Monetary Economics
Homework Exercises - Answers

(1) (A) The extra income is independent of how hard the household works; it is a pure wealth increase. The household responds to pure wealth increases by consuming more and working less. The extra income does not begin until the next period, so the household would like to shift to the current period some of the extra income that it now expects to receive in the future. However, the isolated household has no way to move income across time periods because there is no one with whom to borrow or lend. Consequently, changes in the household's expectations about next period's income have no effect at all on what the household does today, and consumption and labor choices in the current period are unchanged.

(B) The household has the same desires as in part (A), but now it can borrow. It therefore borrows in the first period to pay for higher consumption and lower work effort (= less earned income).

(C) Now all households try to do the same thing: borrow today to increase consumption and reduce labor. It is impossible for all households to borrow, however; their attempt to do so forces the interest rate to rise. The higher interest rate makes current consumption less attractive and current labor more attractive, offsetting the effects of higher expected future incomes. Consumption and labor are unaffected by the change in beliefs.

(2) (A) The interest rate on money, R_M, drops to zero. That raises the yield spread $R-R_M$, which in turn reduces the demand for money. Money demand therefore is less than money demand, and there is excess supply of money. To eliminate the excess supply of money, the economy raises the price level P to a value at which M/P falls to equal the new, lower level of money demand.

(B) The cost γ of making conversion between money and bonds is reduced. As a result, the demand for money falls. Once again, P must rise.

(3) The real value of the present value of nominal income is

$$\frac{1}{P_0}\sum_{i=0}^{\infty}\frac{P_{t+i}Y_{t+i}}{\prod_{j=0}^{i}(1+R_j)} = \frac{1}{P_0}\sum_{i=0}^{\infty}\frac{\left[\prod_{j=0}^{i}(1+\pi_j)P_0\right]Y_{t+i}}{\prod_{j=0}^{\infty}[(1+r_j)(1+\pi_j)]}$$

$$= \frac{1}{P_0}\sum_{i=0}^{\infty}\frac{(P_0Y_{t+i})\prod_{j=0}^{i}(1+\pi_j)}{\left[\prod_{j=0}^{i}(1+r_j)\right]\left[\prod_{j=0}^{i}(1+\pi_j)\right]}$$

$$= \frac{1}{P_0}\sum_{i=0}^{\infty}\frac{P_0Y_{t+i}}{\prod_{j=0}^{i}(1+r_j)}$$

$$= \sum_{i=0}^{\infty}\frac{Y_{t+i}}{\prod_{j=0}^{i}(1+r_j)}$$

which is the present value of real income.

(4) The reconciliation is straightforward. If people's perceptions of the price level change more slowly than the price level itself, then the central bank can have the effects it says it has. For example, if the central bank increases the nominal money supply, the price level begins to rise. If people are unaware of the increase in P, then their belief P^e about P lags behind P. As a result, they perceive the accompanying increases in nominal wages W as increases in real wages W/P^e. In response to the higher wage rate, people work more, output rises, lending rises, and interest rates fall - which is precisely what the central bank says is going to happen. Eventually, of course, P^e catches up to P, and the interest rate returns to its old level. (We should be careful here to distinguish between the real and nominal interest rates. The real interest rate definitely returns to its old level. The nominal rate goes to a level equal to the real interest rate plus the inflation rate. If the increase in the money supply was a one-time shock, there will be no permanent increase in inflation, so the nominal interest rate in the long run will equal the real interest rate and therefore return to its old value. If instead the central bank had raised the money growth rate, the new equilibrium would have a higher rate of inflation, and the ultimate value of the nominal interest rate will be higher than before the central bank's action.)

(5) We are given the equation

(*) $$\log M^D_t - \log P_t = a_0 - a_1 \log P_{t+1} + a_1 \log P_t$$

(A) Let p=logP and m=logM to simplify notation. Impose the equilibrium condition that

demand equals supply so that we may substitute the actual money stock for money demand. Then rearrange (*) to solve for p_t:

$$p_t = -\frac{a_0}{(1+a_1)} + \frac{1}{(1+a_1)} m_t + \frac{a_1}{(1+a_1)} p_{t+1}$$

But notice that

$$p_{t+1} = -\frac{a_0}{(1+a_1)} + \frac{1}{(1+a_1)} m_{t+1} + \frac{a_1}{(1+a_1)} p_{t+2}$$

so that by successive substitution

$$\begin{aligned} p_t &= \sum_{i=0}^{\infty} \left(\frac{a_1}{1+a_1} \right)^i \left(\frac{-a_0}{1+a_1} \right) + \frac{1}{1+a_1} \sum_{j=0}^{\infty} \left(\frac{a_1}{1+a_1} \right)^j m_{t+j} \\ &= A_0 + \frac{1}{1+a_1} \sum_{j=0}^{\infty} \left(\frac{a_1}{1+a_1} \right)^j m_{t+j} \end{aligned}$$

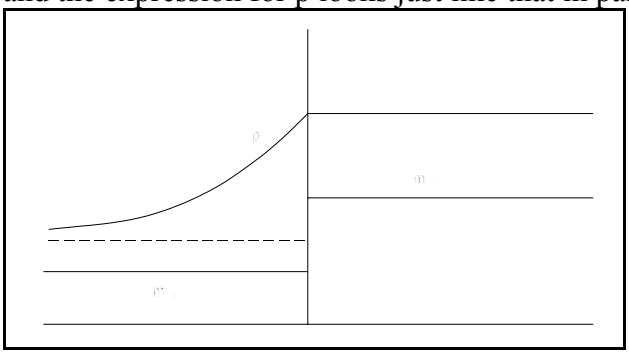
which means that $p_t=\log P_t$ depends on all (expected) future values of $m=\log M$.

