Output, the Interest Rate, and the Exchange Rate

CHAPTER 20

Output, the Interest Rate, and the Exchange Rate

The model developed in this chapter is an extension of the open economy IS-LM model, known as the **Mundell-Fleming model**.

The main questions we try to solve are:

What determines the exchange rate?

How can policy makers affect exchange rates?

20-1   Equilibrium in the Goods Market

Equilibrium in the goods market can be described by the following equations:

$$Y = C(Y-T) + I(Y,r) + G - IM(Y,\varepsilon)/\varepsilon + X(Y^*,\varepsilon)$$
$$\quad (+) \quad\quad (+,-) \quad\quad\quad (+,-) \quad\quad (+,+)$$

$$NX(Y,Y^*,\varepsilon) \equiv X(Y^*,\varepsilon) - IM(Y,\varepsilon)/\varepsilon$$

$$Y = C(Y-T) + I(Y,r) + G + NX(Y,Y^*,\varepsilon)$$
$$\quad (+) \quad\quad (+,-) \quad\quad\quad (-,+,+)$$

Equilibrium in the Goods Market

- Consumption *C* depends positively on disposable income *Y-T*.
- Investment *I* depends positively on output *Y*, and negatively on the real interest rate *r*.
- Government spending G is taken as given.
- The quantity of imports IM depends positively on both output Y and the real exchange rate ε.
- Exports X depend positively on foreign output Y* and negatively on the real exchange rate ε.

Equilibrium in the Goods Market

$$Y = \underset{(+)}{C(Y-T)} + \underset{(+,-)}{I(Y,r)} + G + \underset{(-,+,+)}{NX(Y,Y^*,\varepsilon)}$$

The main implication of this equation is that both the real interest rate and the real exchange rate affect demand and, in turn, equilibrium output:

- An increase in the real interest rate leads to a decrease in investment spending, and to a decrease in the demand for domestic goods.
- An increase in the real exchange rate leads to a shift in demand toward foreign goods, and to a decrease in net exports.

Equilibrium in the Goods Market

In this chapter we make two simplifications:

- Both the domestic and the foreign price levels are given; thus, the nominal and the real exchange rate move together:

$$\frac{P^*}{P} = 1 \Rightarrow \varepsilon = E$$

- There is no inflation, neither actual nor expected.

$$\pi^e = 0, \ so \ r = i$$

Then, the equilibrium condition becomes:

$$Y = \underset{(+)}{C(Y-T)} + \underset{(+,-)}{I(Y,r)} + G + \underset{(-,+,+)}{NX(Y,Y^*,E)}$$

Equilibrium in Financial markets

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Now that we look at a financially open economy, we must also take into account the fact that people have a choice between domestic bonds and foreign bonds.

Money Versus Bonds

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We wrote the condition that the supply of money be equal to the demand for money as:

$$\frac{M}{P} = YL(i)$$

We can use this equation to think about the determination of the nominal interest rate in an open economy.

Domestic Bonds Versus Foreign Bonds

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What combination of domestic and foreign bonds should financial investors choose in order to maximize expected returns?

$$(1+i_t) = (1+i^*_t) + \left(\frac{E_t}{E^e_{t+1}} \right)$$

The left side gives the return, in terms of domestic currency. The right side gives the expected return, also in terms of domestic currency. In equilibrium, the two expected returns must be equal.

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Domestic Bonds Versus Foreign Bonds

$$(1+i_t)=(1+i^*_t)+\frac{E_t}{E^e_{t+1}}$$

If the expected future exchange rate is given, then:

$$E_t=\frac{1+i_t}{1+i^*_t}E^e_{t+1}$$

The current exchange rate is:

$$E=\frac{1+i}{1+i^*}\overline{E}^e$$

Domestic Bonds Versus Foreign Bonds

An increase in the U.S. interest rate, say, after a monetary contraction, will cause the U.S. interest rate to increase, and the demand for U.S. bonds to rise. As investors switch from foreign currency to dollars, the dollar appreciates.

The more the dollar appreciates, the more investors expect it to depreciate in the future.

The initial dollar appreciation must be such that the expected future depreciation compensates for the increase in the U.S. interest rate. When this is the case, investors are again indifferent and equilibrium prevails.

Domestic Bonds Versus Foreign Bonds

Figure 20 - 1

The Relation Between the Interest Rate and the Exchange Rate Implied by Interest Parity

A higher domestic interest rate leads to a higher exchange rate – an appreciation.

