Topic G
National Income Determination and Price Level

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Learning Outcomes

After completing this topic, you should be able to

- *Explain* why the aggregate demand (AD) curve is downward sloping
- *Identify* and understand the determinants of AD
- *Explain* why the long run aggregate supply (LRAS) curve is vertical
- *Explain* why the short run aggregate supply (SRAS) curve is upward sloping
- *Identify* and understand factors affecting LRAS and SRAS
- *Determine* output and price levels in the AS-AD model
- *Explain* and illustrate the changes in equilibrium output and price levels caused by changes in AD and/or AS
- *Analyse* the relationship between employment and output level

1. Introduction

In Topic F, we learn how to compile Gross Domestic Product (GDP) which measures the total value of production of all resident producing units of an economy in a specified period (typically a year or a quarter), before deducting the consumption of fixed capital. Empirically, for most of the countries, particularly for those advanced countries, GDP demonstrates an upward trend in the long run. However, in the short run, we observe that GDP fluctuates around this long term trend. During economic booms, consumption increases and firms invest more, GDP goes up. During recessions, consumers spend less and firms cut its investment, GDP goes down. The ups and downs of GDP not only affect the living standards, but also employment level of an economy.

In this unit, we use an aggregate demand (AD) and aggregate supply (AS) model to analyse the determination of output and price levels. We will then illustrate how changes in AD and AS affect the output and price levels. After that, we will discuss the relationship between output and employment levels.

2. Aggregate Demand

2.1 What is aggregate demand?

We learn from Topic F that GDP (Y) is made up of four components: consumption (C), investment (I), government expenditure (G), and net exports (NX). Each of the four components is a part of aggregate demand (AD). Then we have:

$$Y = C + I + G + NX$$

2.2 What is an AD curve?

An AD curve shows the relationship between price and the quantity of output (real GDP) demanded by the households, firms, the government and foreign sectors.

2.3 Why is the aggregate demand curve downward sloping?

Figure 1 shows a downward sloping AD curve which indicates that a fall in the price level increases quantity of real GDP(output) demanded, and vice versa. This means that to understand why the AD curve slopes downward, we must understand how changes in the price level affect consumption, investment, and net exports. Government expenditure is assumed to be fixed by policy, not by price level. Thus it is not included in the analysis at this stage.

