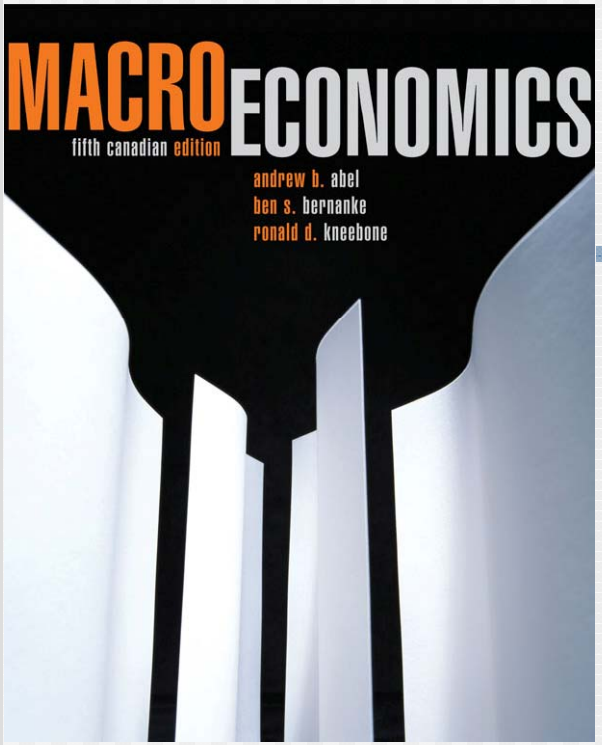


Chapter 10 (part 1)

Exchange Rates, Business Cycles, and Macroeconomic Policy in the Open Economy

This Chapter

- In this chapter we build an open-economy version of the IS-LM model
  - Extend our analysis to include the foreign sector to understand international trade, financial markets and exchange rates.
- Crucial as most economies are now internationally linked.
- Important relationship between interest rates, *r*, and exchange rates, *e* through asset markets.

The Open Economy

- Two aspects of the interdependence of the world economies:
  - international trade in goods and services;
  - worldwide integration of financial markets.
- Fiscal and Monetary policies are going to have different outcomes, because of the international relationships.

Exchange Rates

- First let's distinguish between nominal and real exchange rates:
- Nominal: e_{nom}
  - How many units of a foreign currency can I get with one unit of the domestic currency?
- Real: e
  - How many units of a foreign good can I get in exchange for one unit of a domestic good?

Nominal Exchange Rates

- Some well known currencies traded in the foreign exchange market : US $, Canadian $, Japanese Yen, British pounds, Euro...
- The rate at which one currency can be traded for another is e_{nom}
  - E.g. the amount of US $ one can get with 1 Canadian $, currently about 90 US cents, so e_{nom} = 90¢ US
- So this rate is like the 'price' of US currency

Nominal Exchange Rates

- If someone in one country wants to buy goods, services, or assets from someone in another country, normally she will first have to exchange her currency for that of her trading partner's country.

Exchange Rate Systems

- In a flexible-exchange-rate, or floating-exchange-rate system, exchange rates are not officially fixed, but are determined by conditions of supply and demand in the foreign exchange market.
  - Exchange rates adjust continuously in response to market developments.
- At present: (mostly) floating exchange rate system

Exchange Rate Systems (continued)

- In a fixed-exchange-rate system exchange rates are set at officially determined levels.
  - The official rates are maintained by the commitment of nations' central banks to buy and sell their own currencies at the fixed exchange rate.
  - E.g. Bretton Woods system (1944)
    - Fixed currency in terms of the US dollar
    - Collapsed amidst high inflation rates in the US in the 1970s which made it nearly impossible to maintain the fixed exchange rate.

Real vs Nominal Exchange Rates

- Suppose nominal exchange rate for Canada-Japan is: 1 dollar = 78 yen
  - great: go to Japan and you're rich
  - not really…
- We need to account for cost of living:
  - Hamburgers: ¥312 in Tokyo, $3 in Kingston
  - so ¥312/(¥78/$1)=$4 Canadian
  - so Kingston burger is ¾ price of Tokyo burger

Real Exchange Rate

- In our example, the real exchange rate between Canada and Japan is 0.75 Japanese hamburgers per Canadian hamburger
- More formally, the real exchange rate is the number of foreign goods someone gets in exchange for one domestic good:

$$e = \frac{e_{\text{nom}} P}{P_{\text{For}}}$$

e_{nom} is the nominal exchange rate;

P_{For} is the price of foreign goods, measured in foreign currency;

P is the price of domestic goods, measured in nominal currency.

Real Exchange Rate (continued)

- In reality, real exchange rates are based on price indexes of "baskets" of goods (such as the GDP deflator or the CPI)
- To simplify the analysis, we assume that each country produces a single good.

Appreciation and Depreciation

Type of Exchange Rate System	Exchange rate *increases* "stronger"	Exchange rate *decreases* "weaker"
Flexible exchange rates	Appreciation	Depreciation
Fixed exchange rates	Revaluation	Devaluation

Appreciation and Depreciation

- Changes in e_{nom} are referred to as nominal appreciation / nominal depreciation
  - With nominal appreciation the same amount of domestic currency can buy more units of foreign currency than before.
- Changes in the real exchange rate, *e* are referred to as real appreciation / real depreciation
  - With real appreciation the same quantity of domestic goods can be traded for more foreign goods than before.

Purchasing Power Parity

- How are nominal and real exchange rates related?
- Suppose all countries produce the same goods and these goods are freely traded
- Then in the absence of transportation and transactions costs, Purchasing Power Parity (PPP) says similar foreign and domestic goods (or baskets of goods) should have the same price in terms of the same currency ($e=1$).

Purchasing Power Parity (continued)

- PPP implies that:

$$e_{nom} = \frac{P_{For}}{P}$$

- This says that the nominal exchange rate changes quickly to reflect relative price movements.
- Empirically, PPP holds in the very long-run.
- To find a relationship that holds more generally we can use the definition of the real exchange rate and derive a relative PPP measure.

Purchasing Power Parity (continued)

Starting with the definition of *e*:

$$\frac{\Delta e}{e} = \frac{\Delta e_{nom}}{e_{nom}} + \frac{\Delta P}{P} - \frac{\Delta P_{For}}{P_{For}}$$

After re-arranging $$\frac{\Delta e_{nom}}{e_{nom}} = \frac{\Delta e}{e} + \pi_{For} - \pi$$

So, relative PPP is $$\frac{\Delta e_{nom}}{e_{nom}} = \pi_{For} - \pi$$

Purchasing Power Parity (continued)

- In growth terms, the percentage change in the nominal exchange rate depends on the growth of the RER and the difference in the inflation rates between countries
- Nominal appreciation occurs if:
  - the real exchange rate grows
  - domestic inflation is less than foreign inflation
- Relative PPP usually works well for high inflation countries, not for low inflation countries like Canada

The Real Exchange Rate and Net Exports

- We have not yet discussed the importance of the real exchange rate.
- The real exchange rate:
  - represents the rate at which domestic goods can be traded for foreign goods;
  - affects a country's net export.
- The higher the real exchange rate, the lower is a country's net exports which affects real economic activity.