Putting Goods and Financial Markets Together

Goods-market equilibrium implies that output depends, among other factors, on the interest rate and the exchange rate.

$$Y = C(Y - T) + I(Y,i) + G + NX(Y,Y^*,E)$$

Putting Goods and Financial Markets Together

The interest rate is determined by the equality of money supply and money demand:

$$\frac{M}{P} = YL(i)$$

The interest-parity condition implies a negative relation between the domestic interest rate and the exchange rate:

$$E=\frac{1+i}{1+i^*}\overline{E}^e \qquad \begin{array}{c} i\uparrow \Rightarrow E\downarrow \\ i\downarrow \Rightarrow E\uparrow \end{array}$$

Putting Goods and Financial Markets Together

The open-economy versions of the *IS* and *LM* relations are:

$$IS:\ Y=C(Y-T)+I(Y,i)+G+NX\left(Y,Y^*,\frac{1+i}{1+i^*}\overline{E}^e\right)$$

$$LM:\ \frac{M}{P} = YL(i)$$

- Changes in the interest rate affect the economy directly through investment,
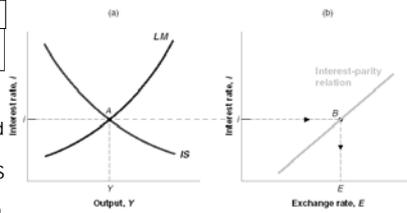- indirectly through the exchange rate.

Putting Goods and Financial Markets Together

Figure 20 - 2

The IS-LM Model in the Open Economy

An increase in the interest rate reduces output both directly and indirectly (through the exchange rate). The IS curve is downward sloping. Given the real money stock, an increase in output increases the interest rate: The LM curve is upward sloping.

The Effects of Policy in an Open Economy

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Figure 20 - 3

The Effects of an Increase in Government Spending

An increase in government spending leads to an increase in output, an increase in the interest rate, and an appreciation.
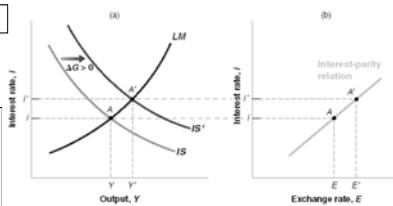
The increase in government spending shifts the *IS* curve to the right. It shifts neither the *LM* curve nor the interest-parity curve.

The Effects of Policy in an Open Economy

Can we tell what happens to the various components of demand for money when the government increases spending:

- Consumption and government spending both go up.
- The effect of government spending on investment was ambiguous in the closed economy, it remains ambiguous in the open economy.
- Both the increase in output and the appreciation combine to decrease net exports.

The Effects of Monetary Policy in an Open Economy

Figure 20 - 4
The Effects of a Monetary Contraction

A monetary contraction leads to a decrease in output, an increase in the interest rate, and an appreciation.

A monetary contraction shifts the *LM* curve up. It shifts neither the *IS* curve nor the interest-parity curve.

FOCUS

Monetary Contraction, and Fiscal Expansion: The United States in the Early 1980s

Table 1   The Emergence of Large U.S. Budget Deficits, 1980-1984

	1980	1981	1982	1983	1984
Spending	22.0	22.8	24.0	25.0	23.7
Revenues	20.2	20.8	20.5	19.4	19.2
Personal taxes	9.4	9.6	9.9	8.8	8.2
Corporate taxes	2.6	2.3	1.6	1.6	2.0
Budget surplus (-:deficit)	−1.8	−2.0	−3.5	−5.6	−4.5

Numbers are for fiscal years, which start in October of the previous calendar year. All numbers are expressed as a percentage of GDP.

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Monetary Contraction, and Fiscal Expansion: The United States in the Early 1980s

Supply siders—a group of economists who argued that a cut in tax rates would boost economic activity.

High output growth and dollar appreciation during the early 1980s resulted in an increase in the trade deficit. A higher trade deficit, combined with a large budget deficit, became know as the **twin deficits** of the 1980s.

