ECU44161/63 International Macroeconomics A
BOP, Output, Exchange Rates, and Macroeconomic Policies in the Short Run

Agustín S. Bénétrix

Trinity College Dublin

November 2021

1. Demand in the Open Economy
2. Goods Market Equilibrium: The Keynesian Cross
3. Goods and Forex Market Equilibria: Deriving the IS Curve
4. Money Market Equilibrium: Deriving the LM Curve
5. The Short-Run IS-LM-FX Model of an Open Economy
6. Stabilization Policy

Introduction

- Build a model that explains the relations between the major macroeconomic variables in an in the short run

- Feasibility and effectiveness of macroeconomic policies depend on the type of exchange rate regime

Demand in the Open Economy

Preliminaries and Assumptions

Take the foreign economy as the "the rest of the world" (ROW)

Assumptions:

- Home and foreign price levels ($\overline{P}$ and $\overline{P}^*$) are fixed due to price stickiness $\Rightarrow$ expected inflation is fixed at zero, $\pi^e = 0$ and all quantities can be viewed as both real and nominal quantities

- Government spending $\overline{G}$ and taxes $\overline{T}$ are fixed, but subject to policy change

Demand in the Open Economy

Preliminaries and Assumptions

- $\overline{Y}^*$ and i^* are fixed

- Income Y is equivalent to output: gross domestic product (GDP) = gross national disposable income (GNDI)

- Net factor income from abroad (NFIA) and net unilateral transfers (NUT) are zero $\Rightarrow$ current account (CA) = trade balance (TB)

Demand in the Open Economy
Consumption

The simplest model of aggregate private consumption relates household **consumption** C to **disposable income** Y^d
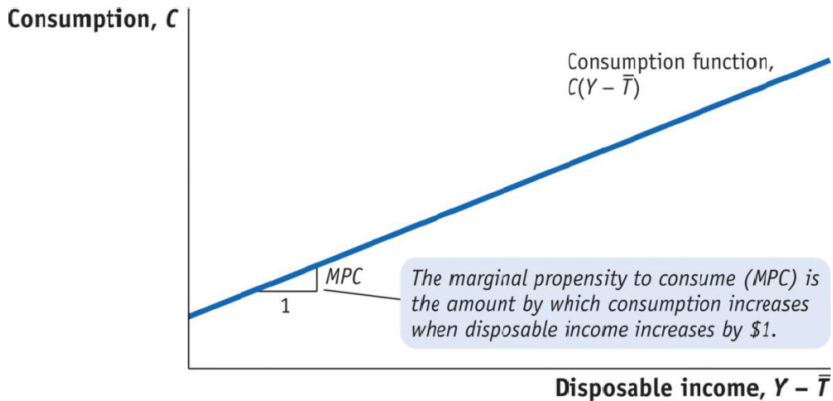
$$C = C(Y - \overline{T})$$

- This equation is known as the Keynesian consumption function

Marginal Effects:

- The slope of the consumption function is called the marginal propensity to consume (MPC)
- We can also define the marginal propensity to save $MPS = 1 - MPC$

Demand in the Open Economy
Consumption

Consumption, C

Consumption function,
$C(Y - \bar{T})$

MPC

1

The marginal propensity to consume (MPC) is the amount by which consumption increases when disposable income increases by \$1.

Disposable income, $Y - \bar{T}$

Demand in the Open Economy
Investment

- The firm's borrowing cost is the expected real interest rate r^e :
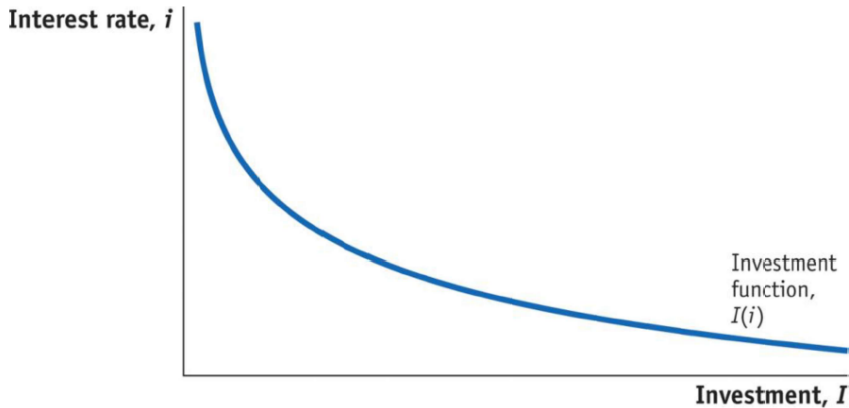
$$r^e = i - \pi^e$$