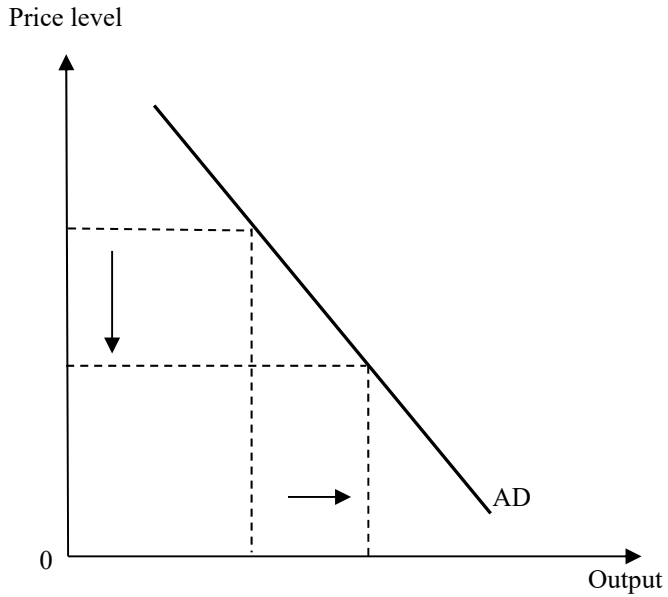


Figure 1 A downward-sloping aggregate demand curve

I. The Wealth Effect: The Price Level and Consumption

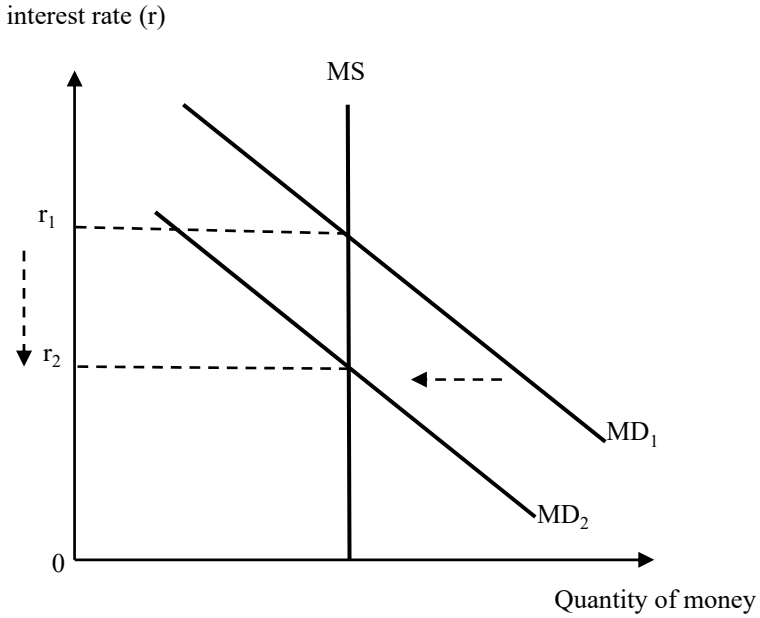
A household's wealth is the difference between the value of its assets and the value of its debt. For example, if you hold all your $10,000 assets in cash and you have no debt, your wealth is $10,000. Suppose that the price level unexpectedly drops by 20%, the real value of your wealth will increase by 20% as your purchasing power has increased. A fall in the price level makes consumers become wealthier, which in turn encourages them to spend more. The increase in consumption spending means a larger quantity of goods and services demanded.

II. The Interest-Rate Effect: The Price Level and Investment

- When the price level is lower, households needs less money to buy goods and services. They withdraw less and borrow less money from the banks. They need to sell less financial assets, such as bond, in the market. All these add liquidity (i.e. funds) in the financial market and interest rates will fall.
- A fall in interest rates encourages borrowing by firms that want to invest in new plants and equipment. Thus, a lower price level leads to a fall in the interest rate, encourages greater spending on investment goods, resulting in an increase in the quantity of goods and services demanded.

Alternative analysis -relationship between price level and interest rate- money market

When the price level falls, the quantity of money required for a given amount of transaction would decrease. Hence the quantity of money demanded at each interest rate would decrease, the money demand curve will shift to left (MD_1 to MD_2) and the interest rate will decrease from r_1 to r_2.



III. The Exchange-Rate Effect: The Price Level and Net Exports

Net exports (NX) is equal to the value of exports (X) minus the value of imports (M). Suppose the price level of Country A decreases and becomes relatively lower than that in other countries, Country A's exports will become less expensive and foreign imports will become relatively more expensive. Consumers in foreign countries will shift their consumption from domestic products to importing Country A's products, and consumers in Country A will also shift from buying imported products to buying domestic products. Hence Country A's exports will increase and its imports will decrease. Country A's net exports will in turn increase. It means the quantity of goods and services demanded in Country A will increase.

Alternative analysis- relationship between price level and net exports: capital flow

As discussed in the previous section, a lower price level decreases interest rate. Suppose a fall in the price level in the United States lowers the U.S. interest rate. American investors will gain higher returns by investing abroad. Increasing U.S. capital outflow raises the supply of US dollars in the foreign exchange market. US dollars will then depreciate. U.S. goods become relatively cheaper than foreign goods. Exports rise and imports fall. Net exports increase, thereby raising the quantity of goods and services demanded in the U.S.

Don't Confuse!

Shift of the AD curve versus Movement along the AD curve

The AD curve shows the relationship between price level and quantity of output demanded, ***holding other factors unchanged****. As discussed above, when price level changes, the output level changes due to the wealth effect, interest-rate effect and exchange-rate effect. Such changes are shown by movements along an AD curve. However, when other factors (e.g. government policy) change, and the* ***price level remains unchanged****, the whole AD curve will shift to the right or left. For example, when government increases spending on infrastructure, the AD curve will shift to the right from* AD_1 *to* AD_2*. This shift is caused by government policy,* ***not by the changes in the price level****.*