The Real Exchange Rate and Net Exports (continued)

- An increase in *e* (real appreciation) means that domestic goods can buy more foreign goods (domestic goods become more expensive)

Domestically: switch to foreign goods, or an increase in *IM*

Foreigners: switch away from domestic goods, or a decrease in *X*

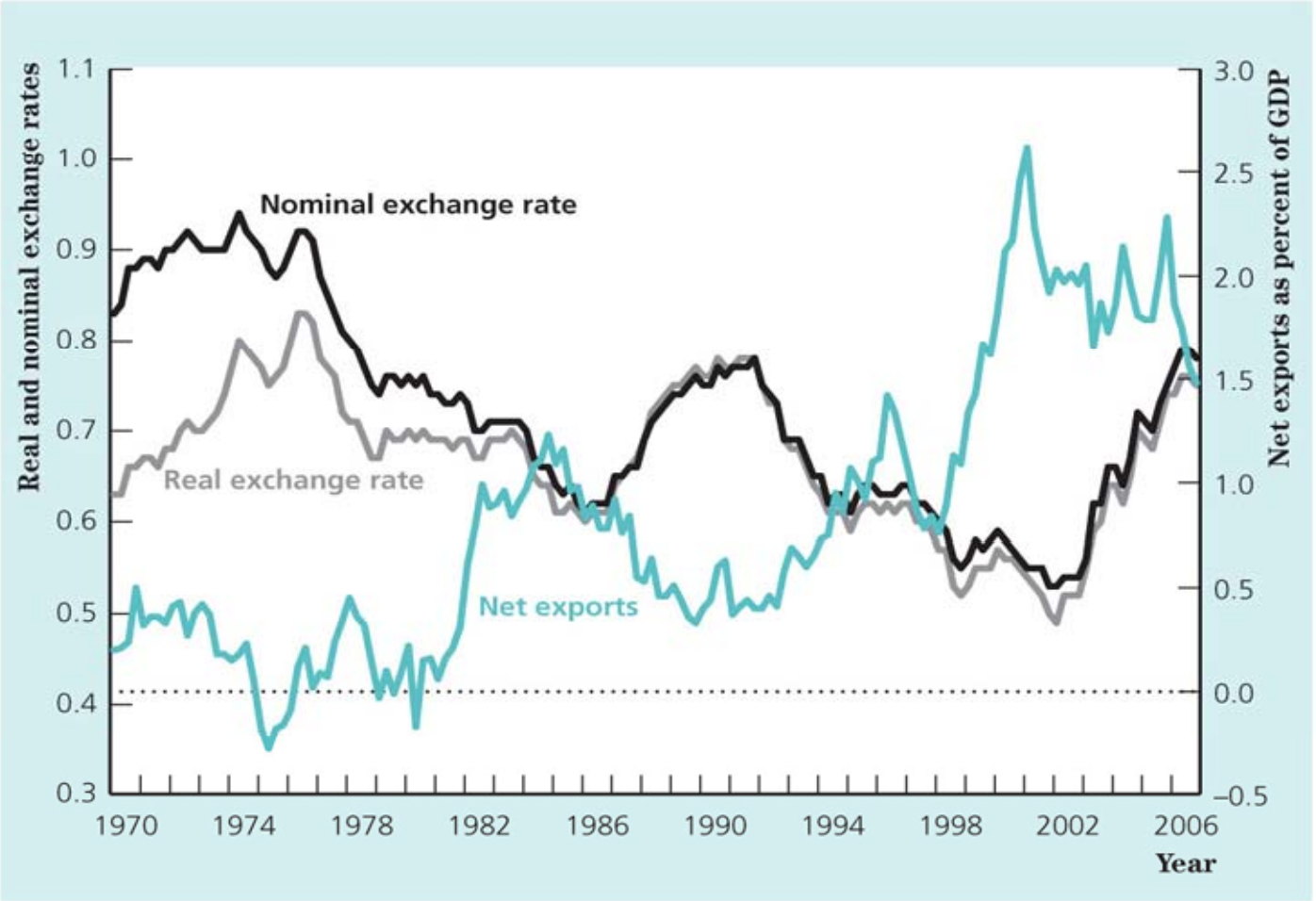
$$\downarrow\downarrow NX = \downarrow X - \uparrow IM$$

FIGURE 10.1

CANADA–US REAL AND NOMINAL EXCHANGE RATES AND NET EXPORTS, 1970–2006

Canadian net exports to the United States are measured on the right vertical axis and the Canada–US real and nominal exchange rates are measured on the left vertical axis. Note that the nominal and real exchange rates tend to move together. Note also that net exports rise when the real exchange rate falls.

Source: Adapted from the following: Net exports to the United States in millions of dollars, seasonally adjusted, quarterly: CANSIM II series v114387. Canadian GDP in millions of dollars, seasonally adjusted, quarterly: CANSIM II series v498086. Nominal Canada–US exchange rate, monthly: CANSIM II series v37426. Real Canada–US exchange rate calculated using Canadian GDP implicit price deflator (CANSIM II series v498086/v1992067) and US GDP implicit price deflator (CANSIM II series v122054/v21581591).



