

Practice Set 9

Banking & The Monetary System

This set contains problems for your own practice. Do not just read the provided solutions — try to solve the problems first, and use the solutions only when you are stuck. Reading solutions without attempting the problems first has the same value for your preparation as watching someone else run a marathon and then expecting to be able to run it yourself. If you are unable to comprehend the solution of a problem even after reading the instructional answer key, you have most likely missed the relevant part of the material underlying this problem. Direct any questions about this problem set to your section's teaching assistant.

1. Bank A offers a 0.5% annual interest rate to its depositors and provides loans to clients at a 5% annual interest rate. The bank operates under a strict policy: it must hold at least \$1 in cash, reserves, or other liquid assets for every \$9 of outstanding credit it has provided. If Bank A requires additional reserves, it can borrow from other banks on the interbank market at a 1% annual rate, or from the Central Bank (CB) at a 2% annual rate. Currently, Bank A has received \$90 in deposits and also holds \$10 of its owner's money.
 - (a) How much can Bank A loan out to client X, if client X uses the loan to pay client Y, who also has an account at Bank A? What will the bank earn?
 - (b) What will the bank earn if X withdraws the loan in cash immediately upon approval? (Assume Bank A can borrow funds from the interbank market).
 - (c) What will the bank earn if X withdraws the loan in cash immediately upon approval but the interbank market does NOT have excess funds to lend?
2. The Monetary Authority of Singapore (MAS) holds government securities valued at S\$60.3B. Commercial banks in Singapore hold an additional S\$18.2B in government securities.
 - (a) Explain how MAS can conduct Open Market Sales to decrease the money supply in Singapore by S\$400M.
 - (b) Explain how MAS can conduct Open Market Purchases to increase the money supply in Singapore by S\$200M.
3. You currently have \$24,000 in a debit account that yields 0% interest. You know you will need exactly \$2,000 per month to cover your living expenses for the next 12 months. You are considering moving some of your funds into a money market account. This account offers an interest rate of 1% per month, but it charges a 4.5% withdrawal fee every time you take money out.
 - (a) How much money should you transfer to the money market account?
 - (b) If the money market account's monthly interest rate increases to 1.6%, will you hold more or less cash for your daily transactions?
 - (c) Based on your answers above, explain how an increase in the interest rate affects the demand for money.
4. Consider Cornovia, a country that exclusively produces corn. This year, Cornovia's real GDP is 1,000 kg of corn. The Central Bank of Cornovia has issued a fiat money supply of 500 cornals (the national currency) that Cornovians hold.
 - (a) If the price of 1 kg of corn is 10 cornals, how many transactions per year is a single cornal used for on average?
Cornovia's Central Bank prints an additional 50 cornals and gifts them to the government to buy corn and trade it with another country for vaccines against "cornvid-19."
 - (b) Assuming the average number of transactions per cornal remains constant, what will happen to the price of corn?

- (c) What percentage of *real purchasing power* did a cornal lose?
- (d) What is the *inflation rate* in Cornovia?
- (e) Why would the Central Bank print the extra 50 cornals knowing that this would weaken the currency?
- (f) How much real purchasing power will a Cornovian lose if she used her entire cash reserves of 20 cornals to buy 2 kg of corn right before the Central Bank printed the extra money?

Answer Key

1. Bank A offers a 0.5% annual interest rate to its depositors and provides loans to clients at a 5% annual interest rate. The bank operates under a strict policy: it must hold at least \$1 in cash, reserves, or other liquid assets for every \$9 of outstanding credit it has provided. If Bank A requires additional reserves, it can borrow from other banks on the interbank market at a 1% annual rate, or from the Central Bank (CB) at a 2% annual rate. Currently, Bank A has received \$90 in deposits and also holds \$10 of its owner's money.

- (a) How much can Bank A loan out to client X, if client X uses the loan to pay client Y, who also has an account at Bank A? What will the bank earn?

Bank A has $\$90 + \$10 = \$100$ in cash which is a sufficient base to issue a \$900 worth of total credit (based on its 1-to-9 ratio). It already has \$90 liability in credit from the deposits, so it can issue a loan of \$810 to X. Because no money leaves bank A, the bank's annual profit is the interest earned on the loan minus the interest paid to depositors: $810 \cdot 5\% - 90 \cdot 0.5\% = \40.05 per year.

- (b) What will the bank earn if X withdraws the loan in cash immediately upon approval? (Assume Bank A can borrow funds from the interbank market).

Bank A has \$90 in deposits, requiring \$10 in reserves, and must produce \$810 in cash for the loan withdrawal. Bank A's total cash needs are therefore \$820, but it only holds \$100 in cash, so it must borrow \$720 from the interbank market at a 1% interest rate. Bank A will earn $\$810 \cdot 5\% - \$90 \cdot 0.5\% - \$720 \cdot 1\% = \33.30 per year.

- (c) What will the bank earn if X withdraws the loan in cash immediately upon approval but the interbank market does NOT have excess funds to lend?

Bank A must borrow the \$720 from the Central Bank at a 2% interest rate. Bank A will earn $\$810 \cdot 5\% - \$90 \cdot 0.5\% - \$720 \cdot 2\% = \25.65 per year.

