Section 3
The Money Market
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Objectives

• To know the roles of money.
• To know how to determine the money market equilibrium.
• To know how to relate the money market to exchange rates via the foreign exchange market and the uncovered interest parity condition.
• To understand exchange rate overshooting.
A Definition of Money

• Money
  – Commodity money versus fiat money
  – Assets widely used and accepted as a means of payment.
  – Money is very liquid, but pays little or no return.
A Definition of Money

• The roles of money
  – Unit of Account
    • A widely recognized measure of value.
    • If N goods, there are N(N-1)/2 prices. But, if one of those goods is the unit of account, need to know only (N-1) prices.
  – Store of Value
    • Transfer wealth or purchasing power through time.
    • Money is dominated in returns.
  – Medium of Exchange
    • A generally accepted means of payment.
    • The double coincidence of wants.
A Definition of Money

• Money Supply
  – An economy’s money supply is controlled by its central bank.
  – **Money Supply**: Currency + Checkable Deposits

• The value of Money
  – Commodity money: The marginal cost of producing the money.
  – Fiat money: The inverse of the price level (1/P)
The Demand for Money

• Factors that affect money demand:
  – Expected Return
  • The interest rate measures the opportunity cost of holding money rather than interest-bearing bonds.
  • A rise in the interest rate raises the cost of holding money and causes money demand to fall
The Demand for Money

– Risk

• Holding money is risky.

• An unexpected increase in the prices of goods and services could reduce the value of money in terms of the commodities consumed.

• Changes in the riskiness of money causes an equal change in the riskiness of bonds.
The Demand for Money

– Liquidity

• The main benefit of holding money comes from its liquidity.

• Households and firms hold money because it is an accepted medium of exchange.

• A rise in the average value of transactions carried out by a household or firm causes its demand for money to rise.
The Demand for Money

• The aggregate demand for money is

\[ M^d = PL(i, Y) \]

\( P \) is the price level
\( Y \) is real national income
\( L(i, Y) \) is the aggregate real money demand
  – A rise in \( i \) lowers real money demand.
  – A rise in \( Y \) raises real money demand
The Demand for Money

\[ L(i, Y) \]
The Demand for Money

A rise in real income

\[ L(i, \gamma) \]

\[ L(i, \gamma) \]
The Money Market Equilibrium

- The supply of money is: \( M^s = M \)
- The equilibrium in the money market requires:
  \[ M^s = M^d \]
- The money market equilibrium condition can be expressed in terms of aggregate real money demand as:
  \[ M/P = L(i, Y) \]
The Money Market Equilibrium

\[ \frac{M}{P} = \frac{L}{P}(i, Y) \]
The Money Market Equilibrium

• For a given level of output and price, an increase in the money supply reduces the interest rate.

• Open market operations.
  – To raise the stock of money, the central bank purchases government bonds on the open market.
  – This raises the price of bonds $q$.
  – This lowers interest rates, because $(1+i) = 1/q$. 
The Money Market Equilibrium

An rise in $M$, fixing $P$ and $Y$

$L(i, Y)$
The Money Market Equilibrium

• For a given level of money and price, an increase in real output raises the interest rate.
The Money Market Equilibrium

An rise in $Y$, fixing $P$ and $M$
The Money Market Equilibrium

• For the remainder of this section.
  – Prices are sticky: They are fixed in the very short run, but perfectly flexible in the long run.
  – Real output is constant in the very short run, and at constant at its full employment level in the long run.
The Exchange Rate in the Short Run

- The U.S. money market determines the USD interest rate $i$.
- The Foreign (Canadian) money market determines the CAD interest rate $i^\ast$.
- The interest parity condition links interest rates and exchange rate.
- Thus, home and foreign monetary policy affect both interest rates and exchange rate.
The Exchange Rate in the Short Run

- U.S. Money Market: $M/P = L(i,Y)$
- Canadian Money Market: $M^*/P^* = L(i^*,Y^*)$
- Foreign Exchange Market (via UIP):
  \[ i = i^* + (S^e - S)/S \]
  where $S$ is the price of the CAD.
- For now, we abstract from changes abroad.
The Exchange Rate in the Short Run

\[ \frac{M}{P} \]

USD Returns

Foreign exchange market

Money market

\[ S \]

\[ 0 \]

\[ \frac{M}{P} \]

\[ i^* + (S^e - S)/S \]

\[ L(i, Y) \]
The Exchange Rate in the Short Run

• Home monetary policy
  – In the short run, an increase in USD money supply reduces the USD interest rate.
  – A fall in USD interest rate causes the USD to depreciate in the foreign exchange market.
The Exchange Rate in the Short Run