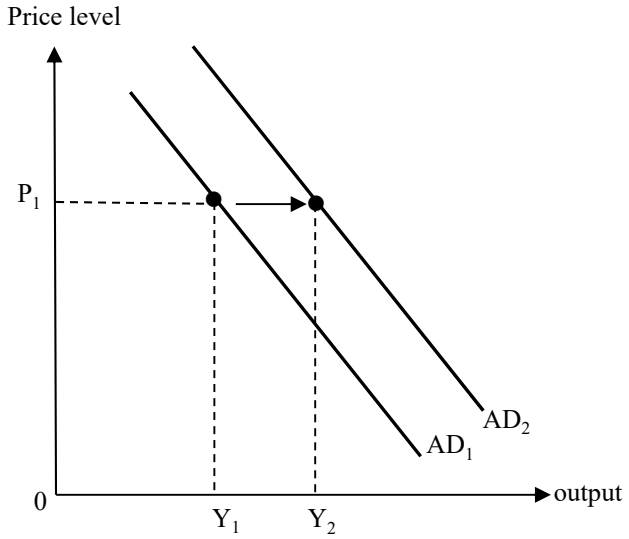


Figure 3 Shift of the AD Curve

2.4 Determinants of aggregate demand

As mentioned above, when the price level keeps constant, other factors may change the aggregate demand, which shifts the AD curve to the left or right. These 'other factors' are called the determinants of aggregate demand. Put it in another way, these determinants are the factors shifting the AD curve while keeping the price level unchanged. The factors are discussed below.

I. Private consumption expenditure

Other things being equal, an increase in private consumption expenditure will shift the AD curve to the right and vice versa. Private consumption expenditure is mainly determined by:

(i) *Disposable income (after-tax income)*: If the government cuts taxes e.g. salaries tax, people's disposable income increases and they would spend more. This will result in an increase in aggregate demand.

(ii) *Desire to save*: If Hong Kong people become more concerned with saving for retirement and reduce current consumption, aggregate demand will decline.

(iii) *Wealth (value of assets)*: If the Hong Kong stock market booms, people become wealthier and they tend to spend more.

(iv) *Interest rate*: When interest rate falls, people find the costs of borrowing lower and they have higher incentive to borrow for consumption.

II. Investment expenditure

Any factors fostering firms to invest more would shift the AD curve to the right and vice versa. Firms' incentives to invest are determined primarily by:

(i) *Productivity of factor inputs*: If firms find new tools and machinery (e.g. a faster computer) that can increase output given the same amount of resources, firms are more willing to invest in the new tools and machinery.

(ii) *Business prospects:* Optimistic business prospects offer better returns on investment. Business firms have higher incentive to invest. On the contrary, pessimistic business conditions incentivize firms to cut back investment spending.

(iii) *Government policy*: Government policy can encourage or discourage investment. For example, tax exemption for investment will motivate firms to invest more.

(iv) *Money supply and interest rate*: An increase in the supply of money lowers the interest rate in the short run. This leads to more investment spending, which causes an increase in aggregate demand.

III. Government expenditure

When government increases expenditure on infrastructure or other services such as education and medical services, this shifts the AD curve to the right and vice versa for a decrease in government expenditure.

IV. Net export

Net exports (NX) is equal to the value of exports minus the value of imports. Apart from being affected by the income of the domestic economy, it is also determined by the economic conditions of trading partners and the exchange rate.

(i) *Economic conditions of foreign countries:* When the income levels of foreign countries (i.e. trading partners) grow faster than that of domestic economy, foreign countries will buy more goods from the domestic economy and NX of domestic economy will rise. The AD curve will shift to the right. On the contrary, if the income level of domestic economy grows faster than those of foreign countries, domestic economy will import more and export less. NX will fall and the AD curve will shift to the left.

(ii) *Exchange rate*: NX will fall when the value of domestic currency rises against foreign currency. To illustrate, if the exchange rate between euro and US$ changes from €1 = US$1.5 to €1 = US$1.7, the value of euro increases and the prices of European products in the US will rise, which makes European goods less competitive in the US market. The NX of European countries will fall and the AD curve will shift to the left. By the same analysis, a decrease in value of domestic currency will make domestically produced goods more competitive in the overseas market. It will shift the AD curve to the right.

