

Practice Set 9 – KEY

Banking & The Monetary System

This set contains problems for your own practice. It is highly recommended to work on the problems on your own. Do not just read the provided solutions. Instead, try to solve the problems and use the solutions only when you cannot continue on your own. Reading problems that someone else has solved has the same value for your preparation like watching someone else running a marathon on TV and then expecting to be able to run it, too. If you have questions on this set, please ask your section's teaching assistant.

- Bank A pays rate r_D to its depositors per year and it will always reserve 10% of deposits in case some depositors wish to withdraw cash from their accounts. Bank A can loan out funds to non-bank customers at rate r_L per year and can borrow funds from other banks for r_I per year, or by the CB for r_C per year. The CB has mandated that banks must have at least \$1 in cash, reserves, or other liquid assets for every 9 dollars of loans.

- Bank A has \$100 of checking deposits. How much can it loan out to customer X and how much will the bank earn?

Bank A must reserve \$10 and can loan out \$90 to customer X. Bank A will earn $(90r_L - 100r_D)$ per year.

- Bank A only has \$10 of its owner's money. How much can it loan out to customer X and how much will the bank earn if X spends the loan to vendor V who has an account at bank B? Assume that bank A can borrow funds from other banks (the interbank market).

The \$10 is sufficient capitalization for bank A to loan out \$90 to customer X. When X uses the loan to buy something from vendor V, bank A must transfer \$90 to V's account at bank B. Bank A already has \$10 and will go to the interbank market to borrow another \$80 at rate r_I . Bank A will earn $(90r_L - 80r_I)$ in the end of the year.

- Bank A only has \$10 of its owner's money. How much will bank A earn loaning to customer X, if X spends the loan to vendor V who has an account at bank B? Assume that the interbank market does not have excess funds to loan out.

If the interbank market does not have sufficient funds for lending, bank A will have to borrow the \$80 from the CB at rate r_C . In this case, bank A will earn $(90r_L - 80r_C)$.

- Bank A only has \$10 of its owner's money. How much will bank A earn loaning to customer X, if X spends the loan to vendor V who also has an account at bank A?

If V has an account with bank A, the bank does not need to borrow the \$80 because it can settle the transaction internally. It will just subtract the \$90 of credit from X's account and add them to V's account as deposits for which it already has \$9 (of its own \$10) to keep as reserves. In this case, bank A will earn $90r_L$, as it has zero cost for the money it loaned out because it created it entirely on its own.

- Rank cases (a), (b), (c) and (d) in terms of bank A's profitability.

Bank A makes the highest profit under case (d) because it has created money that never really needed to back up till the expiration of the loan to X. This, however, depends entirely on whether V has an account with bank A, which is beyond bank A's control. The second-best option is (a) because banks pay to depositors much lower rates than r_I or r_C . The third-best option should be (b) because when other banks have excess funds, they would be willing to lend them out at $r_I < r_C$ to not have the money sitting around earning nothing. Option (c) is still profitable, but it is the last resort.

- (f) Explain if bank A has created M1 money in (a), (b), (c) or (d).

In all cases, bank A has created M1 money in the form of credit. In (a) checking accounts were worth \$100 and another \$90 of spendable credit appeared. In (b), (c) and (d), bank A created \$90 worth of credit based only on its own \$10.

- (g) Explain if bank A has created wealth (beyond the value of its banking services) in (a), (b), (c) and (d).

No wealth was created in any of the cases. In (a) bank A channeled \$90 of its depositor's savings to customer X. At the end of the year, X will pay back the loan and the created credit of \$90 will disappear. In (b), (c) and (d), bank A assessed the promise of X that will repay the loan as "credible" and converted it into \$90 worth of credit. Again, at the end of the year, X will pay back the loan and the created credit of \$90 will disappear.

2. In the interbank market, banks who have more cash than they need can loan it out at a rate r_I to other banks who have less cash than they need. r_I is privately agreed upon between the lender bank and the borrower bank. Banks can also borrow directly from the CB at rate r_C or deposit their excess cash to the CB receiving an interest rate r_R . The CB sets r_C and r_R . Explain how the CB can also manipulate r_I .

r_I must be lower than r_C , otherwise banks in need of cash would never borrow from other banks because it would be cheaper to borrow from the CB. r_I must also be above r_R , otherwise banks who have excess cash will prefer to deposit it to the CB instead of lending it to other banks. Thus, $r_R < r_I < r_C$, so by controlling the upper and the lower bounds of r_I the CB can manipulate r_I . Notice that if the CB sets $r_C < r_R$, it can entirely eliminate the interbank money market. This would not be wise though, because the interbank money market allows for excess saving in one bank to be channeled to investment loans from another bank.

3. The Monetary Authority of Singapore (MAS) owns government securities valued at S\$6.3B. Singaporean households and firms own another S\$8.2B in government securities.

- (a) Explain how MAS can do Open Market Sales to decrease the money supply in Singapore by S\$183.2M?

MAS can place for sale securities valued slightly above S\$183.2M for exactly S\$183.2M (in order to make buyers interested). Individuals will buy those securities paying S\$183.2M to the MAS and the MAS will take the S\$183.2M out of circulation decreasing money supply by exactly S\$183.2M.

- (b) Explain how MAS can do Open Market Purchases to increase the money supply in Singapore by S\$96.73M?

MAS can offer to buy securities valued slightly below S\$96.73M for exactly S\$96.73M (in order to make the sellers interested). Those who will sell their securities will receive S\$96.73M of cash just issued by MAS, so now Money Supply (M1 money circulating in the economy) has increased by S\$96.73M.

