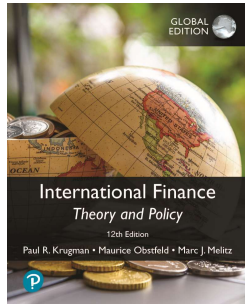


International Finance



Chapter 7

Fixed Exchange Rates and Foreign Exchange Intervention

Learning Objectives

7.1 Understand how a central bank must manage monetary policy so as to fix its currency's value in the foreign exchange market.

7.2 Describe and analyze the relationship among the central bank's foreign exchange reserves, its purchases and sales in the foreign exchange market, and the money supply.

7.3 Explain how monetary, fiscal, and sterilized intervention policies affect the economy under a fixed exchange rate.

7.4 Discuss causes and effects of balance of payments crises.

7.5 Describe how alternative multilateral systems for pegging exchange rates work

Preview

- Balance sheets of central banks
- Intervention in the foreign exchange markets and the money supply
- How the central bank fixes the exchange rate
- Monetary and fiscal policies under fixed exchange rates
- Financial market crises and capital flight
- Types of fixed exchange rates: reserve currency and gold standard systems

Introduction

- Many countries try to fix or “peg” their exchange rate to a currency or group of currencies by intervening in the foreign exchange markets.
- Many with a flexible or “floating” exchange rate in fact practice a **managed floating exchange rate**.
 - The central bank “manages” the exchange rate from time to time by buying and selling currency and assets, especially in periods of exchange rate volatility.
- How do central banks intervene in the foreign exchange markets?

Central Bank Intervention and the Money Supply

- To study the effects of central bank intervention in the foreign exchange markets, first construct a simplified balance sheet for the central bank.
 - This records the assets and liabilities of a central bank.
 - Balance sheets use double-entry bookkeeping: each transaction enters the balance sheet twice.

Central Bank's Balance Sheet (1 of 2)

- Assets
 - Foreign government bonds (official international reserves)
 - Gold (official international reserves)
 - Domestic government bonds
 - Loans to domestic banks (called discount loans in United States)
- Liabilities
 - Deposits of domestic banks
 - Currency in circulation (previously central banks had to give up gold when citizens brought currency to exchange)

Central Bank's Balance Sheet (2 of 2)

- Assets = Liabilities + Net Worth
 - If assume that net worth is constant, then
 - An increase in assets leads to an equal increase in liabilities.
 - A decrease in assets leads to an equal decrease in liabilities.
- Changes in the central bank's balance sheet lead to changes in currency in circulation or changes in deposits of banks, which lead to changes in the money supply.
 - If their deposits at the central bank increase, banks are usually able to use these additional funds to lend to customers, so amount of money in circulation increases.

Assets, Liabilities, and the Money Supply (1 of 2)

- A **purchase** of any asset by the central bank will be paid for with currency or a check written from the central bank,
 - both of which are denominated in domestic currency, and
 - both of which increase the supply of money in circulation.
 - The transaction leads to equal increases of assets and liabilities.
- When the central bank buys **domestic bonds or foreign bonds**, the domestic money supply increases.

Assets, Liabilities, and the Money Supply (2 of 2)

- A **sale** of any asset by the central bank will be paid for with currency or a check written to the central bank,
 - both of which are denominated in domestic currency.
 - The central bank puts the currency into its vault or reduces the amount of deposits of banks,
 - causing the supply of money in circulation to shrink.
 - The transaction leads to equal decreases of assets and liabilities.
- When the central bank sells **domestic bonds or foreign bonds**, the domestic money supply decreases.

Table 7.1 Effects of a \$100 Foreign Exchange Intervention: Summary

Domestic Central Bank's Action	Effect on Domestic Money Supply	Effect on Central Bank's Domestic Assets	Effect on Central Bank's Foreign Assets
Nonsterilized foreign exchange purchase	+\$100	0	+\$100
Sterilized foreign exchange purchase	0	-\$100	+\$100
Nonsterilized foreign exchange sale	-\$100	0	-\$100
Sterilized foreign exchange sale	0	+\$100	-\$100

They make a purchase of 100 => Ms +100

Foreign Exchange Markets

- Central banks trade foreign government bonds in the foreign exchange markets.
 - Foreign currency deposits and foreign government bonds are often substitutes: both are fairly liquid assets denominated in foreign currency.
 - Quantities of both foreign currency deposits and foreign government bonds that are bought and sold influence the exchange rate.