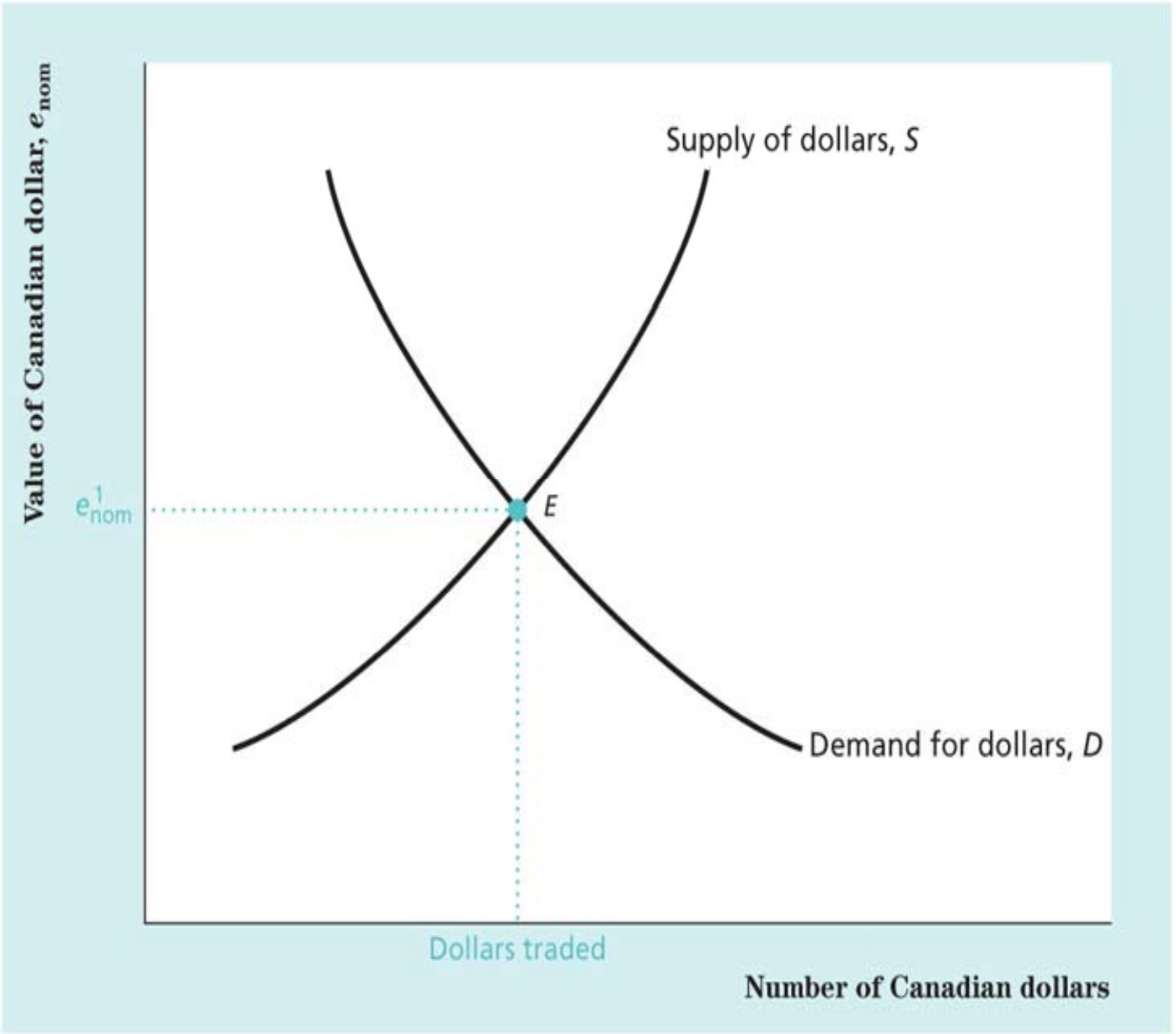
How Exchange Rates are Determined

- It's by supply and demand
  - Supply of currency = Canadians offer to exchange dollars for foreign currency
  - Demand for currency = Foreigners' demand for dollars in the foreign exchange market
- We focus on e_{nom}
  - Recall that: $e = e_{nom}(P/P_{For})$
  - so for P and P_{For} that grow at similar rates, focusing on e_{nom} only is ok
- e_{nom}: value of a currency, determined by supply and demand in the foreign exchange market

FIGURE 10.2

THE SUPPLY OF AND DEMAND FOR THE CANADIAN DOLLAR

The figure shows the determination of the value of the dollar in the foreign exchange market. The supply curve for dollars, *S*, indicates the number of dollars that people are willing to sell in the foreign exchange market at each value of the Canadian nominal exchange rate e_{nom}. The demand curve for dollars, *D*, shows the number of dollars that people want to buy at each nominal exchange rate. At equilibrium, point *E*, the value of the dollar, e^1_{nom}, is the nominal exchange rate at which the quantity of dollars supplied equals the quantity of dollars demanded.



Why is there Supply/Demand for Dollars?

- Why do Canadians supply dollars (S):

(i) To be able to buy foreign goods and services (IM)

(ii) To be able to buy foreign financial assets (capital outflows)

(These transactions correspond to the CA and KA)

- Why do foreigners demand dollars (D):

(i) To be able to buy Canadian goods and services (X)

(ii) To be able to buy Canadian financial assets (capital inflows)

- So, value of the dollar increases if D↑ or S↓

Macroeconomic Determinants of *e* and *NX*

- Recall, the goal is to build an *IS-LM* model for an open economy
- The *IS-LM* model relates *Y* and *r*
- Now we have also *e* and *NX*
- Again, since price levels are held constant, the results we'll present apply to both e_{nom} and *e.*

Effects of Changes in Output (Income)

1. When domestic output (income) rises the demand for imports increases and net exports fall. The domestic currency depreciates, the exchange rate falls:

- When *Y* increases, there is an increase in *M* demand (*NX* decreases because of a *direct* effect) since consumers spend more in *all* goods and services
- Canadians sell CAD$ to get foreign currency, i.e. the Supply of CAD$ increases.
- A depreciation of the exchange rate e_{nom} follows.

Effects of Changes in Output (continued)

2. On the other hand, when foreign output (income) rises, Canadian exports increase and NX rises.

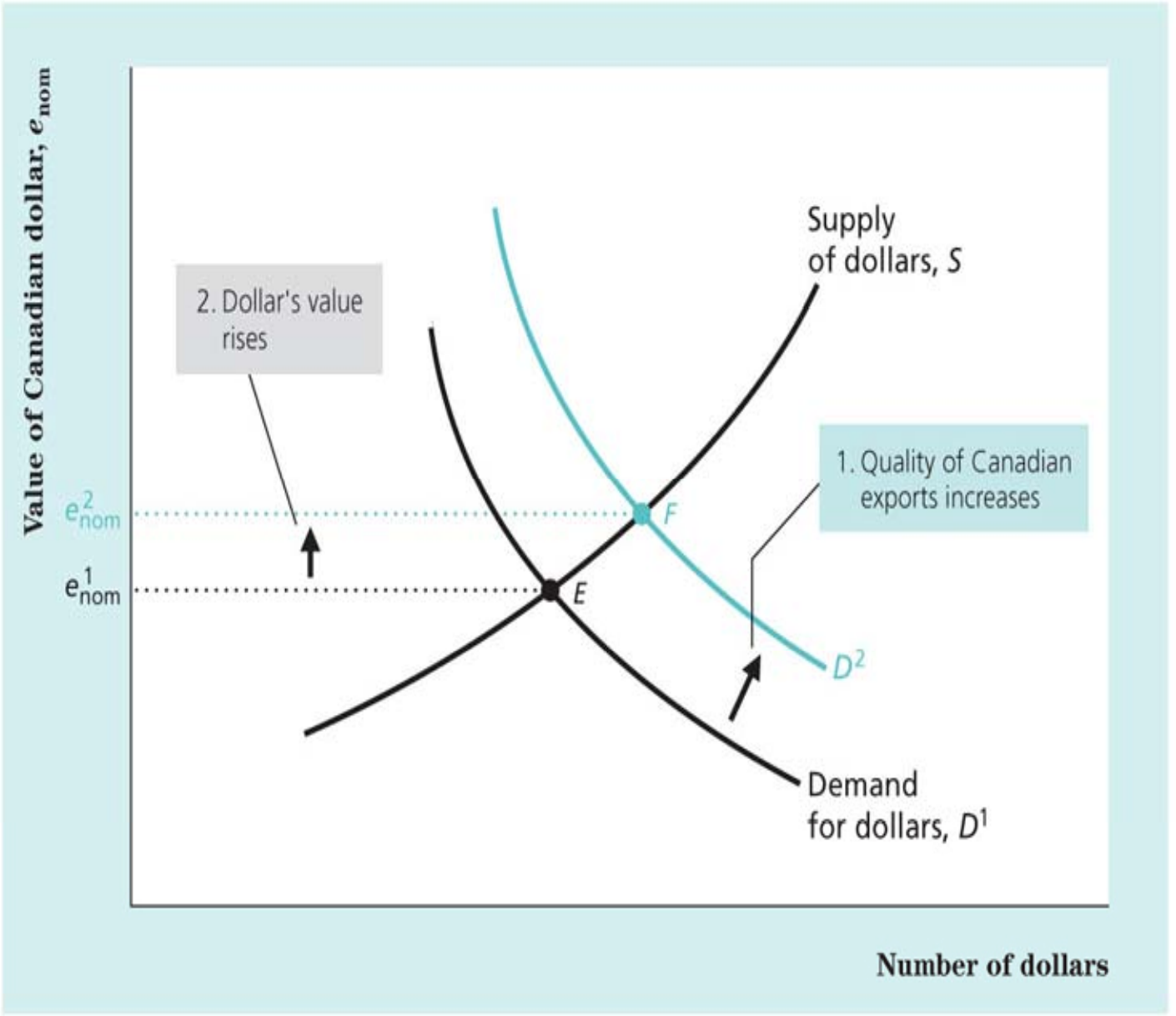
- The domestic currency appreciates, the exchange rate rises.

- The example in Figure 10.3 shows the effect of an improvement in the quality of Canadian goods.