Don't Confuse!

AD curve in Macroeconomics and Demand Curve in Microeconomics

- ***The AD curve in Macroeconomics*** *shows the relationship between price level and aggregate quantity of output demanded,* ***holding all other factors unchanged****. As discussed above, when price level changes, the aggregate quantity of output demanded changes due to the wealth effect, interest-rate effect and exchange-rate effect.*

- ***The demand curve in Microeconomics*** *also slopes downward, but the reasons are not the same as those for the AD curve in Macroeconomics. The demand curve of a good in Microeconomics slopes downward because when the price of the good goes down, the purchasing power of the consumer goes up and they are willing and able to buy more of that good. This is* ***income effect****. At the same time, the fall in price of the good makes it relatively cheaper given prices of other goods remain unchanged. The consumer will buy more of the cheaper good. This is* ***substitution effect****.*

- *The demand curve in Microeconomics is for a single good, so there can be substitution effect when the price of that good changes. However, the AD curve in Macroeconomics depicts the relationship of general price level and aggregate output level (i.e. all goods and services produced). A rise in general price level means that the prices of all domestically produced goods and services rise. Consumers have no other goods and services which they can substitute for.* ***There is no substitution effect for AD curve in Macroeconomics.***

3. Aggregate Supply

3.1 What is aggregate supply?

- Aggregate supply (AS) refers to the total amount of goods and services supplied by the firms in an economy.

3.2 What is an aggregate supply curve?

- The aggregate supply (AS) curve shows the relationship between price level and the quantity of output that firms in an economy are willing and able to supply.
- It must be noted that since the effects of changes in price level on aggregate supply is very different in short run and long run, we will use two AS curves i.e. the short run aggregate supply (SRAS) curve and the long run aggregate supply (LRAS) curve, for our analysis. We will first examine the long run aggregate supply curve.

3.3 Why is the long run aggregate supply (LRAS) curve vertical?

In the long run, an economy's production of goods and services depends on its availability of resources i.e. labour, capital and natural resources along with the available production technology. In other words, we can say that our long run production capacity is constrained by the available resources and technology. Then we can further infer that price will have no effects on output level in the long run because the change of price level will not change the amount of resources and technology available in the economy. *Because the price level does not affect the determinants of output in the long run, the long-run aggregate-supply curve is vertical*.

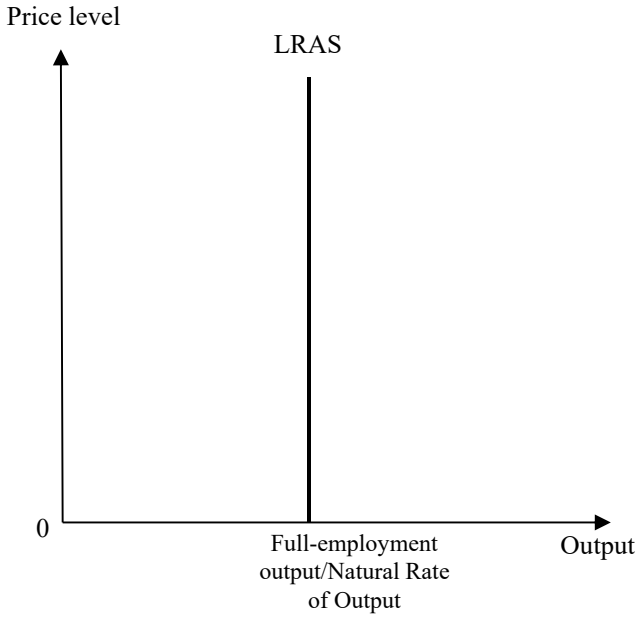


Figure 4 Long run aggregate supply curve

3.4 What are the factors shifting LRAS curve?

The position of the LRAS is at an output level sometimes referred to as *potential output or full-employment output*. This is the level of output that the economy produces when resources are fully utilised (i.e. firms produce at their full capacity) and the economy is at the full-employment level (i.e. the employment level that all people who want to find a job will have one, except those structurally and frictionally unemployed, that is the natural rate of unemployment [1]). This level of output is also called natural rate of output.

[1] Natural rate of unemployment is not required in the Curriculum.