- Since expected inflation is zero $r^e = i$

- Investment I is a decreasing function of the real interest rate; investment falls as the real interest rate rises

- This is true only because when expected inflation is zero, the real interest rate equals the nominal interest rate

Demand in the Open Economy

Investment

Demand in the Open Economy
The Government

- Assume that the government collects an amount T of taxes from households and spends an amount G on government consumption

- We will ignore government transfer programs (such as social security, medical care, or unemployment benefit systems)

- In the unlikely event that $G = T$ exactly, we say that the government has a balanced budget

- If $T > G$, the government is said to be running a budget surplus

- If $G > T$, the government has a budget deficit

Demand in the Open Economy
The Trade Balance

The Role of the Real Exchange Rate

- When aggregate spending patterns change due to changes in the real exchange rate, this is **expenditure switching** from foreign purchases to domestic purchases

- If home's exchange rate is E, and home and foreign price levels are $\overline{P}$ and $\overline{P}^*$, the real exchange rate q of Home is defined as $q = E\overline{P}^*/\overline{P}$
  - We expect the trade balance of the home country to be an increasing function of the home country's real exchange rate

Demand in the Open Economy
The Trade Balance
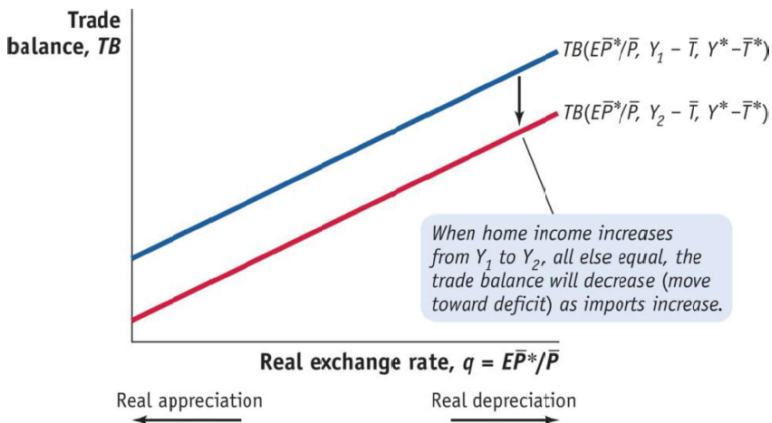
The Role of Income Levels

- We expect an **increase in home income** to be associated with an **increase in home imports** and a fall in the home country's trade balance

- We expect an increase in rest of the world income to be associated with an increase in home exports and a rise in the home country's trade balance

- $\Rightarrow$ trade balance is a function of three variables: the real exchange rate, home disposable income, and rest of world disposable income

$$TB = TB\left(E\overline{P}^*/\overline{P}, Y - T, Y^* - T^*\right)$$

Demand in the Open Economy
The Trade Balance

The Trade Balance and the Real Exchange Rate

$TB(E\bar{P}^*/\bar{P},\ Y_1 - \bar{T},\ Y^* - \bar{T}^*)$

$TB(E\bar{P}^*/\bar{P},\ Y_2 - \bar{T},\ Y^* - \bar{T}^*)$

When home income increases from Y_1 to Y_2, all else equal, the trade balance will decrease (move toward deficit) as imports increase.