(B) If M is constant, so is m. By the previous result, a constant m implies a constant p and therefore a constant P. Thus P never changes if M doesn't.

(C) To see what happens in this case, re-write our solution for p_t as

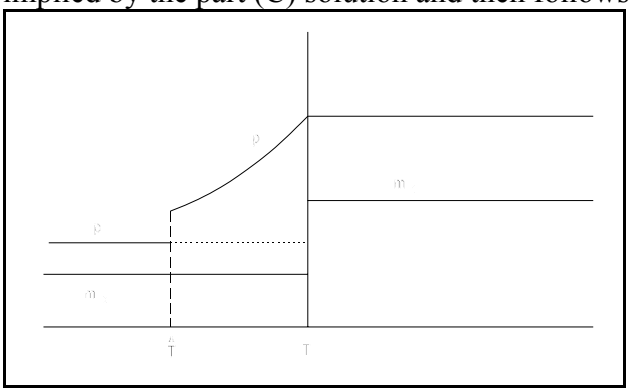
$$p_t = A_0 + \frac{1}{1+a_1} \sum_{j=0}^{I-1} \left(\frac{a_1}{1+a_1} \right)^j m_0 + \frac{1}{1+a_1} \sum_{j=I}^{\infty} \left(\frac{a_1}{1+a_1} \right)^j m_1$$

where I=T-t. When t is small compared to T (i.e., when T is far in the future, I is large. In that case, there are many terms in the first sum, and the terms in the second sum all are heavily discounted. The result is that p mostly reflects m_0. As time passes and t→T, I→0. The first summation declines and the second grows correspondingly, with the result that p increasingly reflects m_1 with the approach of T. Once T is reached, the first summation disappears altogether and the expression for p looks just like that in part (B), with p being a constant from T onward.



(D) If everybody believes $m=m_0$ forever, then we have the solution from part (B);

equivalently, we have the solution from part (C) with $m_1=m_0$. Either way you look at it, p is constant as long as the beliefs about the constancy of m are maintained. At T^ it is announced that m will jump to m_1 at the future date T>T^. From that point on, we have the solution of part (C) with $m_0<m_1$, so we have the solution of part (C), too. Thus p jumps at time T^ to the path implied by the part (C) solution and then follows that path thereafter.



(E) We have

$$M_{t+j} = (1+\mu)^j M_t$$

which implies that

$$m_{t+j} = m_t + j\gamma$$

where $\gamma=\ln(1+\mu)$. Then

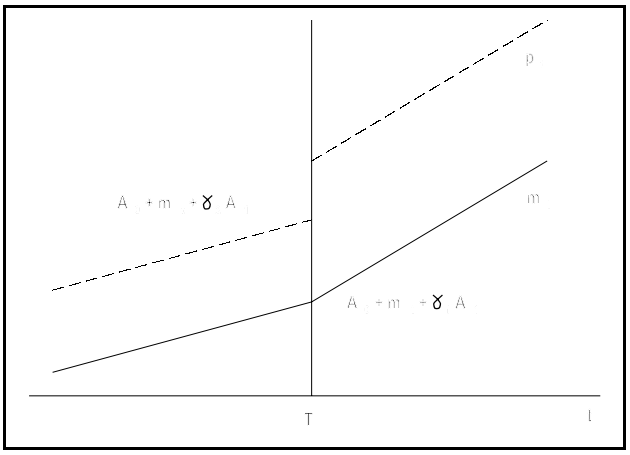
$$p_t = A_0 + m_t + \frac{1}{1+a_1}\sum_{j=0}^{\infty}\left(\frac{a_1}{1+a_1}\right)^j(j\gamma)$$

$$= A_0 + m_t + \gamma A_1$$

$$\text{where } A_1 = \frac{1}{1+a_1}\sum_{j=0}^{\infty}\left(\frac{a_1}{1+a_1}\right)^j(j)$$

Note that p grows at the same rate as m. See the figure in part F below.

(F) The time paths of p and m, for the case where money growth jumps from $\mu_0>0$ to $\mu_1>\mu_0$ are shown in the following figure:



(6) Start with the second part. Growth in real income makes people want to consume more. The increase in consumption demand is accompanied by an increase in money demand. An increase in money demand makes the price level fall, if there is no change in the nominal money supply. If there are continuing increases in the nominal money supply, growth in real income has the same effect on prices, but the effect may not be big enough to offset the increases in prices that would be caused the increases in the nominal money supply. We can say for sure that prices will rise less if there is growth in real income than if there isn't such growth. Consequently, Kemp is right; real "expansion" does "soak up" inflation.

If the government prints money faster than the public wants to absorb it, then the public will try to get rid of the excess money. The money can be spent on goods or it can be lent in the bond market. If people try to spend the money on goods, they will drive up the price level because there are no extra goods to buy with the excess money. If instead people try to lend the money, the interest rate will fall (because everybody is trying to lend), which makes demand for output rise and supply of output fall. The resulting excess demand for goods would make the price level rise. Either way, then, prices rise, and it is true that the resulting inflation reflects the fact that there is "too much money chasing too few goods."