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Monetary Contraction, and Fiscal Expansion: The United States in the Early 1980s

Table 2   Major U.S. Macroeconomic Variables, 1980-1984

	1980	1981	1982	1983	1984
GDP Growth (%)	–0.5	1.8	–2.2	3.9	6.2
Unemployment rate (%)	7.1	7.6	9.7	9.6	7.5
Inflation (CPI) (%)	12.5	8.9	3.8	3.8	3.9
Interest rate (nominal) (%)	11.5	14.0	10.6	8.6	9.6
(real) (%)	2.5	4.9	6.0	5.1	5.9
Real exchange rate	85	101	111	117	129
Trade surplus (–: deficit) (% of GDP)	-0.5	-0.4	-0.6	-1.5	-2.7

Inflation: Rate of change of the CPI. The nominal interest rate is the three-month T-bill rate. The real interest rate is equal to the nominal rate minus the forecast of inflation by DRI, a private forecasting firm. The real exchange rate is the trade-weighted real exchange rate, normalized so that 1973 = 100

20-5   ## Fixed Exchange Rates

Central banks act under implicit and explicit exchange-rate targets and use monetary policy to achieve those targets.

Pegs, Crawling Pegs, Bonds, the EMS, and the Euro

Some countries operate under *fixed exchange rates.* These countries maintain a fixed exchange rate in terms of some foreign currency. Some **peg** their currency to the dollar.

Some countries operate under a **crawling peg**. These countries typically have inflation rates that exceed the U.S. inflation rate.

Pegs, Crawling Pegs, Bonds, the EMS, and the Euro

Some countries maintain their bilateral exchange rates within some bands. The most prominent example is the **European Monetary System (EMS).** Under the EMS rules, member countries agreed to maintain their exchange rate vis-á-vis the other currencies in the system within narrow limits or **bands** around a **central parity.**

Some countries moved further, agreeing to adopt a common currency, the **Euro**, in effect, adopting a "fixed exchange rate."

Pegging the Exchange Rate, and Monetary Control

The interest parity condition is:

$$(1+i_t)=(1+i^*_t)+\left(\frac{E_t}{E^e_{t+1}}\right)$$

Pegging the exchange rate turns the interest parity relation into:

$$(1+i_t)=(1+i^*_t)\Rightarrow i_t=i^*_t$$

Pegging the Exchange Rate, and Monetary Control

In words: *Under a fixed exchange rate and perfect capital mobility, the domestic interest rate must be equal to the foreign interest rate.*

Increases in the domestic demand for money must be matched by increases in the supply of money in order to maintain the interest rate constant, so that the following condition holds:

$$\frac{M}{P}=YL(i^*)$$

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Fiscal Policy Under Fiscal Fixed Exchange Rates

Figure 20 - 5

The Effects of a Fiscal Expansion Under Fixed Exchange Rates

Under flexible exchange rates, a fiscal expansion increases output, from Y_A to Y_B. Under fixed exchange rates, output increases from Y_A to Y_C.

The central bank must accommodate the resulting increase in the demand for money.

Fiscal Policy Under Fixed Exchange Rates

There are a number of reasons why countries choosing to fix its interest rate appears to be a bad idea:

- By fixing the exchange rate, a country gives up a powerful tool for correcting trade imbalances or changing the level of economic activity.
- By committing to a particular exchange rate, a country also gives up control of its interest rate, and they must match movements in the foreign interest rate risking unwanted effects on its own activity.

Fiscal Policy Under Fixed Exchange Rates

There are a number of reasons why countries choosing to fix its interest rate appears to be a bad idea:

- Although the country retains control of fiscal policy, one policy instrument is not enough. A country that wants to decrease its budget deficit cannot, under fixed exchange rates, use monetary policy to offset the contractionary effect of its fiscal policy on output.

German Unification, Interest Rates, and the EMS

Table 1 German Unification, Interest Rates, and Output Growth: Germany, France, and Belgium, 1990-1992

	Nominal Interest Rates (%)			Inflation (%)		
	1990	1991	1992	1990	1991	1992
Germany	8.5	9.2	9.5	2.7	3.7	4.7
France	10.3	9.6	10.3	2.9	3.0	2.4
Belgium	9.6	9.4	9.4	2.9	2.7	2.4

	Real Interest Rates (%)			GDP Growth (%)		
	1990	1991	1992	1990	1991	1992
Germany	5.7	5.5	4.8	5.7	4.5	2.1
France	7.4	6.6	7.9	2.5	0.7	1.4
Belgium	6.7	6.7	7.0	3.3	2.1	0.8

The nominal interest rate is the short term nominal interest rate. The real interest rate is the realized real interest rate over the year – that is, the nominal interest rate minus actual inflation over the year. All rates are annual.

Key Terms

▪ Mundell-Fleming model	▪ European Monetary System (EMS)
▪ supply siders	▪ bands
▪ twin deficits	▪ central parity
▪ peg	▪ Euro
▪ crawling peg	