Trade balance, TB

Real exchange rate, $q = E\bar{P}^*/\bar{P}$

Real appreciation ← → Real depreciation

Demand in the Open Economy
Exogenous Changes in Demand

(a) Shock to Consumption

Consumption, C

$C_2(Y - \overline{T})$

$C_1(Y - \overline{T})$

Disposable income, $Y - \overline{T}$
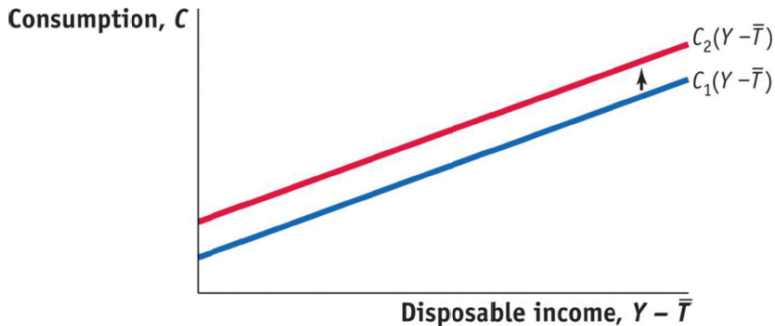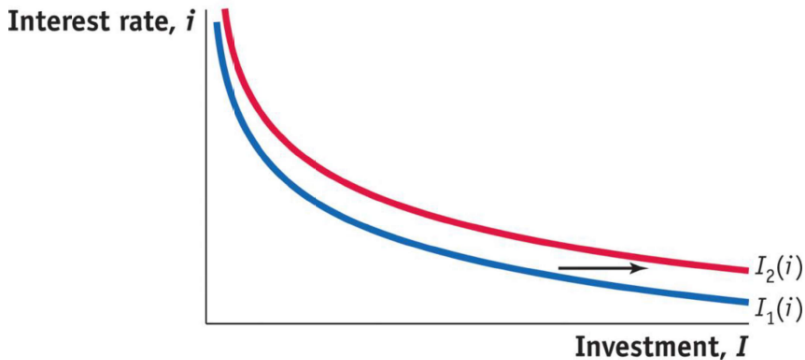
Demand in the Open Economy

Exogenous Changes in Demand

(b) Shock to Investment

Demand in the Open Economy
Exogenous Changes in Demand

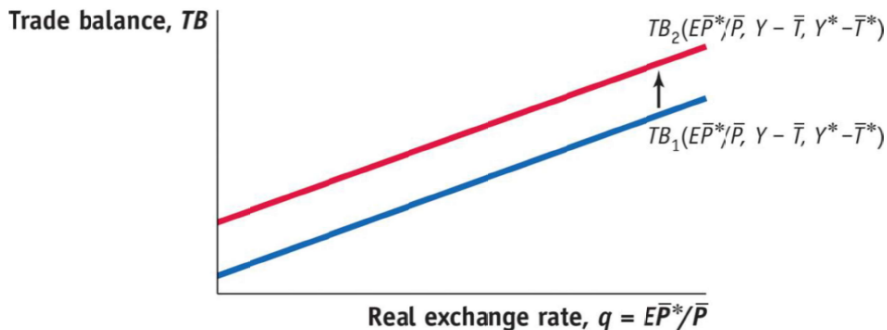## (c) Shock to the Trade Balance

Trade balance, TB

$TB_2(E\bar{P}^*/\bar{P}, \ Y - \bar{T}, \ Y^* - \bar{T}^*)$

$TB_1(E\bar{P}^*/\bar{P}, \ Y - \bar{T}, \ Y^* - \bar{T}^*)$

Real exchange rate, $q = E\bar{P}^*/\bar{P}$

The Keynesian Cross
Supply and Demand

Given our assumption that the current account equals the trade balance, gross national income Y equals GDP:

$$\text{Supply} = GDP = Y$$

Aggregate demand consists of all the possible sources of demand for this supply of output

$$\text{Demand} = D = C + I + G + TB$$

Substituting we have

$$D = C(Y - \overline{T}) + I(i) + \overline{G} + TB\left(E\overline{P}^*/\overline{P}, Y - T, Y^* - T^*\right)$$

The goods market equilibrium condition is

$$Y = C(Y - \overline{T}) + I(i) + \overline{G} + TB\left(E\overline{P}^*/\overline{P}, Y - T, Y^* - T^*\right)$$

The Goods Market Equilibrium

(a) Equilibrium
Goods Market (Keynesian Cross)

$D = Y$
(45-degree line)

$D = C(Y - \bar{T}) + I(i) + \bar{G}$
$+ TB (E\bar{P}^*/\bar{P}, Y - \bar{T}, Y^* - \bar{T}^*)$

Equilibrium (goods supply equals goods demand).

MPC_H

When home income rises by \$1, spending on all goods rises by \$MPC but spending on home goods only rises by \$MPC_H, which is the slope of the demand function.

Demand, D

Output, income, Y

Y_2 Y_1 Y_3

Shifts in Demand

(b) Shifts in Demand
Goods Market (Keynesian Cross)

1. After a shift up in the demand function D …

2. …output must rise to maintain equilibrium.