Sterilization

- Because buying and selling of foreign bonds in the foreign exchange markets affects the domestic money supply, a central bank may want to offset this effect.
- This offsetting effect is called **sterilization**.
- If the central bank sells foreign bonds in the foreign exchange markets, it can buy domestic government bonds in bond markets—hoping to leave the amount of money in circulation unchanged.

Fixed Exchange Rates (1 of 4)

- To fix the exchange rate, a central bank influences the quantities supplied and demanded of currency by trading domestic and foreign assets, so that the exchange rate (the price of foreign currency in terms of domestic currency) stays constant.
- Foreign exchange markets are in equilibrium when

$$R = R^* + \frac{(E^e - E)}{E}$$

- When the exchange rate is fixed at some level E^0 and the market expects it to stay fixed at that level, then

$$R = R^*$$

Fixed Exchange Rates (2 of 4)

- To fix the exchange rate, the central bank must trade foreign and domestic assets in the foreign exchange market until $R = R^*$.
- Alternatively, we can say that it adjusts the quantity of monetary assets in the money market until the domestic interest rate equals the foreign interest rate, given the level of average prices and real output:

$$\frac{M^s}{P} = L(R^*, Y)$$

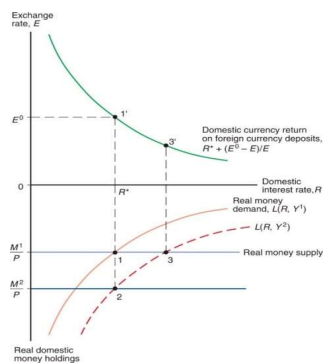
Fixed Exchange Rates (3 of 4)

- Suppose that the central bank has fixed the exchange rate at E^0 but the level of output rises, raising the demand of real monetary assets.
- This is predicted to put upward pressure on interest rates and the value of the domestic currency.
- How should the central bank respond if it wants to fix exchange rates?

Fixed Exchange Rates (4 of 4)

- The central bank should buy foreign assets in the foreign exchange markets,
 - thereby increasing the domestic money supply,
 - thereby reducing interest rates in the short run.
- Alternatively, by demanding (buying) assets denominated in foreign currency and by supplying (selling) domestic currency, the price/value of foreign currency is increased and the price/value of domestic currency is decreased.

Figure 7.1
Asset
Market
Equilibrium
With a
Fixed
Exchange
Rate, E^0

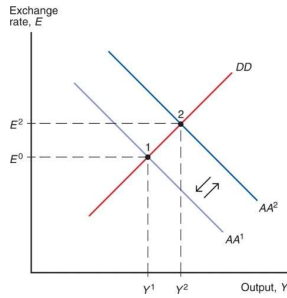


To hold the exchange rate fixed at E^0 when output rises from Y^1 to Y^2 , the central bank must purchase foreign assets and thereby raise the money supply from M^1 to M^2 .

Monetary Policy and Fixed Exchange Rates

- When the central bank buys and sells foreign assets to keep the exchange rate fixed and to maintain domestic interest rates equal to foreign interest rates, it is not able to adjust domestic interest rates to attain other goals.
 - In particular, monetary policy is ineffective in influencing output and employment.