4. A money market account offers an interest rate of 1% per month but charges you 4.5% for each withdrawal. You currently have \$24,000 in your checking account that yields no interest and you know that you need to spend \$2,000 per month.

- (a) How much money would you want to transfer to the money market account and how much you would leave in the checking account?

Any money you will transfer to the money market account must stay there for at least 5 months to acquire enough interest to cover the 4.5% withdrawal fee. If you withdraw it earlier, you will end up losing money. Thus, you will hold in cash the $5 \cdot 2,000 = \$10,000$ that you need to spend in the first 5 months and transfer the rest \$14,000 to the money market account.

- (b) Will you hold less or more cash for transactions if the monthly interest rate increases to 1.6%?

If the interest rate increases to 1.6% per month, leaving the money in the money market account for only 3 months will be enough to acquire a return of $3 \cdot 1.6\% = 4.8\%$ and cover the withdrawal commission of 4.5%. Thus, you will want to hold only $3 \cdot 2,000 = \$6,000$ in cash.

- (c) Explain how an increase in the interest rate like the one in (b) will affect M1 for transactions?

When the interest rate increases, individuals have a higher incentive to place their wealth in interest bearing assets such as money market accounts (which are not part of the M1) and hold less in cash and checking (which is part of the M1). That is, an increase in the interest rate makes people hold less M1 cash for transactions.

5. Bond A is a security that you can acquire for \$100, it will pay interest to you of \$10 per year, and after 30 years (at maturity), the issuer will buy it back from you for \$100. If you wish, you can sell your bond before its maturity at the so called "secondary market" to someone else at a price that you and the potential buyer agree to. If the bond is resold, the new buyer will be eligible to claim the interest every year and the \$100 principal at maturity.

- (a) How much is the interest rate on bond A?

If it yields \$10 per year and it costs \$100, its interest rate is implied to be 10% per year.

- (b) Two years after the issuing of bond A, a similar bond B is being issued offering an interest rate of 10%. How would this affect the price of bond A if its owner wanted to sell it?

Since bond A offers the same return as the new bond B, potential buyers would be indifferent between bond A and bond B. Bond A could still be sold for \$100.

- (c) Four years after the issuing of bond A, a similar bond C is being issued offering an interest rate of 20%. How would this affect the price of bond A if its owner wanted to sell it?

Since bond A offers a lower return than the new bond C, the owner of A should sell it for significantly less than \$100 in order to make it attractive to potential buyers. Otherwise, no one would prefer to buy bond A over bond C.

- (d) Six years after the issuing of bond A, a similar bond D is being issued offering an interest rate of 5%. How would this affect the price of bond A if its owner wanted to sell it?

Since bond A offers a higher return than the new bond D, the owner of A could sell it for more than \$100.

- (e) If you were a speculator, would you buy bonds at the secondary market when the interest rates were lower than usual or when they were higher than usual?

Speculators want to buy an asset when it is cheap and profit by reselling it when it becomes expensive. Speculators buy bonds when the interest rate increases because their prices fall.

- (f) Would you expect a bond speculator to hold more M1 money when the interest rate is low or when it is high?

When the interest rate is low, prices of bonds are high, so speculators sell their bonds at the secondary market receiving cash. Thus, M1 holdings for speculation are higher when the interest rate is low.

6. Consider the country of Cornovia, which produces only corn and nothing else. This year, Cornovia's real GDP was 1,000 kg of corn. Cornovia's Central Bank issues a fiat money supply of 500 cornals (the currency of Cornovia).

- (a) If the price of 1 kg of corn is 10 cornals, for how many transactions per year on average is a cornal used?

If there are 1,000 kg of corn to be transacted for 10 cornals each, the total value that has to be transacted is $1,000 \cdot 10 \text{ cornals} = 10,000 \text{ cornals}$. Since there are only 500 cornals available, each cornal should be used for $10,000/500 = 20$ transactions on average.

Cornovia's Central Bank prints another 50 cornals and gives it to the government for spending it to buy corn and trade it with another country for vaccines against cornvid-19.

- (b) If the number of average transactions for each cornal remains constant, what will happen to the price of corn?

Now there are in circulation 550 cornals capable of transacting value of $550 \cdot 20 = 11,000$ cornals. Cornovians now think that they have more purchasing value and when they attempt to spend it buying more corn, they will effectively increase the demand for corn. Since the supply of corn has not increased, the price of corn should increase to $11,000$ cornals / $1,000$ kg of corn or 11 cornals per kg.

- (c) How much purchasing power will a Cornovian lose if he holds 20 cornals?

From the increase in price from 10 to 11 cornals, we can figure that inflation is 10%. Thus, one who holds 20 cornals will lose the 10% of its purchasing value or equivalently 2 cornals.

- (d) How much purchasing power will all Cornovians who held cornals lose in total?

There is 10% inflation in Cornovia, thus they will lose the 10% of the 500 cornals they all together were holding. That is, $0.1 \cdot 500 = 50$ cornals. They all together lost exactly as much as the Central Bank printed and gave to the government. That is why we say that seignorage transfers purchasing power from the citizens to the government and that inflation acts like a tax.

- (e) How much purchasing power will a Cornovian lose if she used all her 20 cornals of cash holdings to buy 2 kg of corn right before the Central Bank printed the extra 50 cornals?

She will lose no purchasing power because she holds no cash. Only cash holders are affected by inflation, and thus, seignorage.