Chapter 16
Output and the Exchange Rate in the Short Run

Prepared by Iordanis Petsas
To Accompany
International Economics: Theory and Policy, Sixth Edition
by Paul R. Krugman and Maurice Obstfeld
Chapter Organization

- Determinants of Aggregate Demand in an Open Economy
- The Equation of Aggregate Demand
- How Output Is Determined in the Short Run
- Output Market Equilibrium in the Sort Run: The DD Schedule
- Asset Market Equilibrium in the Short Run: The AA Schedule
- Short-Run Equilibrium for an Open Economy: Putting the DD and AA Schedules Together
Chapter Organization

- Temporary Changes in Monetary and Fiscal Policy
- Inflation Bias and Other Problems of Policy Formulation
- Permanent Shifts in Monetary and Fiscal Policy
- Macroeconomic Policies and the Current Account
- Gradual Trade Flow Adjustment and Current Account Dynamics
- Summary
Chapter Organization

- Appendix: The *IS-LM* Model and the *DD-AA* Model
- Appendix: Intertemporal Trade and the Current Account
Introduction

- Macroeconomic changes that affect exchange rates, interest rates, and price levels may also affect output.
  - This chapter introduces a new theory of how the output market adjusts to demand changes when product prices are themselves slow to adjust.

- A short-run model of the output market in an open economy will be utilized to analyze:
  - The effects of macroeconomic policy tools on output and the current account
  - The use of macroeconomic policy tools to maintain full employment
Determinants of Aggregate Demand in an Open Economy

- **Aggregate demand**
  - The amount of a country’s goods and services demanded by households and firms throughout the world.

- The aggregate demand for an open economy’s output consists of four components:
  - Consumption demand \((C)\)
  - Investment demand \((I)\)
  - Government demand \((G)\)
  - Current account \((CA)\)
Determinants of Aggregate Demand in an Open Economy

- **Determinants of Consumption Demand**
  - Consumption demand increases as disposable income (i.e., national income less taxes) increases at the aggregate level.
    - The increase in consumption demand is less than the increase in the disposable income because part of the income increase is saved.
Determinants of Aggregate Demand in an Open Economy

- Determinants of the Current Account
  - The \( CA \) balance is viewed as the demand for a country’s exports \( (EX) \) less that country's own demand for imports \( (IM) \).
  - The \( CA \) balance is determined by two main factors:
    - The domestic currency’s real exchange rate against foreign currency \( (q = EP*/P) \)
    - Domestic disposable income \( (Y^d) \)
How Real Exchange Rate Changes Affect the Current Account

- An increase in $q$ raises $EX$ and improves the domestic country’s $CA$.
  - Each unit of domestic output now purchases fewer units of foreign output, therefore, foreign will demand more exports.
- An increase $q$ can raise or lower $IM$ and has an ambiguous effect on $CA$.
  - $IM$ denotes the value of imports measured in terms of domestic output.
Determinants of Aggregate Demand in an Open Economy

- There are two effects of a real exchange rate:
  - Volume effect
    - The effect of consumer spending shifts on export and import quantities
  - Value effect
    - It changes the domestic output worth of a given volume of foreign imports.
- Whether the CA improves or worsens depends on which effect of a real exchange rate change is dominant.
- We assume that the volume effect of a real exchange rate change always outweighs the value effect.
Trade Elasticities

- Let $EX(q) = \text{exports}$
- Let $IM(q, Y) = \text{imports (in volume terms, e.g., number of widgets)}$
- Then imports valued in terms of domestic goods (exports) = $q \ IM(q, Y)$
- Exports $EX$ rise when $q$ rises (real depreciations)
- Import volume $IM$ falls when $q$ rises
- So import value $q \ IM$ may rise or fall when $q$ rises.
Trade Elasticities (cont.)

- \( CA(q, Y) = EX(q) - qIM(q) \).
- So a rise in \( q \) (real depreciation of the home currency) may cause home current account to rise or worsen.
- Depends on elasticities of export and import demand w.r.t the real exchange rate \( q \). Define:

\[
\eta = \frac{q}{EX} \left( \frac{dEX}{dq} \right), \quad \eta^* = -\frac{q}{IM} \left( \frac{dIM}{dq} \right)
\]
Trade Elasticities (cont.)