FIGURE 10.3

THE EFFECT OF INCREASED EXPORT QUALITY ON THE VALUE OF THE DOLLAR

An increase in the quality of Canadian exports raises foreigners' demands for Canadian goods and, hence, their demand for Canadian dollars, which are needed to buy Canadian goods. The demand curve for dollars shifts, from D^1 to D^2, raising the value of the dollar (the nominal exchange rate) from e^1_{nom} to e^2_{nom}.



Effects of Changes in Real Interest Rate

- If the domestic country's real interest rate rises, other factors held constant, the country's real and financial assets are more attractive for investment.
- The demand for the domestic currency increases and the exchange rate appreciates (e_{nom} rises).
- After the domestic real interest rate rises, the exchange rate appreciation reduces net exports ($NX\downarrow$ because of an *indirect* effect)

Effects of Changes in Real Interest Rate (continued)

- Conversely, if the foreign country's real interest rate rises (r_{For}), foreign assets will become more attractive to Canadians
- The supply of domestic currency (Canadian dollars) increases
- The exchange rate depreciates (e_{nom} falls), and the Canada's net exports rise.

The International Asset Market: Interest Rate Parity

- In an open economy, savers have an opportunity to buy financial assets sold by foreign borrowers as well as those sold by domestic borrowers.
- Investment decisions depend on:
  - nominal interest rates
  - expected changes to the exchange rate.
- International asset markets give a particular relationship between interest rates and exchange rates

Returns on Domestic and Foreign Assets: Example

- A Canadian saver has $10,000 to invest for one year either in Canadian bonds or German bonds. Canadian bonds pay interest $i = 8\%$ and German bonds pay interest $i_{For} = 6\%$
- Assume both assets have the same risk of default and liquidity. Which bond should we buy?
- It may seem that since $i = 8\% > i_{For} = 6\%$, we should buy Canadian bonds...

Returns on Domestic and Foreign Assets (continued)

- ...but, this answer may not be correct since we haven't accounted for expected changes in the exchange rate:
  - the German bond carries an additional potential return (gain/loss) because we need to purchase Euros.
- Assume that the current nominal exchange rate is e_{nom} = 0.7 euros per $
- Before the pay-out next year, you expect the euro to appreciate ($ will depreciate) to e^{f}_{nom} = 0.679.

Returns on Domestic and Foreign Assets (continued)

- General steps to calculate the gross nominal rate of return on foreign asset: (board)
  - Step 1: Convert home currency to foreign currency.
  - Step 2: Earn interest on foreign asset.
  - Step 3: Convert foreign currency to home currency.
  - Expected gross nominal rate of return on foreign asset = $(1+i_{\text{For}})\frac{e_{\text{nom}}}{e^{\text{f}}_{\text{nom}}}$

Interest Rate Parity

- Why would gross nominal rates of return differ in a free and competitive market?
- The difference in returns cannot persist for long since *arbitragers* should make them equal (investors who move to take advantage of the differences in nominal interest rates)
- An explicit equilibrium condition summarizes this concept: it's called nominal interest rate parity

Interest Rate Parity (continued)

- The equilibrium for the international asset market or nominal interest rate parity condition: taking the exchange rates e_{nom} and e^{f}_{nom} as given the interest rates, i and i_{For}, will adjust until the expected return for two similar investment options are equal (No-Arbitrage condition):

$$\frac{e_{nom}}{e^{f}_{nom}}(1+i_{For}) = 1+i$$

Interest Rate Parity (continued)

- For this to hold exactly a number of conditions must be met like similar liquidity, default risk, transactions costs, taxes, etc.
- If the nominal exchange rate is expected to remain the same as its current value the nominal interest rate parity condition reduces to:

$$i = i_{For}$$

Interest Rate Parity (continued)

- The real interest rate parity condition is:

$$\frac{e}{e^f}(1+r_{For})=1+r$$

- The difference in returns cannot persist for long, interest rates equalize
- For $e=e^f$ the condition is $r=r_{For}$, which is the assumption we make for now, though we will return to this issue later.

The *IS-LM* Model for an Open Economy

- We now look at how trade and exchange rates affect the economy by using the *IS=LM* model
- Assume that the expected (trend) rates of growth in P, P_{for}, and M are given. If both P and P_{for} grow at given rates, then we can equate changes in e with changes in e_{nom}.
- Our analysis will not affect the supply/demand for money so we can use the same *LM* curve as in Ch 9.

The *IS-LM* Model for an Open Economy (continued)

- The labour market and production function are not directly affected by international factors, so the *FE* line is also the same.
- The effect of opening up the economy to trade will come through the *IS* curve.
- *NX* has to be incorporated into the *IS* curve:
  - *IS* is still downward sloping.
  - All factors shifting the *IS* curve in the closed economy shift the *IS* curve in the open economy.
  - All factors that change *NX* also shift the *IS* curve.

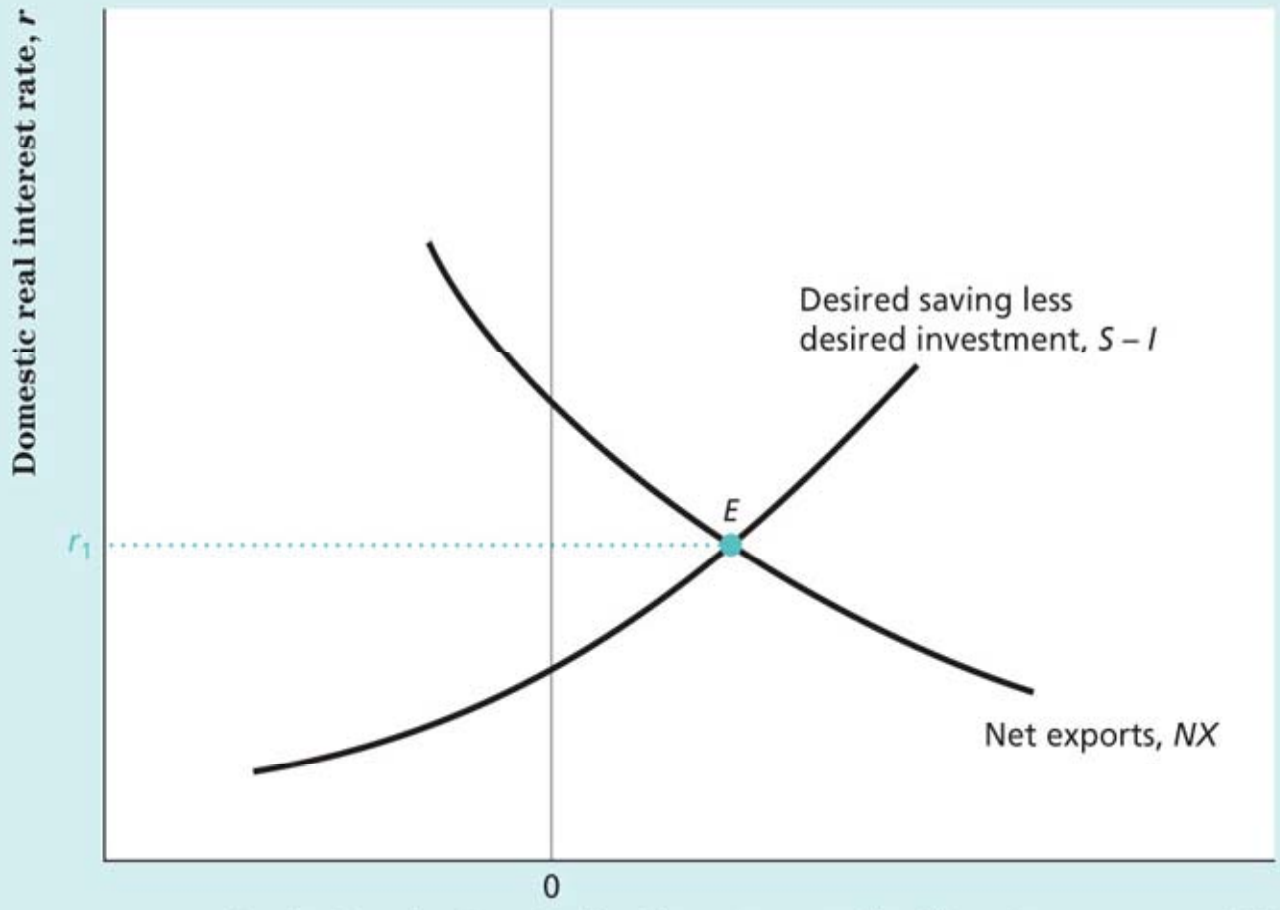
The Open-Economy *IS* Curve (continued)