Figure 7.2
Monetary
Expansion
Is
Ineffective
Under a
Fixed
Exchange
Rate

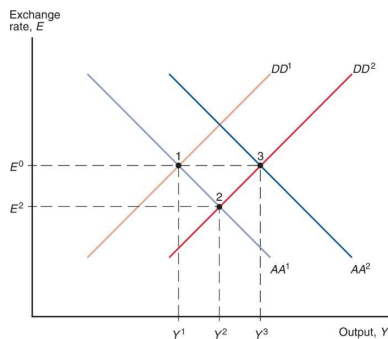


Initial equilibrium is shown at point 1, where the output and asset markets simultaneously clear at a fixed exchange rate of E^0 and an output level of Y^1 . Hoping to increase output to Y^2 , the central bank decides to increase the money supply by buying domestic assets and shifting AA^1 to AA^2 . Because the central bank must maintain E^0 , however, it has to sell foreign assets for domestic currency, an action that decreases the money supply immediately and returns AA^2 back to AA^1 . The economy's equilibrium therefore remains at point 1, with output unchanged at Y^1 .

Fiscal Policy and Fixed Exchange Rates in the Short Run

- Temporary changes in fiscal policy are more effective in influencing output and employment in the short run:
 - The rise in aggregate demand and output due to expansionary fiscal policy raises demand for real monetary assets, putting upward pressure on interest rates and on the value of the domestic currency.
 - To prevent an appreciation of the domestic currency, the central bank must buy foreign assets, thereby increasing the money supply and decreasing interest rates.

Figure 7.3
Fiscal
Expansion
Under a
Fixed
Exchange
Rate



Fiscal expansion (shown by the shift from DD^1 to DD^2) and the intervention that accompanies it (the shift from AA^1 to AA^2) move the economy from point 1 to point 3.

Fiscal Policy and Fixed Exchange Rates in the Long Run (1 of 2)

- When the exchange rate is fixed, there is no real appreciation of the value of domestic products in the short run.
- But when output is above its potential level, wages and prices tend to rise in the long run.
- A rising price level makes domestic products more expensive:
a **real** appreciation ($\frac{EP^*}{P}$ falls).
 - Aggregate demand and output decrease as prices rise: *DD* curve shifts left.
 - Prices tend to rise until employment, aggregate demand, and output fall to their normal (potential or natural) levels.

Fiscal Policy and Fixed Exchange Rates in the Long Run (2 of 2)

- Prices are predicted to change proportionally to the change in the money supply when the central bank intervenes in the foreign exchange markets.
 - *AA* curve shifts down (left) as prices rise.
 - Nominal exchange rates will be constant (as long as the fixed exchange rate is maintained), but the real exchange rate will be lower (a real appreciation).

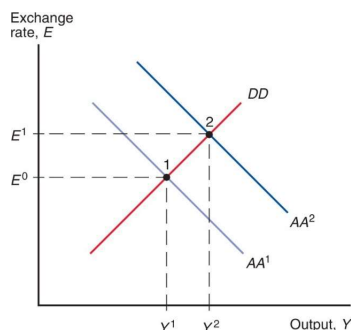
Devaluation and Revaluation

- **Depreciation** and **appreciation** refer to changes in the value of a currency due to market changes.
- **Devaluation** and **revaluation** refer to changes in a fixed exchange rate caused by the central bank.
 - With devaluation, a unit of domestic currency is made less valuable, so that more units must be exchanged for 1 unit of foreign currency.
 - With revaluation, a unit of domestic currency is made more valuable, so that fewer units need to be exchanged for 1 unit of foreign currency.

Devaluation

- For devaluation to occur, the central bank buys foreign assets, so that domestic monetary assets increase and domestic interest rates fall, causing a fall in the rate return on domestic currency deposits.
 - Domestic products become less expensive relative to foreign products, so aggregate demand and output increase.
 - Official international reserve assets (foreign bonds) increase.

Figure 7.4
Effect of a
Currency
Devaluation



When a currency is devalued from E^0 to E^1 , the economy's equilibrium moves from point 1 to point 2 as both output and the money supply expand.

Financial Crises and Capital Flight (1 of 6)

- When a central bank does not have enough official international reserve assets to maintain a fixed exchange rate, a **balance of payments crisis** results.
 - To sustain a fixed exchange rate, the central bank must have enough foreign assets to sell in order to satisfy the demand of them at the fixed exchange rate.