Summary

Fall in taxes $\overline{T}$

Rise in government spending $\overline{G}$

Fall in the home interest rate i

Rise in the nominal exchange rate E

Rise in foreign prices P^{*}

Fall in home prices P

Any shift up in the consumption function C

Any shift up in the investment function I

Any shift up in the trade balance function TB

$\Rightarrow$ Demand curve D

shifts up

Increase in demand D
at a given level of output Y

# Goods and Forex Market Equilibria: Deriving the IS Curve

Equilibrium in Two Markets

- A general equilibrium requires equilibrium in all markets - that is, equilibrium in the goods market, the money market, and the forex market

- The IS curve shows combinations of output Y and the interest rate i for which the goods and forex markets are in equilibrium

Forex market recap (UIP)

$$i = i^* - \left(\frac{E^e}{E} - 1\right)$$
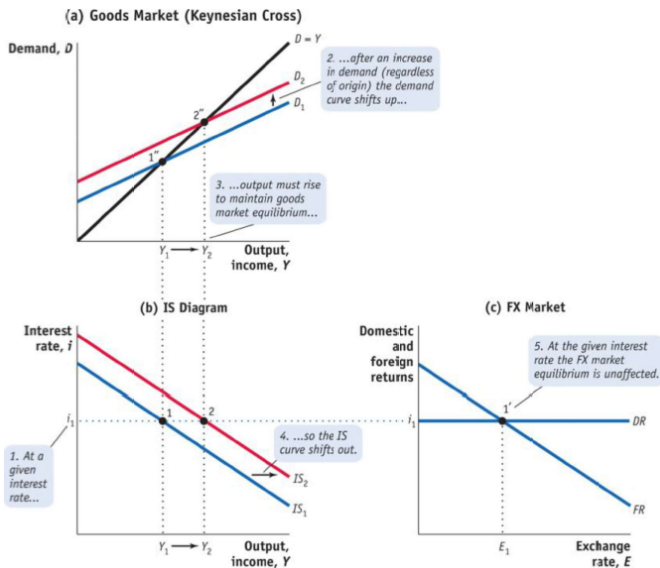
Equilibrium in two Markets: deriving IS curve
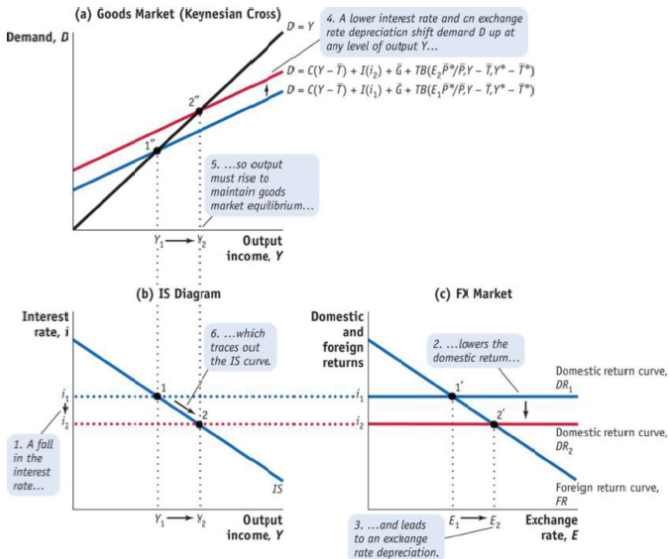
Deriving IS curve

- In an open economy, lower interest rates stimulate demand through the traditional closed-economy investment channel and through the trade balance

- The trade balance effect occurs because lower interest rates cause a nominal depreciation (a real depreciation in the short run), which stimulates external demand

We have now derived the shape of the IS curve, which describes goods and forex market equilibrium:

- The IS curve is downward-sloping. It illustrates the negative relationship between the interest rate i and output Y

Exogenous shifts in Demand make IS to shift

(a) Goods Market (Keynesian Cross)

2. ...after an increase in demand (regardless of origin) the demand curve shifts up...

3. ...output must rise to maintain goods market equilibrium...

(b) IS Diagram

1. At a given interest rate...

4. ...so the IS curve shifts out.