- The goods market equilibrium condition for an open economy is: $S^d - I^d = NX$
- This condition says that, for goods market equilibrium, desired foreign lending must equal desired foreign borrowing.
- The *S*-*I* curve is upward sloping; it increases when *r* rises: $\uparrow r \rightarrow \uparrow S^d$ and $\downarrow I^d$
- The *NX* curve is downward sloping; it decreases when *r* rises through the effect of *r* on the real exchange rate, *e*.

FIGURE 10.4

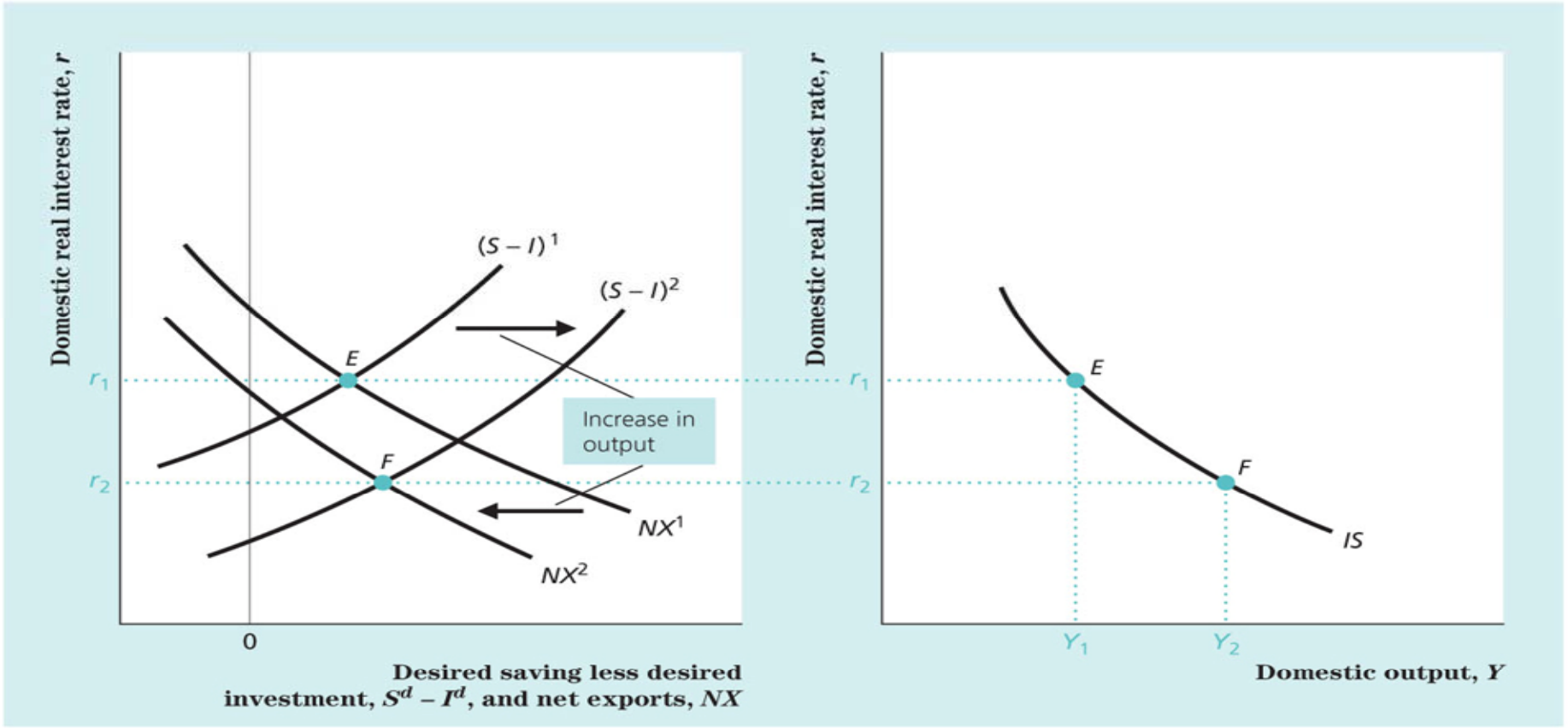
GOODS MARKET EQUILIBRIUM IN AN OPEN ECONOMY

The upward-sloping curve shows desired saving S^d less desired investment I^d. This curve slopes upward because a higher domestic real interest rate increases the excess of desired saving over desired investment. The *NX* curve relates net exports to the domestic real interest rate. This curve slopes downward because a higher domestic real interest rate causes the real exchange rate to rise, reducing net exports. Goods market equilibrium occurs at point *E*, where the excess of desired saving over desired investment equals net exports (equivalently, where desired lending abroad equals desired borrowing by foreigners). The real interest rate that clears the goods market is r_1.



The Open-Economy *IS* Curve (continued)

- To derive the open economy version of the *IS* curve we need to know what happens to real interest rates when output rises.
- Suppose that output rises:
  - S^d increases but not I^d so the *S*-*I* curve shifts to the right;
  - import rises, *NX* falls and the *NX* curve shifts to the left;
  - the equilibrium is restored with lower *r*;
  - the *IS* curve slopes downward (see next slide).