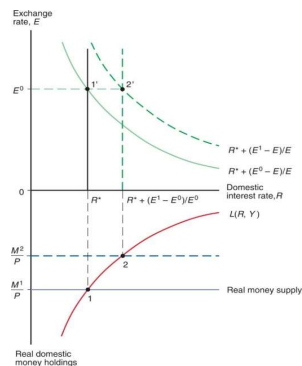
Financial Crises and Capital Flight (2 of 6)

- Investors may expect that the domestic currency will be devalued, causing them to want foreign assets instead of domestic assets, whose value is expected to fall soon.
- This expectation or fear only makes the balance of payments crisis worse:
 - Investors rush to change their domestic assets into foreign assets, depleting the stock of official international reserve assets more quickly.

Financial Crises and Capital Flight (3 of 6)

- As a result, financial capital is quickly moved from domestic assets to foreign assets: **capital flight**.
 - The domestic economy has a shortage of financial capital for investment and has low aggregate demand.
- To avoid this outcome, domestic assets must offer high interest rates to entice investors to hold them.
 - The central bank can push interest rates higher by reducing the money supply (by selling foreign and domestic assets).
- As a result, the domestic economy may face high interest rates, a reduced money supply, low aggregate demand, low output, and low employment.

Figure 7.5
Capital Flight, the Money Supply, and the Interest Rate



To hold the exchange rate fixed at E^0 after the market decides it will be devalued to E^1 , the central bank must use its reserves to finance a private financial outflow that shrinks the money supply and raises the home interest rate.

Financial Crises and Capital Flight (4 of 6)

- Expectations of a balance of payments crisis only worsen the crisis and hasten devaluation.
 - What causes expectations to change?
 - Expectations about the central bank's ability and willingness to maintain the fixed exchange rate.
 - Expectations about the economy: shrinking demand of domestic products relative to foreign products means that the domestic currency should become less valuable.
- In fact, expectations of devaluation can cause a devaluation: a **self-fulfilling crisis**.

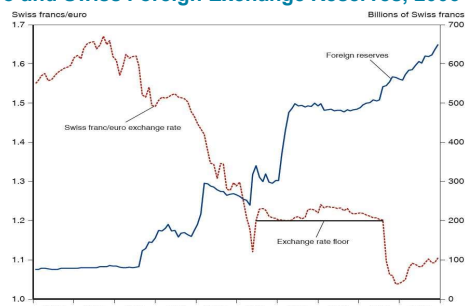
Financial Crises and Capital Flight (5 of 6)

- What happens if the central bank runs out of official international reserve assets (foreign assets)?
- It must devalue the domestic currency so that it takes more domestic currency (assets) to exchange for 1 unit of foreign currency (asset).
 - This will allow the central bank to replenish its foreign assets by buying them back at a devalued rate,
 - increasing the money supply,
 - reducing interest rates,
 - reducing the value of domestic products,
 - increasing aggregate demand, output, and employment over time.

Financial Crises and Capital Flight (6 of 6)

- In a balance of payments crisis,
 - the central bank may buy domestic bonds and sell domestic currency (to increase the money supply) to prevent high interest rates, but this only depreciates the domestic currency more.
 - the central bank generally cannot satisfy the goals of low domestic interest rates (relative to foreign interest rates) and fixed exchange rates simultaneously.

Figure 7.6 The Swiss Franc's Exchange Rate against the Euro and Swiss Foreign Exchange Reserves, 2006–2016



The Swiss National Bank intervened heavily to slow the Swiss franc's appreciation against the euro, setting a floor under the price of the euro in September 2011 and abandoning that floor in January 2015.

Source: Swiss National Bank.

Interest Rate Differentials (1 of 3)

- For many countries, the expected rates of return are not the same: $R > R^* + \frac{(E^e - E)}{E}$. Why?
- Default risk:**
The risk that the country's borrowers will default on their loan repayments. Lenders therefore require a higher interest rate to compensate for this risk.
- Exchange rate risk:**
If there is a risk that a country's currency will depreciate or be devalued, then domestic borrowers must pay a higher interest rate to compensate foreign lenders.