(c) FX Market

5. At the given interest rate the FX market equilibrium is unaffected.

Factors that shift the IS curve

Fall in taxes $\overline{T}$

Rise in government spending $\overline{G}$

Rise in foreign interest rate i^*

Rise in future expected exchange rate E^e

Rise in foreign prices P^*

Fall in home prices P

Any shift up in the consumption function C

Any shift up in the investment function I

Any shift up in the trade balance function TB

$\Rightarrow$ Demand curve D shifts up
Increase in demand D at any level of output Y and at a given home interest rate i

$\Rightarrow$ IS curve shifts right
Increase in equilibrium output Y at a given home interest rate i
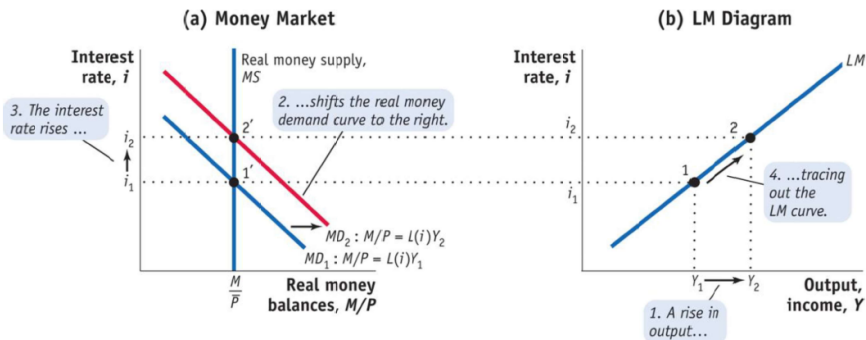
Money Market Equilibrium: Deriving the LM Curve

- We derive a set of combinations of Y and i that ensures equilibrium in the money market: the LM curve

- In the short-run, the price level is assumed to be sticky at a level $\overline{P}$, and the money market is in equilibrium when the demand for real money balances $L(i)Y$ equals the real money supply $M/\overline{P}$
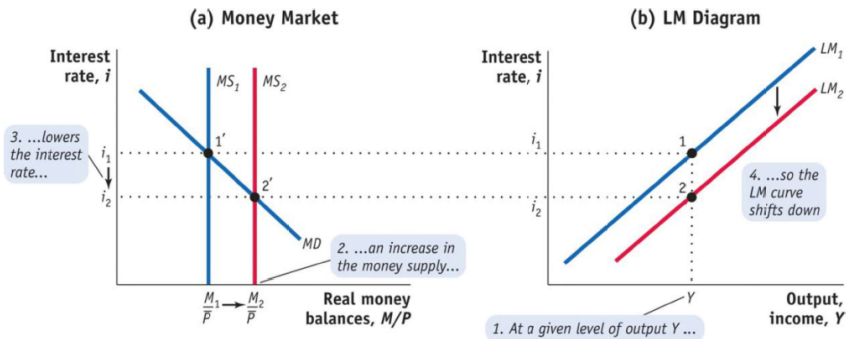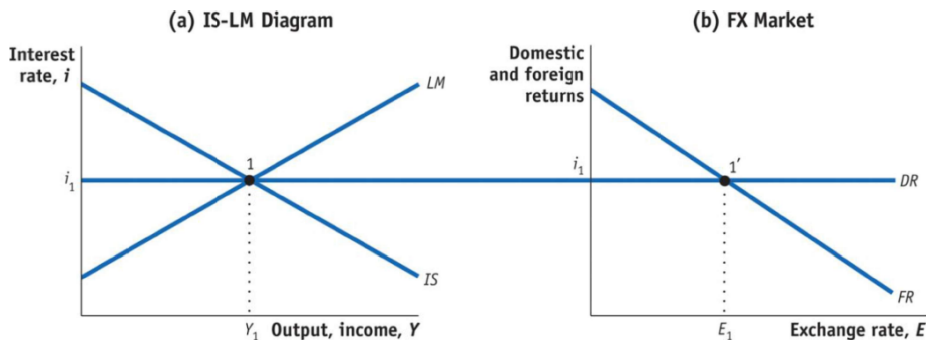
$$\frac{M}{P} = L(i)Y$$

Deriving the LM Curve

(a) Money Market

Interest rate, i

Real money supply, MS

3. The interest rate rises ...

2. ...shifts the real money demand curve to the right.

i_2

i_1

$2'$

$1'$

$MD_2 : M/P = L(i)Y_2$
$MD_1 : M/P = L(i)Y_1$

$\frac{M}{P}$

Real money balances, M/P

(b) LM Diagram

Interest rate, i

LM

i_2

i_1

2

1

4. ...tracing out the LM curve.

Y_1 Y_2

Output, income, Y

1. A rise in output...

Factors that shift the LM Curve
Change in the Money Supply Shifts the LM Curve

(a) Money Market

3. ...lowers the interest rate...

2. ...an increase in the money supply...