(a) Goods market equilibrium **(b) Open-economy *IS* curve**

FIGURE 10.5

DERIVATION OF THE *IS* CURVE IN AN OPEN ECONOMY

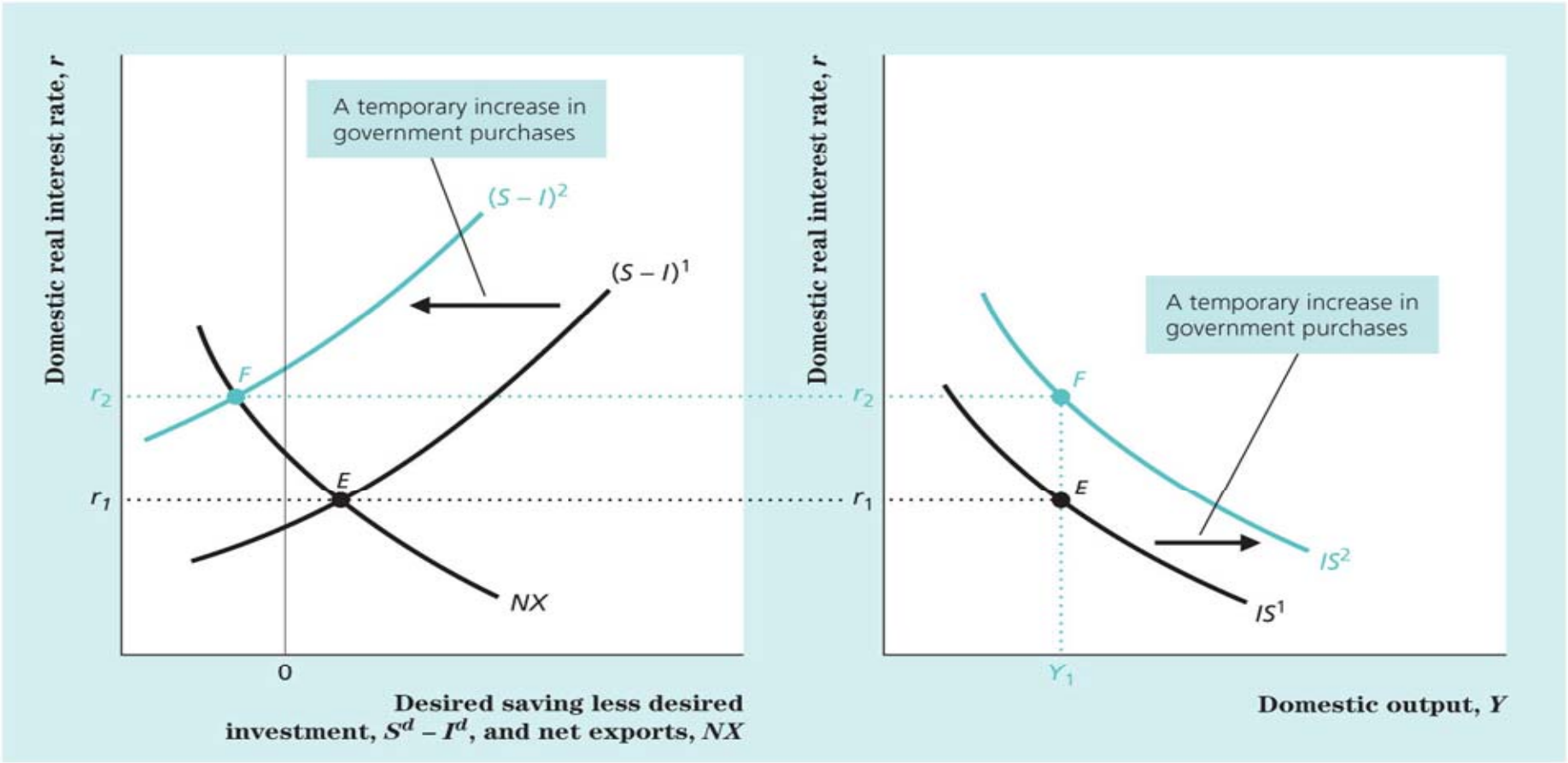
The initial equilibrium in the goods market is represented by point *E* in both (a) and (b).

(a) At point *E*, domestic output is Y_1 and the domestic real interest rate is r_1. An increase in domestic output from Y_1 to Y_2 raises desired national saving at each real interest rate and does not affect desired investment. Therefore, the $S - I$ curve shifts to the right, from $(S - I)^1$ to $(S - I)^2$. The increase in output also raises domestic spending on imports, reducing net exports and causing the *NX* curve to shift to the left, from NX^1 to NX^2. At the new equilibrium point, *F*, the real interest rate is r_2.

(b) Because an increase in output from Y_1 to Y_2 lowers the real interest rate that clears the goods market from r_1 to r_2, the *IS* curve slopes downward.

Factors that Shift The Open-Economy *IS* Curve

- As in a closed economy, any factor that changes the real interest rate that clears the goods market at a constant level of output shifts the *IS* curve.
- Consider a temporary increase in *G*:
  - S^d is lower at every level of Y and r so *S*-*I* shifts left
  - This raises the r that clears the goods market, so *IS* shifts right
  - Notice that an increase in *G* has the same effect as it did in a closed economy.



(a) Goods market equilibrium **(b) Open-economy *IS* curve**

FIGURE 10.6

EFFECT OF AN INCREASE IN GOVERNMENT PURCHASES ON THE OPEN-ECONOMY *IS* CURVE

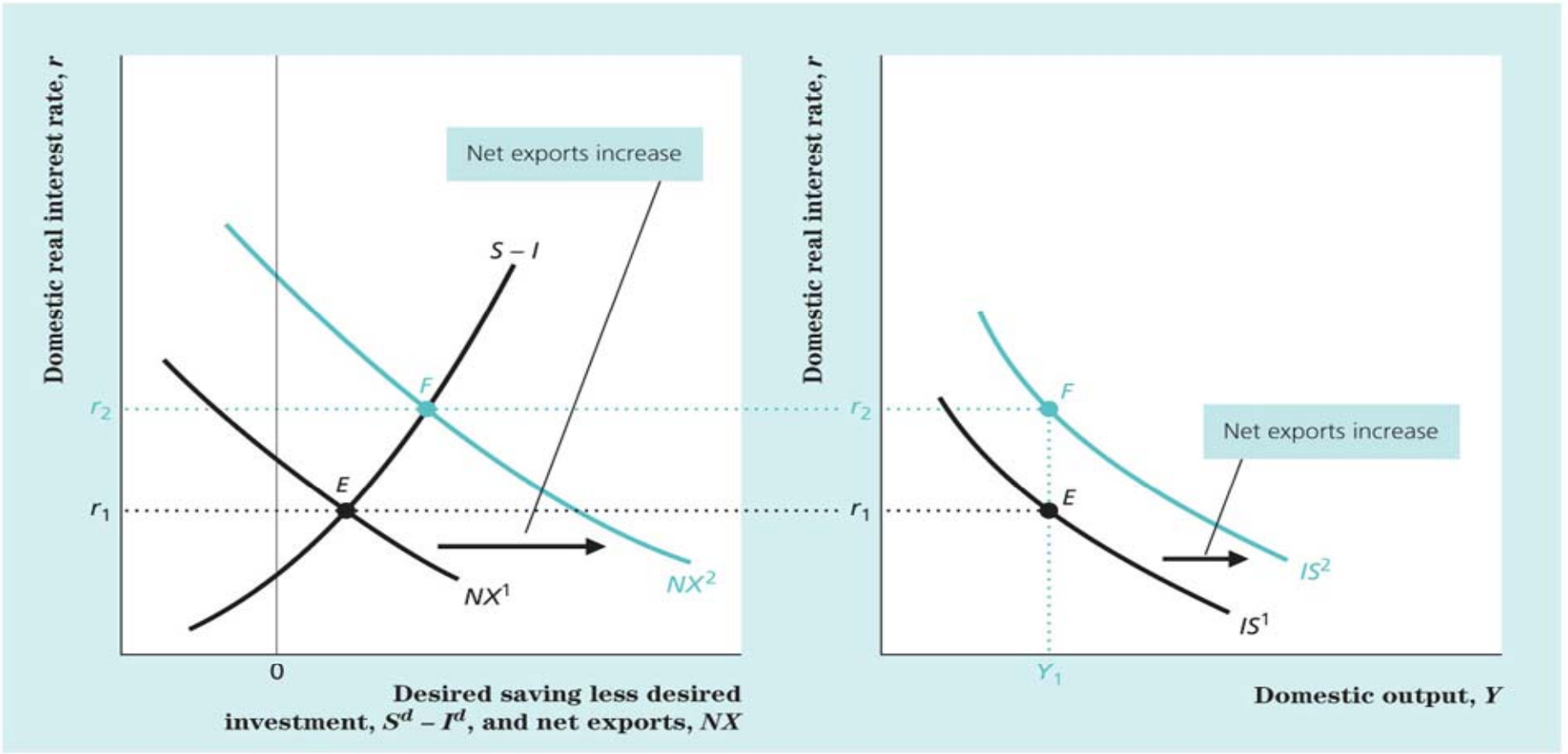
Initial equilibrium is at point *E*, where output is Y_1 and the real interest rate is r_1, in both (a) and (b).