2. The Monetary Authority of Singapore (MAS) holds government securities valued at S\$60.3B. Commercial banks in Singapore hold an additional S\$18.2B in government securities.

- (a) Explain how MAS can conduct Open Market Sales to decrease the money supply in Singapore by S\$400M.

To remove S\$400 million from the money supply, MAS can sell government securities to commercial banks. To incentivize the banks to buy, MAS might offer these securities at a slight discount. When banks purchase these securities, the S\$400 million is deducted from their cash reserves. Consequently, the banks have S\$400 million less in reserves available to loan out to the public, which directly contracts the money supply.

- (b) Explain how MAS can conduct Open Market Purchases to increase the money supply in Singapore by S\$200M.

To inject S\$200 million into the economy, MAS can purchase government securities from commercial banks. To encourage the banks to sell, MAS might offer a slight premium (e.g., paying exactly S\$200 million for securities currently priced slightly below that amount in the market). When banks accept this offer, MAS pays for the securities by crediting the banks' reserve accounts with a total of S\$200 million, which banks can use to issue loans, thereby expanding the money supply.

3. You currently have \$24,000 in a debit account that yields 0% interest. You know you will need exactly \$2,000 per month to cover your living expenses for the next 12 months. You are considering moving some of your funds into a money market account. This account offers an interest rate of 1% per month, but it charges a 4.5% withdrawal fee every time you take money out.

- (a) How much money should you transfer to the money market account?

*Any funds transferred to the money market account must stay there long enough for the interest earned to exceed the 4.5% withdrawal fee. At 1% interest per month, the money must remain in the account for at least 5 months to become profitable. Thus, you will hold 5 months $\times$ \$2,000 = \$10,000 in your debit account and transfer the remaining **\$14,000** to the money market account. [Note: using compound rates in this question would not alter the answer]*

- (b) If the money market account's monthly interest rate increases to 1.6%, will you hold more or less cash for your daily transactions?

With a higher interest rate of 1.6% per month, it takes less time to overcome the 4.5% withdrawal fee. Leaving the money in the account for just 3 months yields $3 \times 1.6\% = 4.8\%$, which covers the fee. The break-even period is now shorter, so you only need to hold 3 months' worth of expenses in your debit account: $3 \times \$2,000 = \textbf{\$6,000}$. We could also have calculated the compound interest in this question, but the time period is too short, and it would not make a difference to the answer.

- (c) Based on your answers above, explain how an increase in the interest rate affects the demand for money.

A higher interest rate increases the opportunity cost of holding liquid M1 money (cash or debit). It incentivizes individuals to convert it into interest-bearing assets such as money market accounts, fixed deposits, or bonds. As interest rates rise, people choose to hold less cash or debit — demonstrating the inverse relationship between interest rates and money demand.

4. Consider Cornovia, a country that exclusively produces corn. This year, Cornovia's real GDP is 1,000 kg of corn. The Central Bank of Cornovia has issued a fiat money supply of 500 cornals (the national currency) that Cornovians hold.

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

The total value of all transactions in the economy is 1,000 kg of corn $\times$ 10 cornals/kg = 10,000 cornals. With only 500 cornals in circulation, the average number of transactions per cornal is: $10,000/500 = \textbf{20 transactions per cornal}$.

Cornovia's Central Bank prints an additional 50 cornals and gifts them to the government to buy corn and trade it with another country for vaccines against "cornvid-19."

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

There are now 550 cornals in circulation. The total value of transactions the money supply can support is $550 \times 20 = 11,000$ cornals, because each cornal is used for 20 transactions on average. Since citizens have more money to spend but the supply of actual corn has not changed (still 1,000 kg), the price of corn must rise: $11,000/1,000 = \textbf{11 cornals per kg}$.

- (c) What percentage of real purchasing power did a cornal lose?

A loss in real purchasing power is how much less the currency can buy. A cornal originally bought $1/10 = 0.1$ kg of corn. After the money printing, it buys $1/11 \approx 0.0909$ kg. The loss in purchasing power per cornal is $(0.1 - 0.0909)/0.1 = \textbf{9.1\%}$.

(d) What is the *inflation rate* in Cornovia?

*The inflation rate is the percentage increase in the price level. The price of corn rose from 10 to 11 cornals/kg, which amounts to **10%** inflation.*

(e) Why would the Central Bank print the extra 50 cornals knowing that this would weaken the currency?

Printing money allowed the government to acquire vaccines without raising income tax or sales tax, or issuing debt. By printing the extra 50 cornals, the Central Bank diluted the value of the pre-existing 500 cornals in circulation by 9.1%. Yet, this value was not lost. It was entirely transferred to the government. This perfectly illustrates seigniorage: printing money effectively transfers purchasing power from the citizens to the government, acting as a hidden "inflation tax".

(f) How much real purchasing power will a Cornovian lose if she used her entire cash reserves of 20 cornals to buy 2 kg of corn right before the Central Bank printed the extra money?

No purchasing power is lost. By converting fiat currency into a real asset (corn) before the inflation occurred, her wealth is protected. Only those holding cash or assets fixed in nominal terms are hurt by inflation.

Please report any typos, mistakes, or suggestions for improvement to kmarinakis@smu.edu.sg.