A rise in $M$, fixing $P$, $Y$, and $i^*$

\[ i^* + \frac{(S^e - S)}{S} \]
The Exchange Rate in the Short Run

• Foreign monetary policy
  – An increase in foreign money supply reduces foreign interest rates $i^*$.  
  – A reduction in foreign interest rates causes an appreciation of the USD on the foreign exchange market (a fall in $S$).
The Exchange Rate in the Short Run

A rise in \( M^* \), fixing \( P \), \( Y \), and \( M \)

\[ i^* + \frac{(S^e - S)}{S} \]
The Exchange Rate in the Long Run

• The Long-run equilibrium
  – Prices are perfectly flexible and adjust to maintain output at full employment.
  – The money market equilibrium yields the long run price level:
    \[ P = \frac{M}{L(i,Y)} \]
  – An increase in money supply causes a proportional increase in prices.
The Exchange Rate in the Long Run

• The Long-Run Effects of Monetary Policy
  – Monetary policy is neutral in the long run: It has no effect on the long-run values of the interest rate or output.
  – In the long run, a permanent increase in money causes a proportional increase in prices: \( \pi = \Delta P/P = \Delta M/M \)
  – In the long-run, inflation is a monetary phenomenon: The inflation rate equals the growth rate of money.
The Exchange Rate in the Long Run

• Empirically, long-run changes in money supply and price levels are positively correlated.

• A permanent increase in a USD money supply causes a proportional long-run depreciation of the USD against foreign currencies.
  – Purchasing Power Parity: $P = SP^*$
  – An increase in the supply of a good reduces its price!
The Exchange Rate in the Long Run

In a cross-section of countries, long-term changes in money supplies and price levels show a clear positive correlation. (The diagonal line indicates exactly proportional changes in money supplies and price levels.)

Exchange Rate Dynamics

• Sticky or rigid prices:
  – In the very short-run, prices are fixed.
  – In the long-run, prices are perfectly flexible.
  – Prices adjust slowly to their long-run equilibrium.
  – Asset prices react much more rapidly than goods prices to economic events.
Exchange Rate Dynamics

- The effects of a permanent increase in USD money supply.
  - In the short-run, prices are fixed and output constant. The rise in $M$ reduces $i$, which causes a depreciation of the USD against foreign currencies (a rise in $S$).
  - In the long-run prices are flexible and output at full employment. The rise in $M$ does not affect $i$, but cause a depreciation of the USD (a rise in $S$).
Exchange Rate Dynamics

A permanent rise in $M$

(a) Short-run effects

(b) Long-run effects

\[ i^* + \left( S^o - S \right) / S \]

USD Rates of return

\[ M/P \]

\[ M/p \]

\[ L(i, Y) \]
Exchange Rate Dynamics

Time Paths of US Variables

\[ M \]
\[ M^2 \]
\[ M^1 \]
\[ t_0 \]
\[ t \]

\[ i \]
\[ i^1 \]
\[ i^2 \]
\[ t_0 \]
\[ t \]

\[ P \]
\[ P^2 \]
\[ P^1 \]
\[ t_0 \]
\[ t \]

\[ S \]
\[ S^2 \]
\[ S^3 \]
\[ S^1 \]
\[ t_0 \]
\[ t \]
Exchange Rate Dynamics

• Exchange Rate Overshooting
  – In the very short run, the exchange rate overshoots its long run value.
  – This occurs because American investors expect an of the USD (depreciation of foreign currency).
  – This appreciation is required for the equilibrium in the foreign exchange market. That is, the foreign rate of returns $i^* + (S^e - S)/S$ must fall to mimic the fall in USD returns $i$. 
Exchange Rate Dynamics

• Exchange Rate Overshooting
  – The overshooting behavior is a direct result of sticky prices and the uncovered interest parity condition.
  – Overshooting helps explain the large observed volatility of exchange rates.
Summary

• Aggregate money demand: $M^d = PL(i,Y)$, where $L_i < 0$ and $L_Y > 0$.

• Aggregate money supply: $M^s = M$

• The money market equilibrium: $M^d = M^s$

• An increase in money supply reduces interest rates, and cause a depreciation of the home currency against foreign currencies.
Summary

• Permanent changes in the money supply are neutral in the long run:
  – They do not affect output and interest rates in the long run.
  – They generate a proportional rise in prices in the long run.

• A permanent increase in the money supply causes the exchange rate to overshoot its long-run level in the short run.