- You can show (see Chapter 16, appendix 2) that the condition for a real depreciation to improve the current account balance (other things equal) is that the elasticities be sufficiently big.
- This gives the following *Marshall-Lerner* condition:

\[
\eta + \eta^* > 1.
\]
## Some Empirical Estimates of Trade Elasticities for Manufactured Goods

<table>
<thead>
<tr>
<th>Country</th>
<th>( \eta )</th>
<th></th>
<th></th>
<th>( \eta^* )</th>
<th></th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Impact</td>
<td>Short-run</td>
<td>Long-run</td>
<td>Impact</td>
<td>Short-run</td>
<td>Long-run</td>
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<tr>
<td>Austria</td>
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<td>1.37</td>
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<td>—</td>
<td>—</td>
<td>0.70</td>
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<td>—</td>
<td>0.31</td>
<td>0.60</td>
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<td>0.64</td>
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<td>1.61</td>
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<td>0.72</td>
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<td>Netherlands</td>
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<td>0.89</td>
<td>0.71</td>
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<td>Norway</td>
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<td>0.01</td>
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<td>—</td>
<td>0.94</td>
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<td>United States</td>
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<td>1.06</td>
<td>1.06</td>
</tr>
</tbody>
</table>

Trade Elasticities (cont.)

USD Real Effective Exchange Rate: IMF Measures

Current account of U.S.
Determinants of Aggregate Demand in an Open Economy

- How Disposable Income Changes Affect the Current Account
  - An increase in disposable income \( (Y_d) \) worsens the \( CA \).
  - A rise in \( Y_d \) causes domestic consumers to increase their spending on all goods.
### Table 16-1: Factors Determining the Current Account

<table>
<thead>
<tr>
<th>Change</th>
<th>Effect on current account, CA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real exchange rate, $EP^*/P\uparrow$</td>
<td>$CA\uparrow$</td>
</tr>
<tr>
<td>Real exchange rate, $EP^*/P\downarrow$</td>
<td>$CA\downarrow$</td>
</tr>
<tr>
<td>Disposable income, $Y^d\uparrow$</td>
<td>$CA\downarrow$</td>
</tr>
<tr>
<td>Disposable income, $Y^d\downarrow$</td>
<td>$CA\uparrow$</td>
</tr>
</tbody>
</table>
The four components of aggregate demand are combined to get the total aggregate demand:

\[ D = C(Y - T) + I + G + CA(EP^*/P, Y - T) \]

This equation shows that aggregate demand for home output can be written as:

\[ D = D(EP^*/P, Y - T, I, G) \]
The Real Exchange Rate and Aggregate Demand

- An increase in $q$ raises $CA$ and $D$.
  - It makes domestic goods and services cheaper relative to foreign goods and services.
  - It shifts both domestic and foreign spending from foreign goods to domestic goods.
  - A real depreciation of the home currency raises aggregate demand for home output.
    - A real appreciation lowers aggregate demand for home output.
The Equation of Aggregate Demand

- Real Income and Aggregate Demand
  - A rise in domestic real income raises aggregate demand for home output.
  - A fall in domestic real income lowers aggregate demand for home output.
The Equation of Aggregate Demand

**Figure 16-1:** Aggregate Demand as a Function of Output

The Equation of Aggregate Demand

Aggregate demand function,

\[ D(EP^*/P, Y - T, I, G) \]

Output (real income), \( Y \)

Aggregate demand, \( D \)
How Output Is Determined in the Short Run

Output market is in equilibrium in the short-run when real output, Y, equals the aggregate demand for domestic output:

\[ Y = D(EP*/P, Y - T, I, G) \]  (16-1)
How Output Is Determined in the Short Run

Figure 16-2: The Determination of Output in the Short Run

Aggregate demand, $D$

Aggregate demand = aggregate output, $D = Y$

Output, $Y$

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Output, the Exchange Rate, and Output Market Equilibrium

- With fixed price levels at home and abroad, a rise in the nominal exchange rate makes foreign goods and services more expensive relative to domestic goods and services.
  - Any rise in \( q \) will cause an upward shift in the aggregate demand function and an expansion of output.
  - Any fall in \( q \) will cause output to contract.
Output Market Equilibrium in the Short Run: The \( DD \) Schedule

Figure 16-3: Output Effect of a Currency Depreciation with Fixed Output Prices
Output Market Equilibrium in the Short Run: The $DD$ Schedule

- Deriving the $DD$ Schedule
  - $DD$ schedule
    - It shows all combinations of output and the exchange rate for which the output market is in short-run equilibrium (aggregate demand = aggregate output).
    - It slopes upward because a rise in the exchange rate causes output to rise.
Output Market Equilibrium in the Short Run: The $DD$ Schedule