(b) LM Diagram

4. ...so the LM curve shifts down

1. At a given level of output Y ...

The Short-Run IS-LM-FX Model of an Open Economy

(a) IS-LM Diagram
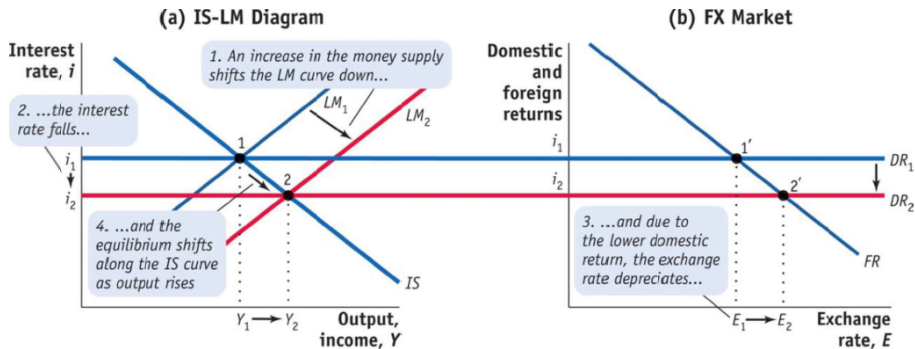
(b) FX Market

Macroeconomic Policies in the Short Run

Two main policy actions:

1. changes in **monetary policy**, through changes in the money supply
2. changes in **fiscal policy**, involving changes in government spending or taxes

From here onward we assume:

- The economy begins in a state of long-run equilibrium
- Conditions in the foreign economy are unchanged
- The home economy is subject to the usual short-run assumption of a sticky price level at home and abroad
- The forex market operates freely and unrestricted by capital controls and that the exchange rate is determined by market forces
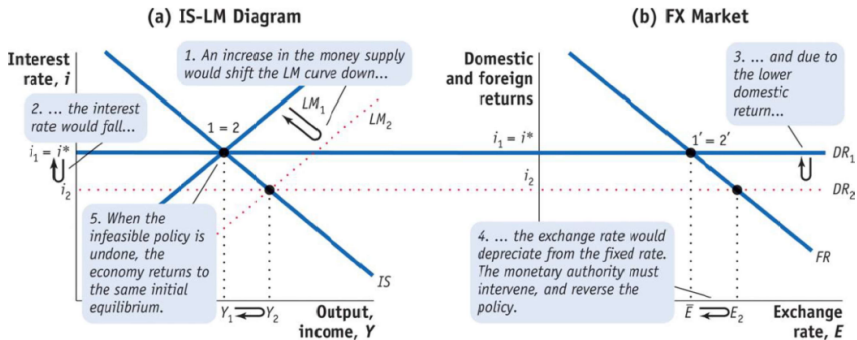
Monetary Policy Under Floating ER

(a) IS-LM Diagram

Interest rate, i

1. An increase in the money supply shifts the LM curve down...

LM_1

LM_2

2. ...the interest rate falls...

1

2

i_1

i_2

4. ...and the equilibrium shifts along the IS curve as output rises

IS

$Y_1 \rightarrow Y_2$ **Output, income, Y**

(b) FX Market

Domestic and foreign returns

i_1

i_2

1'

2'

DR_1

DR_2

3. ...and due to the lower domestic return, the exchange rate depreciates...

FR

$E_1 \rightarrow E_2$ **Exchange rate, E**

Monetary Policy Under Floating ER

- A temporary monetary expansion under floating exchange rates is effective in combating economic downturns by boosting output

- It raises output at home, lowers the interest rate, and causes a depreciation of the exchange rate
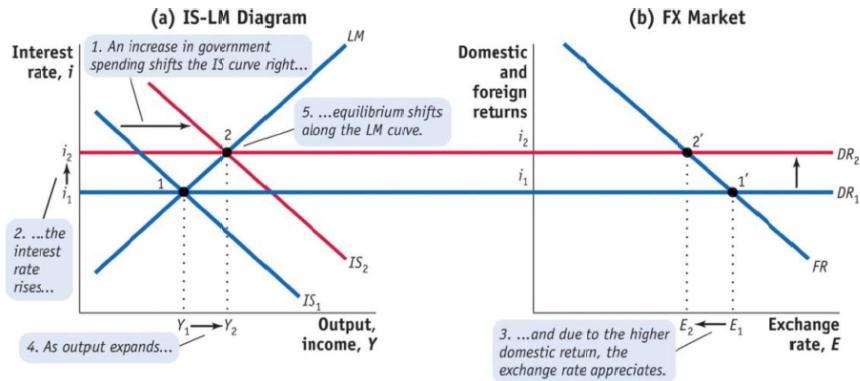 - What happens to the trade balance cannot be predicted with certainty