Knowledge Enrichment

- ***Structural unemployment*** *refers to the unemployment caused by the mismatch of the skills and attributes of workers and the requirements of the jobs.*
- ***Frictional unemployment*** *refers to the short-term unemployment arising from the time and process of matching job-seekers and the jobs available.*
- Please note that when we say the economy is operating at the full-employment level, it does not mean the unemployment rate is zero in the economy, there is still structural and frictional unemployment.

Based on the above discussion, it follows that any factors, which can change the natural rate of output, will shift the LRAS curve. The following four factors are able to change the production capacity of an economy, which in turn shifts the LRAS curve.

(i) *Labour*: Labour supply can be increased by growth in population, increases in immigrants, and a fall in the natural rate of unemployment. The long-run aggregate-supply curve would then shift to the right.

(ii) *Capital:* Capital includes both physical and human capital. An increase in the economy's physical capital stock (e.g. factories, machinery and tools) raises productivity and thus shifts the LRAS curve to the right. The rightward shift of LRAS curve can also be accomplished by an increase in human capital (e.g. skills and knowledge of the workers).

(iii) *Natural Resources:* A discovery of new minerals and natural resources increases long run aggregate supply. On the contrary, a change in weather patterns e.g. more frequent drought or floods that makes farming more difficult and hence shifts LRAS curve to the left.

(iv) *Technological Knowledge*: Technological change refers to an advance in knowledge which improves ways to produce goods and services, that is to improve the production efficiency of goods and services. For example, the invention of computer has allowed us to produce more goods and services from any given level of resources. As a result, it has shifted the LRAS curve to the right.

3.5 Why is the short run aggregate supply (SRAS) curve upward sloping?

- The LRAS curve is vertical because price level has no effect on output in the long run. However, the SRAS curve is upward sloping, which indicates that an increase in the overall price level tends to raise the quantity of goods and services supplied and a decrease in the overall price level tends to lower the quantity of goods and services supplied in the economy. Why is there a positive relationship between price and output levels in the short run? **The clue lies on the absence of capacity constraints and the imperfect adjustment of input and output prices[2].**

[2] Starting from S4 in 2013/14, i.e.2016 HKDSE Examination, students are expected to grasp "imperfect adjustment of input and output prices" as the ONLY explanation required for an upward-sloping SRAS curve.

3.5.1 Absence of capacity constraints

- In Figure 5, the full production capacity point is Point C. Suppose the economy is not producing in full capacity (i.e. point C) in the short run but producing at a ***low*** level of output (e.g. point A). It means that there is excess capacity (i.e. **no capacity constraints**) in either individual firms or in the whole economy. There are unemployed resources/factor inputs (labour, capital and so on) available in the economy. When there is a rise in aggregate demand, the firms can increase more output than they raise the output prices (from point A to point B). The firms can achieve this because they can recruit the originally unemployed factor inputs whose prices do not increase much. Therefore, the SRAS curve is relatively flatter in this portion.

- However, when output continues to expand the economy would move closer to full capacity (point C). The unemployed factor inputs will be falling and their prices will begin to rise rapidly. Therefore, the proportion of increase in output price will be larger than that in output quantity. The SRAS curve becomes much steeper (i.e. the portion near point C).

3.5.2 Imperfect adjustment of input and output prices

- The above exposition shows that when the economy is producing below full capacity, the SRAS curve is upward sloping, whether or not it is flat or steep. However, excess production capacity itself cannot fully explain why SRAS is upward sloping. Imagine that if factor prices rise at the same pace as output prices, firms have no incentive to produce more as they make no additional profit, the SRAS curve will become vertical, like the LRAS. For example, if a 10% increase in output prices is immediately matched by a 10% increase in factor costs, the profits for the firms remain unchanged and they have no incentive to increase any output.

- However, in reality, adjustments in input prices always lag behind changes in product prices. It is particularly true when wage contracts are signed the wage rates remain unchanged even when product prices change. It also applies to capital goods or other raw materials, the purchase prices are agreed well before the changes in product prices. In this case, factor input prices tend to adjust slowly to the changes in overall output prices. The ***imperfect adjustment of input and output prices*** incentivizes the firms to increase output when output prices rise to capture additional profit. This also applies to the case that when output prices fall, the input prices do not fall at the same pace, the ***imperfect adjustment of input and output prices*** incentivizes the firms to reduce output to minimize losses.