(a) A temporary increase in government purchases lowers desired national saving at every level of output and raises the real interest rate. Thus, the $S - I$ curve shifts to the left, from $(S - I)^1$ to $(S - I)^2$.

(b) For output Y_1, the real interest rate that clears the goods market is now r_2, at point *F* in both (a) and (b). Because the real interest rate that clears the goods market has risen, the *IS* curve shifts up and to the right, from IS^1 to IS^2.

The Open-Economy *IS* Curve Shifters (continued)

- For an open economy, there are additional factors that shift the *IS* curve.
- Any factor that changes *NX*, given *Y*, will shift the open-economy *IS* curve.
- Factors that could cause *NX* to rise include:
  - an increase in foreign output;
  - an increase in foreign interest rates
  - an improvement in the quality of domestic goods and services.



(a) Goods market equilibrium **(b) Open-economy *IS* curve**

FIGURE 10.7

EFFECT OF AN INCREASE IN NET EXPORTS ON THE OPEN-ECONOMY *IS* CURVE

In both (a) and (b), at the initial equilibrium point, E, output is Y_1 and the real interest rate that clears the goods market is r_1.

(a) If some change raises the country's net exports at any given domestic output and domestic real interest rate, the NX curve shifts to the right, from NX^1 to NX^2.

(b) For output Y_1, the real interest rate that clears the goods market has risen from r_1 to r_2, at point F in both (a) and (b). Thus, the IS curve shifts up and to the right, from IS^1 to IS^2.

The Transmission of Business Cycles

- The impact of foreign economic conditions on the real exchange rate and net exports is one of the principal ways by which cycles are transmitted internationally.
- Example: if US goes into recession, *NX* for Canada falls, *IS* shifts down, *Y* falls
- The cycle can also be transmitted through international asset markets.

Macroeconomic Policy with Flexible Exchange Rates

- Analyze using the *Mundell-Fleming* model

Assumptions:

- A small open economy.
- Savers expect no change in exchange rates: $r = r_{for}$ (real interest rate parity/no arbitrage)
- We then look at the implications for fiscal and monetary policy under both flexible and fixed exchange rates.

Fiscal Expansion and Flexible Exchange Rates

- The Mundell-Fleming model gives the surprising implication that fiscal policy is ineffective in a small open economy with flexible exchange rates
- Consider this: We start off in LR equilibrium, and *G* rises temporarily
  - SR: *IS* shifts right and *Y*, *r* rise
  - In a closed economy, the increase in *r* means that the fiscal expansion would crowd out private investment
  - But, in a small open economy, it doesn't end there

Fiscal Expansion and Flexible Exchange Rates

- Since now $r > r_{For}$, arbitrage kicks in: foreigners demand CAD $ to use their savings in Canada
- e_{nom} rises, so *NX* falls until $r = r_{For}$ (the *IS* curve shifts back to the left)
- Overall: A rise in *G* leads to a fall in *NX*

– this is the net export crowding out

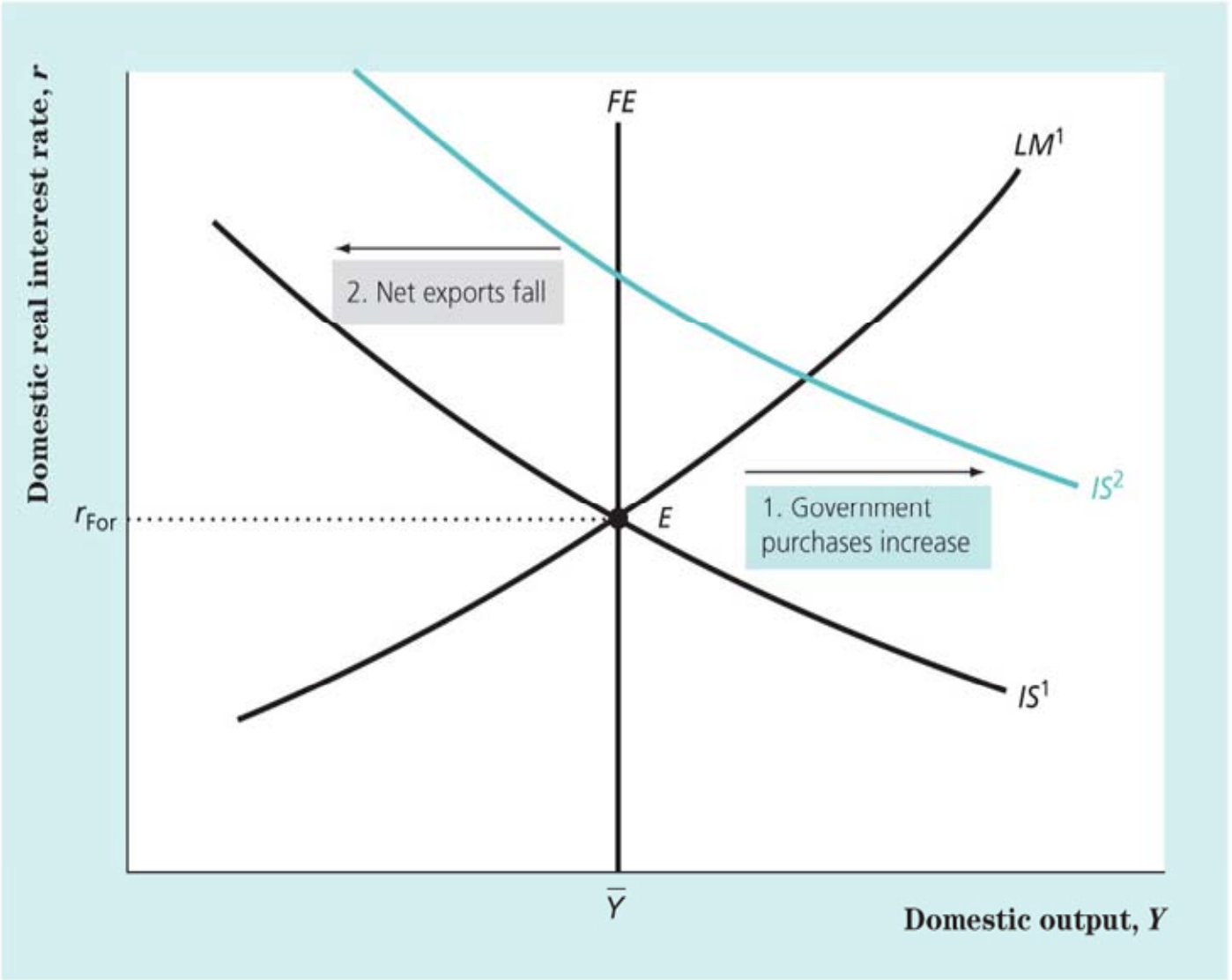
- If *G* rise by $1, *NX* fall by $1

– so *Y* won't rise, meaning that there is no Long Run change in *P* (i.e. no *LM* curve shift)

FIGURE 10.8

AN INCREASE IN GOVERNMENT PURCHASES IN A SMALL OPEN ECONOMY WITH FLEXIBLE EXCHANGE RATES

An increase in government purchases shifts the *IS* curve up and to the right, from IS^1 to IS^2. There results a temporary increase in the domestic interest rate above the foreign interest rate. As a consequence, the exchange rate appreciates, causing net exports to fall. IS^2 must return to IS^1 because only here does the exchange rate appreciation stop. There is no price level response unless the exchange rate is slow to respond to the temporary increase in the domestic interest rate. For this reason, the Keynesian short run, the Keynesian long run, and the classical model all generate the same result—general equilibrium remains at point *E*.