Interest Rate Differentials (2 of 3)

- Because of these risks, domestic assets and foreign assets are not treated the same.
 - Previously, we assumed that foreign and domestic currency deposits were **perfect substitutes**: deposits everywhere were **treated as the same** type of investment, because risk and liquidity of the assets were assumed to be the same.
 - In general, foreign and domestic assets may **differ** in the amount of risk that they carry: they may be **imperfect substitutes**.
 - Investors consider these risks, as well as rates of return on the assets, when deciding whether to invest.

Interest Rate Differentials (3 of 3)

- A difference in the risk of domestic and foreign assets is one reason why expected rates of return are not equal across countries:

$$R = R^* + \frac{(E^e - E)}{E} + \rho$$

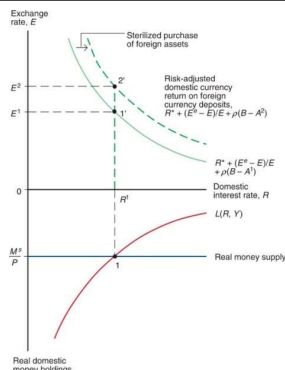
where ρ is called a **risk premium**, an additional amount needed to compensate investors for investing in risky domestic assets.

- The risk could be caused by default risk or exchange rate risk.

The Rescue Package: Reducing ρ

- The United States and IMF set up a \$50 billion fund to guarantee the value of loans made to Mexico's government,
 - reducing default risk,
 - and reducing exchange rate risk, since foreign loans could act as official international reserves to stabilize the exchange rate if necessary.
- After a recession in 1995, the economy began to recover.
 - Mexican goods were relatively inexpensive, allowing production to increase.
 - Increased demand of Mexican products relative to demand of foreign products stabilized the value of the peso and reduced exchange rate risk.

Figure 7.7
Effect of a
Sterilized
Central Bank
Purchase of
Foreign Assets
Under
Imperfect Asset
Substitutability



A sterilized purchase of foreign assets leaves the money supply unchanged but raises the risk-adjusted return that domestic currency deposits must offer in equilibrium. As a result, the return curve in the upper panel shifts up and to the right. Other things equal, this depreciates the domestic currency from E^1 to E^2 .

Types of Fixed Exchange Rate Systems

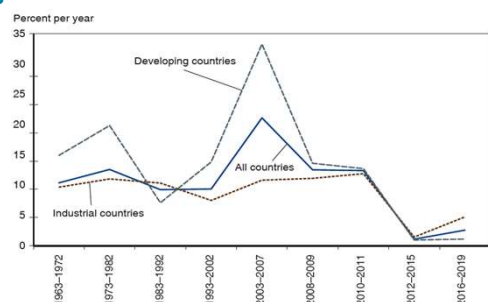
1. **Reserve currency system:** one currency acts as official international reserves
 - The U.S. dollar was the currency that acted as official international reserves from under the fixed exchange rate system from 1944 to 1973.
 - All countries except the United States held U.S. dollars as the means to make official international payments.
2. **Gold standard:** gold acts as official international reserves that all countries use to make official international payments.

Reserve Currency System

- From 1944 to 1973, central banks throughout the world fixed the value of their currencies relative to the U.S. dollar by buying or selling domestic assets in exchange for dollar denominated assets.
- Arbitrage ensured that exchange rates between any two currencies remained fixed.
 - Suppose Bank of Japan fixed the exchange rate at 360¥/US\$1 and the Bank of France fixed the exchange rate at 5Ffr/US\$1.
 - The yen/franc rate was $\frac{\left(\frac{360¥}{US\$1}\right)}{\left(\frac{5Ffr}{US\$1}\right)} = \frac{72¥}{1Ffr}$.
 - If not, then currency traders could make an easy profit by buying currency where it was cheap and selling it where it was expensive.