- In a nutshell, ***excess production capacity*** constitutes a necessary condition and ***imperfect adjustment of input and output prices*** constitutes a sufficient condition for an upward sloping SRAS curve. Put it in a straightforward way, ***excess production capacity*** allows firms to have the resources to produce more if they are willing to do so. ***Imperfect adjustment of input and output prices*** gives an incentive for firms to increase (decrease) output when output prices increase (decrease) faster than input prices.

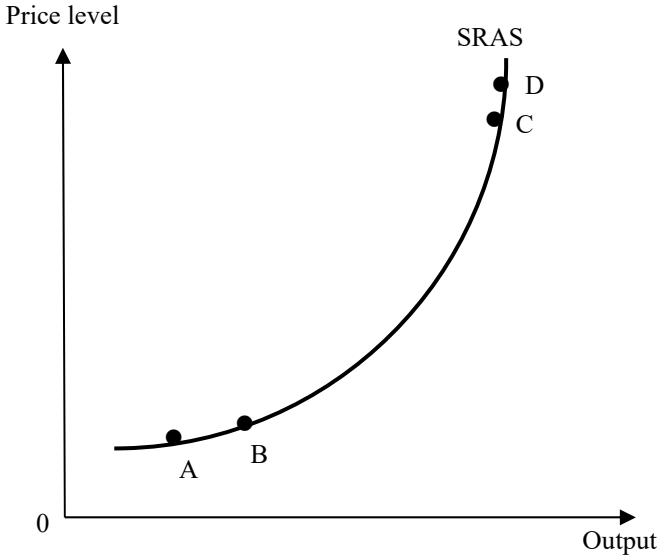


Figure 5 Short run aggregate supply (SRAS) Curve

- The above exposition provides a general explanation of why the SRAS curve is upward sloping. However, to be more specific, there are three theories put forward to explain this relationship.

I. The Sticky-Wage Theory

- Nominal wages are often slow to adjust in the economy due to long-term contracts between workers and firms. Since wages do not immediately adjust to the price level, a reduction in price level makes employment and production less profitable, leading firms to lower the quantity of goods and services supplied.

- For instance, suppose a firm has agreed in advance a certain amount of wage to be paid to workers but then the price level falls unexpectedly. This implies that the firm is now paying a *real wage* (wage/price level) that is larger than it intended and its profit drops. Thus, the firm hires less labor and produces a smaller quantity of goods and services.

II. The Sticky-Price Theory

The prices of some goods and services are also sometimes slow to respond to changes in the economy because of the costs of adjusting prices which are named as ***menu costs***. Menu costs include the costs of printing new menu and catalog as well as the time involved. If the price level rises unexpectedly, some firms immediately adjust their prices upward, but there are firms which do not change the price of its products quickly. It may be due to the fact that these firms would like to *temporarily* avoid the menu costs. The price of their products will be relatively lower and this will lead to a profit in sales. Thus, when sales increase, firms will produce more quantity of goods and services. In a word, because not all prices adjust instantly to changing conditions, an unexpected rise in the price level leaves some firms charging with relatively lower prices, which would boost sales and cause firms to increase the quantity of goods and services supplied.

III. The Misperceptions Theory

- Changes in the price level can ***temporarily mislead*** suppliers about what is happening in the market in which they sell their output. As a result of these misperceptions, suppliers respond to changes in the level of price which causes the SRAS curve to be upward sloping.

- To explain the theory in a more concrete way, suppose that the *general* price level rises *unexpectedly*. Some firms ***mistakenly*** believe that the price of their products rises and they perceive it as an increase in the relative price of their products. Firms may then believe that the reward of supplying their product has increased, and thus they increase the quantity that they supply. A higher *general* price level causes misperceptions about relative prices, and these misperceptions lead firms to respond to the higher price level by increasing the quantity of goods and services supplied.

Don't Confuse!