**Figure 16-4: Deriving the $DD$ Schedule**

Aggregate demand, $D$

Exchange rate, $E$

Output, $Y$

$D = Y$

Aggregate demand ($E^2$)

Aggregate demand ($E^1$)

$E^2$

$E^1$

1

2

$Y^1$

$Y^2$
Factors that Shift the $DD$ Schedule

- Government purchases
- Taxes
- Investment
- Domestic price levels
- Foreign price levels
- Domestic consumption
- Demand shift between foreign and domestic goods

A disturbance that raises (lowers) aggregate demand for domestic output shifts the $DD$ schedule to the right (left).
Figure 16-5: Government Demand and the Position of the $DD$ Schedule

Aggregate demand, $D$

Government spending rises

Exchange rate, $E$

Output, $Y$

$D = Y$

$D(\frac{E^0P^*}{P}, Y - T, I, G^2)$

$D(\frac{E^0P^*}{P}, Y - T, I, G^1)$

$DD^1$

$DD^2$
Asset Market Equilibrium in the Short Run: The $AA$ Schedule

- **$AA$ Schedule**
  - It shows all combinations of exchange rate and output that are consistent with equilibrium in the domestic money market and the foreign exchange market.
Output, the Exchange Rate, and Asset Market Equilibrium

- We will combine the interest parity condition with the money market to derive the asset market equilibrium in the short-run.

- The interest parity condition describing foreign exchange market equilibrium is:

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

where: 
- \( E^e \) is the expected future exchange rate
- \( R \) is the interest rate on domestic currency deposits
- \( R^* \) is the interest rate on foreign currency deposits
Asset Market Equilibrium in the Short Run: The AA Schedule

- The $R$ satisfying the interest parity condition must also equate the real domestic money supply to aggregate real money demand:
  \[ \frac{M^s}{P} = L(R, Y) \]

- Aggregate real money demand $L(R, Y)$ rises when the interest rate falls because a fall in $R$ makes interest-bearing nonmoney assets less attractive to hold.
Asset Market Equilibrium in the Short Run: The $AA$ Schedule

Figure 16-6: Output and the Exchange Rate in Asset Market Equilibrium

Exchange Rate, $E$

- Foreign exchange market
- Money market

Real domestic money holdings

Domestic-currency return on foreign-currency deposits

Domestic interest rate, $R$

Output rises

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For asset markets to remain in equilibrium:

• A rise in domestic output must be accompanied by an appreciation of the domestic currency.
• A fall in domestic output must be accompanied by a depreciation of the domestic currency.
Asset Market Equilibrium in the Short Run: The AA Schedule

- **Deriving the AA Schedule**
  - It relates exchange rates and output levels that keep the money and foreign exchange markets in equilibrium.
  - It slopes downward because a rise in output causes a rise in the home interest rate and a domestic currency appreciation.
Asset Market Equilibrium in the Short Run: The AA Schedule

Figure 16-7: The AA Schedule

Exchange Rate, $E$

$E^1$

$E^2$

Output, $Y$

$Y^1$

$Y^2$

$AA$

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A short-run equilibrium for the economy as a whole must bring equilibrium simultaneously in the output and asset markets.

• That is, it must lie on both DD and AA schedules.
Asset Market Equilibrium in the Short Run: The $AA$ Schedule

- Factors that Shift the $AA$ Schedule
  - Domestic money supply
  - Domestic price level
  - Expected future exchange rate
  - Foreign interest rate
  - Shifts in the aggregate real money demand schedule
Short-Run Equilibrium for an Open Economy: Putting the DD and AA Schedules Together

Figure 16-8: Short-Run Equilibrium: The Intersection of DD and AA

Exchange Rate, $E$

Output, $Y$

Short-Run Equilibrium for an Open Economy: Putting the DD and AA Schedules Together

Figure 16-8: Short-Run Equilibrium: The Intersection of DD and AA

Exchange Rate, $E$

Output, $Y$

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Figure 16-8: Short-Run Equilibrium: The Intersection of DD and AA

Exchange Rate, $E$

Output, $Y$
Short-Run Equilibrium for an Open Economy: Putting the $DD$ and $AA$ Schedules Together

Figure 16-9: How the Economy Reaches Its Short-Run Equilibrium
Temporary Changes in Monetary and Fiscal Policy