Fiscal Expansion and Flexible Exchange Rates

- The *IS* shifts back to its original position. If the response of the exchange rate is fast, there are no real effects, so there is no change in the price level *P*
- Fiscal policy is ineffective in a Small Open Economy with flexible exchange rates
- It merely shifts the composition of domestic spending from *NX* to *G*
- If fiscal policy can't work, can monetary policy?

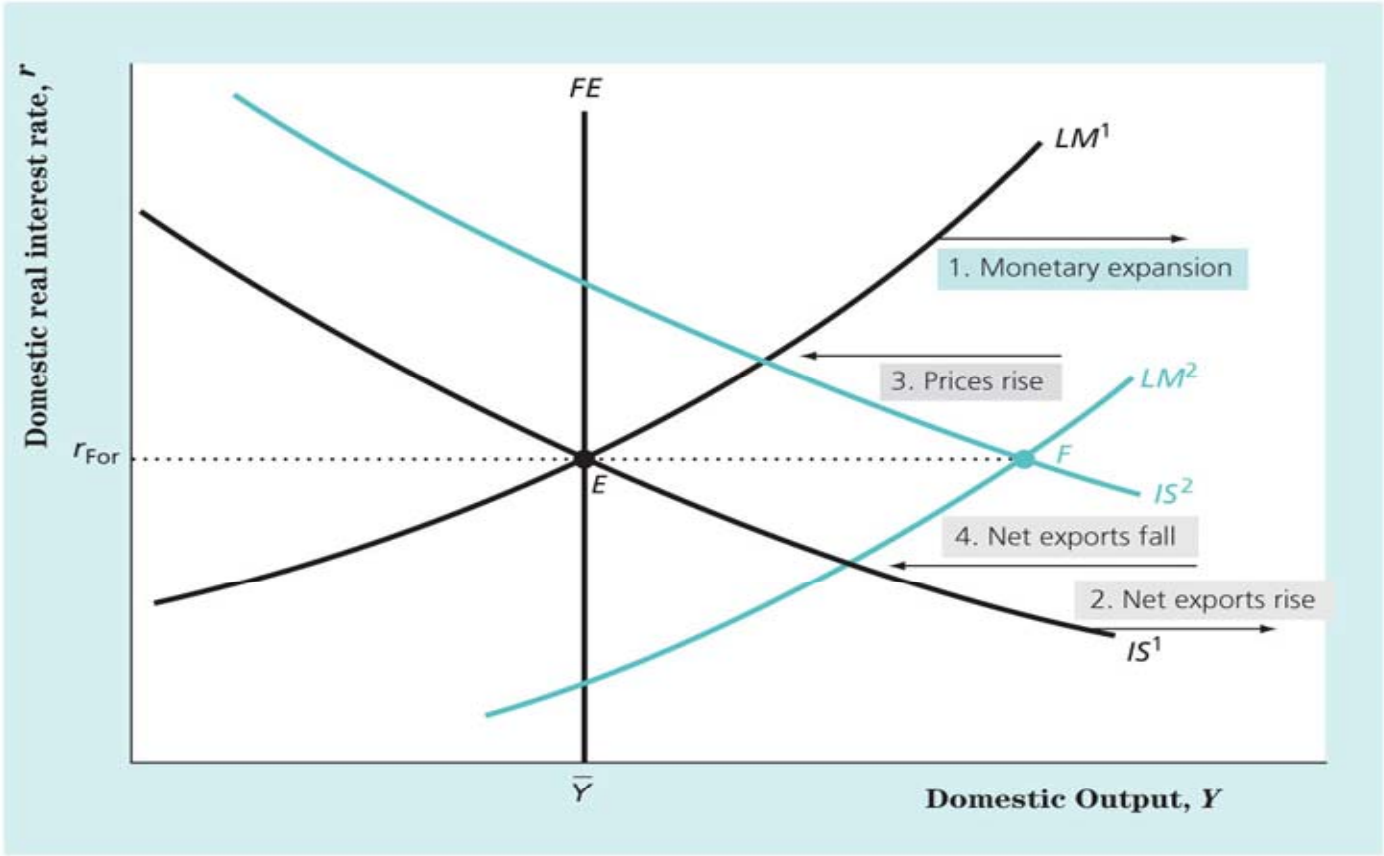
Monetary Expansion and Flexible Exchange Rates

- Consider an increase in *M*: (board)
  - Classical: There is immediate monetary neutrality due to rapid price changes
  - Keynesian: There is only LR monetary neutrality
  - Real exchange rates have no LR change however nominal exchange rates will rise
    - if *M* rises by 10%, then *P* rises by 10%, e_{nom} rises by 10%
    - given $e = e_{nom}(P/P_{For})$ and both e and P_{For} unchanged, e_{nom} must fall by the amount *P* rises.

FIGURE 10.9

A MONETARY EXPANSION IN A SMALL OPEN ECONOMY WITH FLEXIBLE EXCHANGE RATES

A monetary expansion shifts the *LM* curve down and to the right, from LM^1 to LM^2. In the Keynesian short run, there results a temporary decrease in the domestic interest rate below the foreign interest rate. As a consequence, the exchange rate depreciates, causing net exports to increase and causing the *IS* curve to shift up and to the right from IS^1 to IS^2. The curves IS^2 and LM^2 must intersect at point *F*, where the domestic and foreign interest rates are equal. In the Keynesian long run, the domestic price level increases. This causes LM^2 to shift up and to the left and causes the domestic interest rate to increase temporarily above the foreign interest rate. The currency appreciates, causing a fall in net exports. Both IS^2 and LM^2 return to their original positions at point *E*. In the classical model, equilibrium remains at point *E* throughout because of the rapid adjustment of the price level.



Flexible Exchange Rates: A Summary

- Fiscal expansion:
  - no effect, even in short run, as upward pressure on *e* offsets expansionary effect of higher *G*;
  - in long run, *P* doesn't change (as *M* hasn't changed) so e_{nom} does the adjusting – it rises and crowds out *NX* completely
  - the conclusion is that higher *G* then crowds out completely *NX* through the effect on *e*.

Flexible Exchange Rates: A Summary (continued)

- Monetary expansion:
  - large short run effect as increased *M* lowers *e* *(*with *P* constant) and stimulates *NX*;
  - the higher *NX* shifts the IS curve to the right;
  - short-run equilibrium where *r* is unchanged but higher real *M* (with *P* unchanged) and *Y* (which can be determined from *LM* curve);
  - with *Y* greater than $\overline{Y}$, *P* now starts to rise shifting back the *LM* curve;
  - this causes *e* to rise and *NX* to fall, shifting back the *IS* curve.

What's next?

- Q3 from Ch 10 of the textbook

- Next class:
  - Finish off Ch 10
  - Review of the course
  - Details of the final exam