The Sticky-Price Theory and the Misperceptions Theory

Please note that according to the Sticky-Price Theory, the SRAS curve is upward sloping because some suppliers are ***slow*** to respond to the change of general price level to avoid the menu cost temporarily. However, the Misconceptions Theory explains that some suppliers **over-respond** to the change of general price level due to the lack of information.

3.6 What are the factors shifting the short run aggregate supply curve?

- Factors that shift the LRAS curve will also shift the SRAS curve. However, people's expectation of the price level will affect the position of the SRAS curve even though it has no effect on the LRAS curve.

- A higher expected price level decreases the quantity of goods and services supplied and shifts the SRAS curve to the left. Suppose workers and firms expect the future price will increase, the workers will negotiate a rise in wage to maintain their purchasing power and firms facing higher factor prices will raise the output prices accordingly. If all firms and workers in the economy are affected by higher expected prices, the costs of production will increase and the SRAS curve will shift to the left. By the same analysis, a lower expected price level increases the quantity of goods and services supplied and shifts the SRAS curve to the right.

3.7 A concluding remark

In the short run, not all prices, including prices of factor inputs (e.g. wages), adjust at the same pace. Therefore, when price level goes up, firms are willing to supply more goods and services because profits are higher. As a result, the SRAS curve is upward-sloping. However, in the long run, all prices, including prices of factor inputs, are fully (or completely) adjusted. The 3 percent change in price level will be accompanied by 3 percent change in factor prices. Any increase in profits is absorbed by the rise of input prices, so the firm will have no incentive to increase the supply of goods and services. It follows that change in price level will have no effect on aggregate supply in the long run. The LRAS curve is thus vertical.

4. Determination of the Equilibrium Levels of Output and Price in the AS-AD Model

4.1 Determinants of equilibrium output and price levels in the long run

- Long run equilibrium is found where the aggregate demand curve intersects with the long run aggregate supply curve. Output is at its natural rate. Also at this point, perceptions, factor prices, and prices have ***fully*** adjusted and resources are utilized at its full capacity. Therefore, the SRAS curve and AD curve intersect at the potential (i.e. full employment) output level.

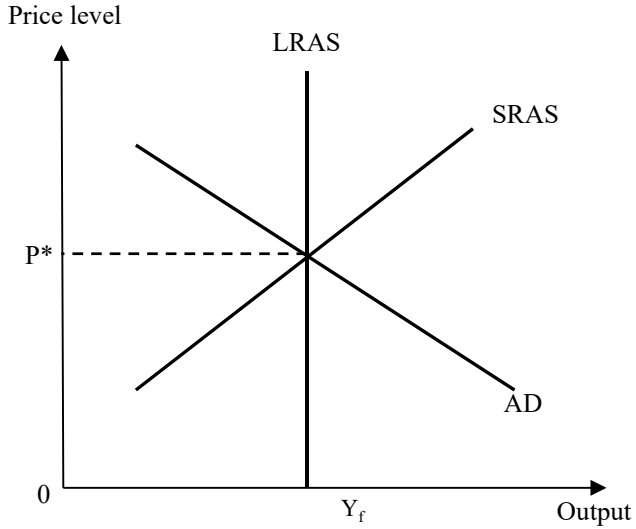


Figure 6 Long Run Equilibrium

4.2 Changes in equilibrium levels of price and output

- Any changes in AD and SRAS will result in changes in price and output levels in the short run. However, the *automatic adjustment mechanism* in the market can restore the economy back to long run equilibrium. We will start our analysis with a change in AD.