Monetary Policy Under Fixed ER

Monetary Policy Under Fixed ER

- Monetary policy under fixed exchange rates is impossible to undertake ⇒ Fixing the exchange rate means giving up monetary policy autonomy

- Countries cannot simultaneously allow capital mobility, maintain fixed exchange rates, and pursue an autonomous monetary policy
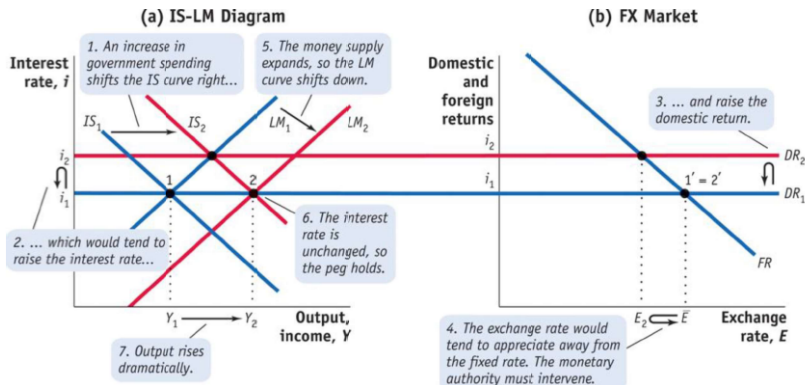
Fiscal Policy Under Floating ER

(a) IS-LM Diagram

Interest rate, i

1. An increase in government spending shifts the IS curve right...

5. ...equilibrium shifts along the LM curve.

LM

i_2

i_1

2. ...the interest rate rises...

IS_2

IS_1

4. As output expands...

$Y_1 \rightarrow Y_2$

Output, income, Y

(b) FX Market

Domestic and foreign returns

i_2

i_1

DR_2

DR_1

FR

3. ...and due to the higher domestic return, the exchange rate appreciates.

$E_2 \leftarrow E_1$

Exchange rate, E

Fiscal Policy Under Floating ER

- As the interest rate rises (decreasing investment, I) and the exchange rate appreciates (decreasing the trade balance), demand falls

- This impact of fiscal expansion is often referred to as **crowding out** ⇒ the increase in government spending is offset by a decline in private spending

- Thus, in an open economy, fiscal expansion crowds out investment (by raising the interest rate) and decreases net exports (by causing the exchange rate to appreciate)

- Over time, it limits the rise in output to less than the increase in government spending

Fiscal Policy Under Floating ER

- An expansion of fiscal policy under floating exchange rates might be temporarily effective

- It raises output at home, raises the interest rate, causes an appreciation of the exchange rate, and decreases the trade balance

- It indirectly leads to crowding out of investment and exports, and thus limits the rise in output to less than an increase in government spending

- A temporary contraction of fiscal policy has opposite effects

Fiscal Policy Under Fixed ER

(a) IS-LM Diagram

(b) FX Market

Interest rate, i

1. An increase in government spending shifts the IS curve right...

5. The money supply expands, so the LM curve shifts down.

IS_1 IS_2 LM_1 LM_2

i_2

i_1

1   2

2. ... which would tend to raise the interest rate...

6. The interest rate is unchanged, so the peg holds.

$Y_1 \rightarrow Y_2$ **Output, income, Y**

7. Output rises dramatically.

Domestic and foreign returns

i_2

i_1

3. ... and raise the domestic return.

DR_2

$1' = 2'$ DR_1

FR

$E_2 \rightleftarrows \bar{E}$ **Exchange rate, E**

4. The exchange rate would tend to appreciate away from the fixed rate. The monetary authority must intervene.

Summary

A temporary expansion of fiscal policy under fixed exchange rates raises output at home by a considerable amount. (The case of a temporary contraction of fiscal policy would have similar but opposite effects)

		Impact on:				
Exchange Rate Regime	Policy	i	E	I	TB	Y
Floating	Monetary expansion	↓	↑	↑	↑?	↑
	Fiscal expansion	↑	↓	↓	↓	↑
Fixed	Monetary expansion	0	0	0	0	0
	Fiscal expansion	0	0	0	↓	↑

Responses to Policy Shocks in the IS-LM-FX Model

Stabilization Policy

Authorities can use changes in policies to try to keep the economy at or near its full-employment level of output

- If the economy is hit by a temporary adverse shock, policy makers could use expansionary monetary and fiscal policies to prevent a deep recession

- Conversely, if the economy is pushed by a shock above its full employment level of output, contractionary policies could tame the boom

The Right Time for Austerity?