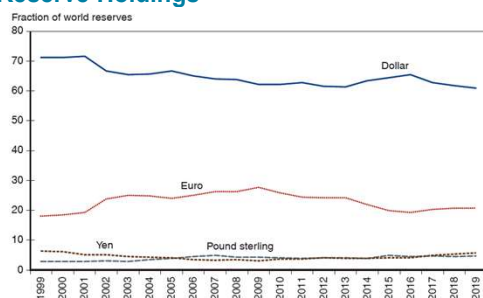
Gold and Silver Standard

- **Bimetallic standard:** the value of currency is based on both silver and gold.
- The United States used a bimetallic standard from 1837 to 1861.
- Banks coined specified amounts of gold or silver into the national currency unit.
 - 371.25 grains of silver or 23.22 grains of gold could be turned into a silver or a gold dollar
 - So gold was worth $371.25 / 23.22 = 16$ times as much as silver.
 - See www.micheloud.com for a fun description of the bimetallic standard, the gold standard after 1873, and the **Wizard of Oz!**

Figure 7.8 Growth Rates of International Reserves

Annualized growth rates of international reserves did not decline sharply after the early 1970s. Recently, developing countries have added large sums to their reserve holdings, but their pace of accumulation has slowed starting with the crisis years of 2008–2009. The figure shows averages of annual growth rates.

Source: International Monetary Fund.

Figure 7.9 Currency Composition of Global Reserve Holdings

While the euro's role as a reserve currency increased during the first decade of its existence, it has taken a hit after the euro crisis. The dollar remains the overwhelming favorite.

Source: International Monetary Fund, Currency Composition of Foreign Exchange Reserves (COFER), at <http://www.imf.org/external/np/sta/cofer/eng/index.htm>. These data cover only the countries that report reserve composition to the IMF.

Summary (1 of 4)

- Changes in a central bank's balance sheet lead to changes in the domestic money supply.
 - Buying domestic or foreign assets increases the domestic money supply.
 - Selling domestic or foreign assets decreases the domestic money supply.
- When markets expect exchange rates to be fixed, domestic and foreign assets have equal expected returns if they are treated as perfect substitutes.

Summary (2 of 4)

- 3. Monetary policy is ineffective in influencing output or employment under fixed exchange rates.
- 4. Temporary fiscal policy is more effective in influencing output and employment under fixed exchange rates, compared to under flexible exchange rates.

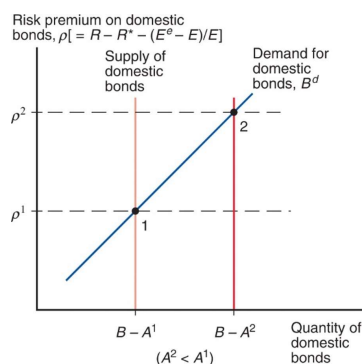
Summary (3 of 4)

- 5. A balance of payments crisis occurs when a central bank does not have enough official international reserves to maintain a fixed exchange rate.
- 6. Capital flight can occur if investors expect a devaluation, which may occur if they expect that a central bank can no longer maintain a fixed exchange rate: self-fulfilling crises can occur.
- 7. Domestic and foreign assets may not be perfect substitutes due to differences in default risk or due to exchange rate risk.

Summary (4 of 4)

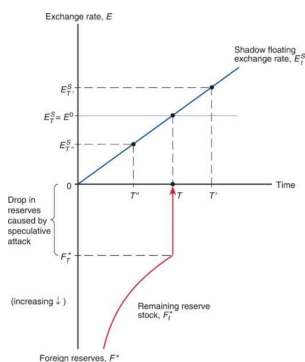
- 8. Under a reserve currency system, all central banks but the one that controls the supply of the reserve currency trade the reserve currency to maintain fixed exchange rates.
- 9. Under a gold standard, all central banks trade gold to maintain fixed exchange rates.

Figure 7A1.1
The Domestic
Bond Supply
and the Foreign
Exchange Risk
Premium Under
Imperfect Asset
Substitutability



An increase in the supply of domestic currency bonds that the private sector must hold raises the risk premium on domestic currency assets.

Figure 7A2.1
How the
Timing of a
Balance of
Payments
Crisis Is
Determined



The market stages a speculative attack and buys the remaining foreign reserve stock F_t^* at time T , which is when the shadow floating exchange rate E_t^s just equals the pre-collapse fixed exchange rate E^0 .
