

Homework 4 Answer Key

Show all your work. Graphs should be clearly labeled. The total for the homework is 5 points. Start early. Homework is due in class on Wednesday, March 24 (or if you cannot make it to class, drop it off in the main office, Buchanan Tower 997, by the end of the class). No late homeworks are excepted.

Problem 1 (2.5 points)

This is Example 8.2 from Champ-Freeman (page 160).

- a. Suppose that each of the economy's 600 young agents has deposits worth 100 goods with a bank no matter what the rate of return. Assume that the reserve requirement is 10 percent and the monetary base is \$3,000. Let $x > n$.
 - a. What is the total nominal money stock?
 - b. What is the value of a unit of fiat money?
 - c. What is the price of a good in units of fiat money?
 - d. How many goods would the government acquire if it increased the monetary base by 50 percent? (HINT: use equation (8.3) in text for seignorage revenue)
 - e. What is the real value of investment by banks?
- b. How would your answer to each question in part a change if the reserve requirement doubled to 20 percent? Explain each of these changes in your own words.
- c. Suppose the reserve requirement stays at 10 percent but banks voluntarily hold an extra 10 percent of deposits as fiat money reserves. Would answers to part b change?

ANSWER:

(a)

i. The total money stock, $(M1)_t$, is [equation (8.9), text]

$$(M1)_t = \frac{M_t}{\gamma} = \frac{\$3,000}{0.1} = (10)(\$3,000) = \$30,000$$

Note that the money multiplier in this economy is 10.

ii. We know that the value of fiat money is determined by the equality of the supply and demand for fiat money. The real supply of fiat money is M_t/P_t and the real demand arises solely from the banks' need for reserves, $\gamma N_t h_t$. We find that $M_t/P_t = \gamma N_t h_t$ so the value of fiat money (which is the reciprocal of the price level) is

$$v_t = \frac{1}{P_t} = \frac{\gamma N_t h_t}{M_t} = \frac{N_t h_t}{(M1)_t} = \frac{(600)(100)}{(30,000)} = \frac{60,000}{30,000} = 2$$

iii. The price of the consumption good is the inverse of the value of fiat money, so that $P_t = 1/2 = 0.5$.

iv. In this problem, the fiat money stock grows 50% each period ($M_t = 1.5M_{t-1}$) so that real seigniorage revenue is [equation (8.3), text]

$$v_t M_t \left[1 - \frac{1}{\mu} \right] = (2)(30,000) \left[1 - \frac{1}{1.5} \right] = 6,000 \left[1 - \frac{2}{3} \right] = 2000 \text{ goods}$$

Note that this is also equal to $\gamma N_t h_t \left[1 - \frac{1}{\mu} \right]$.

v. Banks have a total of 60,000 goods ($N_t h_t$) deposited each period. Of this, only $(1-\gamma) N_t h_t$ can be invested in capital (the rest is put into reserves). This amount is $(1-0.1)(60,000) = (0.9)(60,000) = 54,000$ goods.

(b) You should work these out in detail following the steps in part a. Be sure that you understand the intuition behind these results. Here are the answers.

- i. $(M1)_t = \$15,000 \leftarrow$ halved
- ii. $v_t = 4 \leftarrow$ doubled
- iii. $P_t = 0.25 \leftarrow$ halved
- iv. Seigniorage revenue = 4000 \leftarrow doubled
- v. Investment by banks \leftarrow smaller

(c) Your answers to part b would not change. It does not matter whether the law specifies a 20% reserve requirement or banks are voluntarily holding 20% reserves.

Problem 2 (2.5 points)

This is Exercise 9.1 from Champ-Freeman (page 180).

Suppose there is an unanticipated permanent decrease in transaction costs as represented by ϕ . Find its effect on s^* , the price level, the deposit-to-currency ratio, the money multiplier, the total nominal money stock, capital, and output. Explain each of these effects. Verify that the model economy displays a correlation between the nominal money stock and real output. Will a one-time increase in the monetary base cause an increase in real output?

ANSWER: An unanticipated permanent decrease in transaction costs from ϕ to ϕ' causes an increase in the rate of return on deposits (after transaction costs). It is represented by an upward shift in the curve that represents that rate of return (see Figure). The decrease in ϕ also increases the curvature of the curve. We are assuming that the rate of return on fiat money is 1. In general, it would be n/μ , of course.

As Figure shows, the decrease in ϕ causes a decline in s^ . This implies that there is a decrease in the minimum purchase size for which deposits offer a higher rate of return than fiat money. In the aggregate, more individuals will use deposits instead of fiat money. (This should make intuitive sense since the transaction costs associated with deposits have fallen.) In terms of our notation H_b , inside money, will increase and Q_b , outside money, will decrease. This causes an increase in the money multiplier, $(1 + H_t/Q_t)$. For a given fiat money stock, M_t , the total money stock, $(M1)_t$, will rise [see equation (9.4), text].*

Since Q_t falls, equation (9.1) tells us that the price level rises. The increase in H_t means that banks have more deposits with which to buy capital. The increase in intermediated capital will cause an increase in output next period.

We see that the model displays a correlation between the nominal money stock and real output (both go up, with the increase in output occurring one period later than the increase in the money stock).

A one-time increase in the fiat money stock will not cause an increase in real output. While prices and other nominal values will double, real output will stay the same unless real investment changes. Unlike the increase in inside money just studied, an increase in the monetary base does not represent an increase in real loans to fund capital investment and so will not have an effect on real output.

Unanticipated permanent decrease in transaction cost