- **Two types of government policy:**
  - **Monetary policy**
    - It works through changes in the money supply.
  - **Fiscal policy**
    - It works through changes in government spending or taxes.
  - Temporary policy shifts are those that the public expects to be reversed in the near future and do not affect the long-run expected exchange rate.
  - Assume that policy shifts do not influence the foreign interest rate and the foreign price level.
Temporary Changes in Monetary and Fiscal Policy

- **Monetary Policy**
  - An increase in money supply (i.e., expansionary monetary policy) raises the economy’s output.
    - The increase in money supply creates an excess supply of money, which lowers the home interest rate.
      - As a result, the domestic currency must depreciate (i.e., home products become cheaper relative to foreign products) and aggregate demand increases.
Figure 16-10: Effects of a Temporary Increase in the Money Supply

Temporary Changes in Monetary and Fiscal Policy
Temporary Changes in Monetary and Fiscal Policy

- Fiscal Policy
  - An increase in government spending, a cut in taxes, or some combination of the two (i.e., expansionary fiscal policy) raises output.
    - The increase in output raises the transactions demand for real money holdings, which in turn increases the home interest rate.
      - As a result, the domestic currency must appreciate.
Temporary Changes in Monetary and Fiscal Policy

Figure 16-11: Effects of a Temporary Fiscal Expansion

![Diagram showing the effects of a temporary fiscal expansion on output and the exchange rate.](slide16-45)
Temporary Changes in Monetary and Fiscal Policy

- Policies to Maintain Full Employment
  - Temporary disturbances that lead to recession can be offset through expansionary monetary or fiscal policies.
    - Temporary disturbances that lead to overemployment can be offset through contractionary monetary or fiscal policies.
Figure 16-12: Maintaining Full Employment After a Temporary Fall in World Demand for Domestic Products
Temporary Changes in Monetary and Fiscal Policy

Figure 16-13: Policies to Maintain Full Employment After a Money-Demand Increase

The diagram illustrates the relationship between output, \( Y \), and the exchange rate, \( E \), under temporary changes in monetary and fiscal policy. The curves \( DD^1 \) and \( DD^2 \) represent demand for output at different exchange rates. The curves \( AA^1 \) and \( AA^2 \) represent supply of output. The point of intersection between these curves determines the equilibrium output and exchange rate. The diagram shows how changes in policy can shift these curves, affecting the overall balance of supply and demand in the economy.
Inflation Bias and Other Problems of Policy Formulation

- Problems of policy formulation:
  - **Inflation bias**
    - High inflation with no average gain in output that results from governments’ policies to prevent recession
  - Identifying the sources of economic changes
  - Identifying the durations of economic changes
  - The impact of fiscal policy on the government budget
  - Time lags in implementing policies
A permanent policy shift affects not only the current value of the government’s policy instrument but also the long-run exchange rate.

- This affects expectations about future exchange rates.

A Permanent Increase in the Money Supply

- A permanent increase in the money supply causes the expected future exchange rate to rise proportionally.
  
  - As a result, the upward shift in the $AA$ schedule is greater than that caused by an equal, but transitory, increase (compare point 2 with point 3 in Figure 16-14).
Permanent Shifts in Monetary and Fiscal Policy

Figure 16-14: Short-Run Effects of a Permanent Increase in the Money Supply
Adjustment to a Permanent Increase in the Money Supply

- The permanent increase in the money supply raises output above its full-employment level.
  - As a result, the price level increases to bring the economy back to full employment.
- Figure 16-15 shows the adjustment back to full employment.
Permanent Shifts in Monetary and Fiscal Policy

Figure 16-15: Long-Run Adjustment to a Permanent Increase in the Money Supply

Diagram showing the adjustment of output and exchange rate to a permanent increase in the money supply. The graph illustrates the movement from initial equilibrium (DD') to new long-run equilibrium (DD''). The exchange rate (E) and output (Y) are adjusted accordingly.
Permanent Shifts in Monetary and Fiscal Policy

- A Permanent Fiscal Expansion
  - A permanent fiscal expansion changes the long-run expected exchange rate.
    - If the economy starts at long-run equilibrium, a permanent change in fiscal policy has no effect on output.
      - It causes an immediate and permanent exchange rate jump that offsets exactly the fiscal policy’s direct effect on aggregate demand.
Permanent Shifts in Monetary and Fiscal Policy

Figure 16-16: Effects of a Permanent Fiscal Expansion Changing the Capital Stock

- Output, $Y$
- Exchange Rate, $E$

- $E^1$
- $E^2$
- $Y^f$

- $DD^1$
- $DD^2$
- $AA^1$
- $AA^2$
Macroeconomic Policies and the Current Account

- **XX schedule**
  - It shows combinations of the exchange rate and output at which the CA balance would be equal to some desired level.
  - It slopes upward because a rise in output encourages spending on imports and thus worsens the current account (if it is not accompanied by a currency depreciation).
  - It is flatter than **DD**.
Macroeconomic Policies and the Current Account

• Monetary expansion causes the CA balance to increase in the short run (point 2 in Figure 16-17).