After the global financial crisis, many observers predicted economic difficulties for Eastern Europe in the short run

We use our analytical tools to look at two opposite cases

1. Poland, which fared well
2. Latvia, which did not

- Demand for Poland's and Latvia's exports declined with the contraction of foreign output, this along with negative shocks to consumption and investment can be represented as a leftward shift of the IS curve to the right

- The policy responses differed in each country, illustrating the contrasts between fixed and floating regimes

The Right Time for Austerity?

Examples of Policy Choices Under Floating and Fixed ER

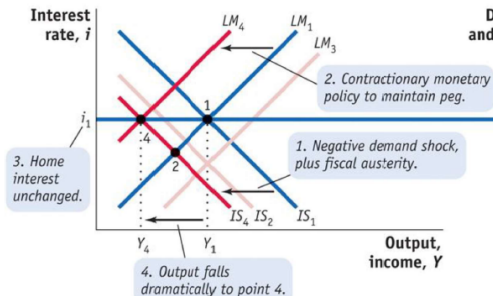(a) IS-LM Diagram: Floating + Monetary Expansion
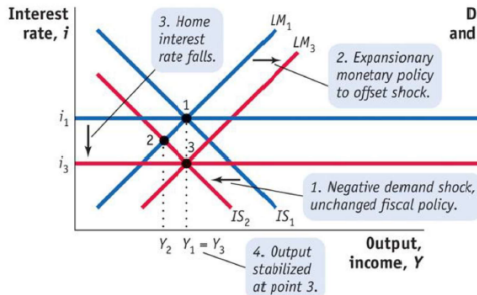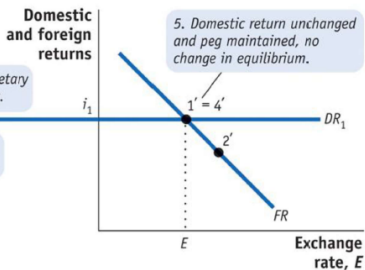
(b) FX Market: Floating + Monetary Expansion
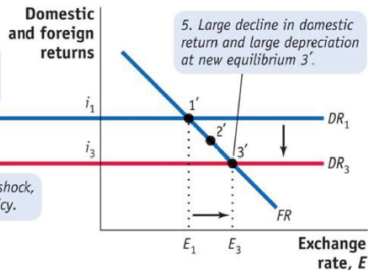
The Right Time for Austerity?

Examples of Policy Choices Under Floating and Fixed Exchange Rates

(c) IS-LM Diagram: Fixed + Fiscal Contraction

(d) FX Market: Fixed + Fiscal Contraction

Stabilisation Policy
Problems in Policy Design and Implementation

- **Policy Constraints**: A fixed exchange rate rules out use of monetary policy

- **Incomplete Information and the Inside Lag**: It takes weeks or months for policy makers to understand the state of the economy today. Then, it takes time to formulate a policy response

- **Policy Response and the Outside Lag**: It takes time for whatever policies are enacted to have any effect on the economy

Stabilisation Policy

Problems in Policy Design and Implementation

- **Long-Horizon Plans**: If the private sector understands that a policy change is temporary, there may be reasons not to change expenditures. (A temporary real appreciation may also have little effect on whether a firm can profit in the long run from sales in the foreign market)

- **Weak Links from the Nominal Exchange Rate to the Real Exchange Rate**: Changes in the nominal exchange rate may not translate into changes in the real exchange rate for some goods and services

- **Pegged Currency Blocs:** Exchange rate arrangements in some countries may be characterized by a mix of floating and fixed exchange rate systems with different trading partners

Stabilisation Policy
Problems in Policy Design and Implementation

- **Weak Links from the Real Exchange Rate to the Trade Balance**: Changes in the real exchange rate may not lead to changes in the trade balance. The reasons for this weak linkage include transaction costs in trade, and the J curve effects.

  - These effects may cause expenditure switching to be a nonlinear phenomenon: it will be weak at first and then much stronger as the real exchange rate change grows larger

    - e.g.: Prices of BMWs in the U.S. barely change in response to changes in the dollar-euro exchange rate