)$ is the price of consumption today relative to consumption tomorrow, so a fall in interest rate today makes consumption today relatively cheaper, so consumption today rises. At the same time, as interest rate falls, I_1 increases because the interest rate is the rate of return on alternative asset to the representative firm, bonds, so a fall in

interest rate makes investing more attractive relative to bonds. Hence, there is a movement downwards along the $\widetilde{Y}_1^d$ from point A.

At the same time, as interest rate falls, the representative consumer works less, since the price of leisure today is less expensive relative to the price of leisure tomorrow, which is $w_1(1+r)/w_2$, and this substitution effect dominates, so $\widehat{N}_1^S(r_1^*)$ starts to shift to the left, and thus causes a movement down the $\widetilde{Y}_1^s$ curve from point B.

Equilibrium is restored in the goods market when the real interest rate has fallen enough to equate output supplied with output demanded at $\left(\widetilde{Y}_1^*, \widetilde{r}_1^*\right)$. In the labour market, unambiguously, wage rate has to increase, but it is not clear what overall employment is. Since in general $Y_1 = z_1 F(K_1, N_1)$, where K_1 is taken as given in time period 1, since both z_1 and Y_1 increase, it is not clear whether N_1 rises or falls. However, data suggests that the real interest rate effect on labour supply is smaller than the change in labour demanded, so overall, current employment rises from N_1^* to $\widetilde{N}_1^*$, and real wage rate today rises to $\widetilde{w}_1^*$.

Further, since $Y_1 \nearrow$ and $r_1 \downarrow$, money demand increases, at every price level, from $P_1 L(Y_1^*, r_1^*)$ to $P_1 L\left(\widetilde{Y}_1^*, \widetilde{r}_1^*\right)$. Equilibrium in the money market is restored at a lower price $\widetilde{P}_1^*$

What happens to C_1?

- rises due to $\downarrow$ in r_1
- rises because $\nearrow$ in current income
- rises because $\nearrow$ in future periods' income

Overall: $C_1 \nearrow$

What happens to I_1?:

- rises because $\nearrow$ in future $TFPs$
- rises because $\downarrow$ in r_1

Overall: $I_1 \nearrow$

Since $Y_1 \nearrow$ and $N_1 \nearrow$, what can you say about Y/N, average labor productivity? Kydland and Prescott's model show that $\frac{Y_1}{N_1} \nearrow$

(ii) Consumption, investment, and average labour productivity are procyclical as discussed above. From the labour market, it is clear from the figure that employment and real wage rate are procyclical. As mentioned, prices level falls, therefore price level is countercyclical. On all these dimensions listed here, the model's predictions are what are observed in the data. However, for money supply, since money supply is fixed, the model has nothing to say about why the data shows money supply to be procyclical.

Question 2

(i) Money is anything that simulataneously has the following three properties:

- a medium of exchange
- a store of value
- a unit of account

(ii)

cash-in-advance constraint (CIA) at time period t is:

$$P_t C_t \leq M_{t-1} + B_{t-1}(1 + R_{t-1}) - P_t T_t - B_t^d,$$

where P_t is price level at time t, C_t is real consumption of representative consumer at time t, T_t is real taxes paid by representative consumer at time t, and B_t^d is nominal bond holdings demand by representative consumer at time t.

The defining characteristic of money in the CIA consraint is its role as a medium of exchange.

(iii) the budget constraint (BC) at time period t is:

$$\begin{aligned} & P_t C_t + B_t^d + M_t^d \\ = \; & M_{t-1} + B_{t-1}(1 + R_{t-1}) + P_t w_t (h - l_t) + P_t \pi_t - P_t T_t \end{aligned}$$

where π_t is dividends paid to the representative consumer by representative firm in real terms.

(iv) The main difference between the BC and CIA is that labour income and dividends (capital income) can't be used when consumer goes to the goods market to purchase consumption goods, but can only use whatever money he has on hand to pay for the goods. The money he has on hand are the terms on the RHS of the CIA constraint. But BC just says whatever the consumer wants to purchase in period t has to come out of his disposable income that period (see latter equation above)