• Expansionary fiscal policy reduces the CA balance.
  – If it is temporary, the DD schedule shifts to the right (point 3 in Figure 16-17).
  – If it is permanent, both AA and DD schedules shift (point 4 in Figure 16-17).
Macroeconomic Policies and the Current Account

Figure 16-17: How Macroeconomic Policies Affect the Current Account
Gradual Trade Flow Adjustment and Current Account Dynamics

- **The J-Curve**
  - If imports and exports adjust gradually to real exchange rate changes, the CA may follow a J-curve pattern after a real currency depreciation, first worsening and then improving.
    - Currency depreciation may have a contractionary initial effect on output, and exchange rate overshooting will be amplified.
  - It describes the time lag with which a real currency depreciation improves the CA.
Gradual Trade Flow Adjustment and Current Account Dynamics

Figure 16-18: The J-Curve

- **Current account (in domestic output units)**
- **Long-run effect of real depreciation on the current account**
- **Real depreciation takes place and J-curve begins**
- **End of J-curve**

- **Point 1**:
  - Real depreciation takes place and J-curve begins

- **Point 2**:
  - Long-run effect of real depreciation on the current account

- **Point 3**:
  - End of J-curve
Exchange Rate Pass-Through and Inflation

- The CA in the DD-AA model has assumed that nominal exchange rate changes cause proportional changes in the real exchange rates in the short run.

- **Degree of Pass-through**
  - It is the percentage by which import prices rise when the home currency depreciates by 1%.
    - In the DD-AA model, the degree of pass-through is 1.
  - Exchange rate pass-through can be incomplete because of international market segmentation.
    - Currency movements have less-than-proportional effects on the relative prices determining trade volumes.
Summary

- The aggregate demand for an open economy’s output consists of four components: consumption demand, investment demand, government demand, and the current account.
- Output is determined in the short run by the equality of aggregate demand and aggregate supply.
- The economy’s short-run equilibrium occurs at the exchange rate and output level.
Summary

- A temporary increase in the money supply causes a depreciation of the currency and a rise in output.
- Permanent shifts in the money supply cause sharper exchange rate movements and therefore have stronger short-run effects on output than transitory shifts.
- If exports and imports adjust gradually to real exchange rate changes, the current account may follow a J-curve pattern after a real currency depreciation, first worsening and then improving.
Appendix I: The *IS-LM* Model and the *DD-AA* Model

**Figure 16AI-1:** Short-Run Equilibrium in the *IS-LM* Model

The diagram illustrates the short-run equilibrium in the *IS-LM* Model. The *IS* and *LM* curves intersect at point 1, indicating the equilibrium levels of output, $Y^1$, and interest rate, $R^1$. The *IS* curve represents the relationship between output and the interest rate, while the *LM* curve shows the supply of money and the demand for money at different interest rates.
Appendix I: The *IS-LM* Model and the *DD-AA* Model

Figure 16AI-2: Effects of Permanent and Temporary Increases in the Money Supply in the *IS-LM* Model

Expected domestic-currency return on foreign-currency deposits

Interest rate, $R$

Output, $Y$

Exchange rate, $E$  (← increasing)
Appendix I: The IS-LM Model and the DD-AA Model

Figure 16AI-3: Effects of Permanent and Temporary Fiscal Expansions in the IS-LM Model

- **Expected domestic-currency return on foreign-currency deposits**
- **Interest rate, \( R \)**
- **Exchange rate, \( E \) (← increasing)**
- **Output, \( Y \)**

Exchange points:
- 1
- 2
- 3

IS curves:
- IS\(^1\)
- IS\(^2\)

LM curve:
- LM

Output levels:
- \( Y^f \)
- \( Y^2 \)
Appendix II: Intertemporal Trade and Consumption Demand

Figure 16AII-1: Change in Output and Saving

Future consumption

Intertemporal budget constraints

Indifference curves

$D^2_F$ $D^1_F = Q^1_F$

$D^1_P = Q^1_P$ $D^2_P$ $Q^2_P$ Present consumption