I. The effects of a shift in aggregate demand curve

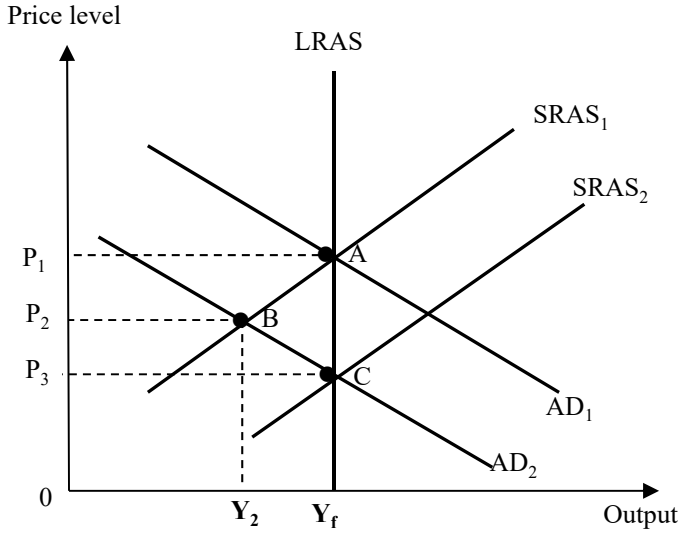


Figure 7 The Effects of a Shift in AD curve

- Suppose households and firms are pessimistic about the future economic conditions, which causes households' spending and firms' investment to decline. This shifts the aggregate demand curve to the left (from AD1 to AD2). In the short run, the equilibrium moves from A to B. Both output and the price levels fall. This drop in output means that the economy is in a recession.

- It is not uncommon for the government to eliminate the recession by boosting government spending. By doing so, aggregate demand curve shifts back to the right. The equilibrium moves back from B to A.

- However, even if the government does nothing, it is possible that the economy will eventually move back to the full-employment output level. As shown in Figure 7, under recession, price level falls from P_1 to P_2. Workers and firms are willing to adjust their sticky wages and sticky prices. When output is low, unemployment is high. Workers are now willing to accept lower wages and firms are willing to accept lower prices. After all adjustments, the SRAS curve shifts to the right, from $SRAS_1$ to $SRAS_2$. Equilibrium moves from B to C, reaching again the full-employment output level at a lower price level P_3. The process of adjustment back to the full-employment output level is called ***automatic adjustment mechanism***.

- In the long run, the decrease in aggregate demand causes a drop in the equilibrium price level but leave the output level unchanged. Thus, the long-run effect of a change in aggregate demand is a *nominal change* (in the price level) but *not a real change* (output level remains constant) .

II. The effects of a shift in short run aggregate supply curve

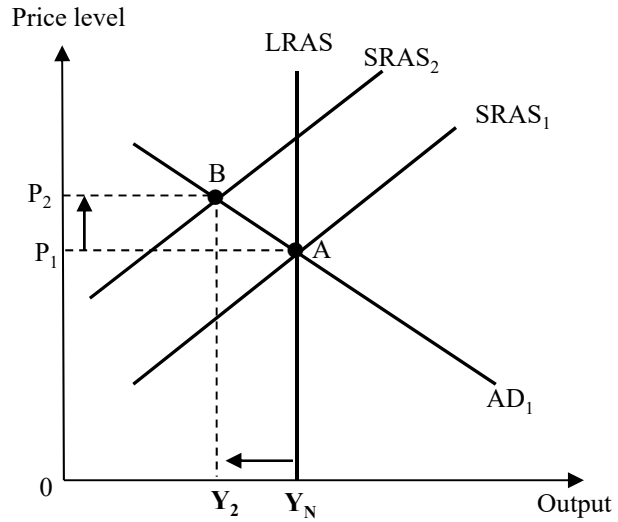


Figure 8 The Effects of a Shift in SRAS curve

Suppose firms face a sudden increase in their costs of production (e.g. oil price increases substantially). This will cause the SRAS curve to shift to the left ($SRAS_1$ to $SRAS_2$ in Figure 8). Assume that it does not affect the LRAS. In the short run, output will fall and the price level will rise, which is called ***stagflation*** (i.e. a period of falling output and rising prices). The equilibrium moves from A to B.

- If the government does nothing, price and wage expectations will adjust. With increased unemployment caused by recession, workers are willing to accept lower wages. When nominal wages fall, producing goods and services becomes more profitable and firms are able and willing to supply more, causing the SRAS curve to shift back to the right. Recession gradually ends and employment rebounds. The equilibrium moves back from B to A ($SRAS_2$ to $SRAS_1$).
- However, if the government is impatient to wait for the automatic adjustment mechanism (the impatience of the government may be due to political pressure), it can shift the AD curve by increasing government expenditure. AD curve shifts from AD_1 to AD_2 (Figure 9). The recession will end, but the price level will be permanently higher at P_3. The higher price level is pushed by the government's expansionary fiscal policy. The equilibrium moves from A to B, and then finally to C.

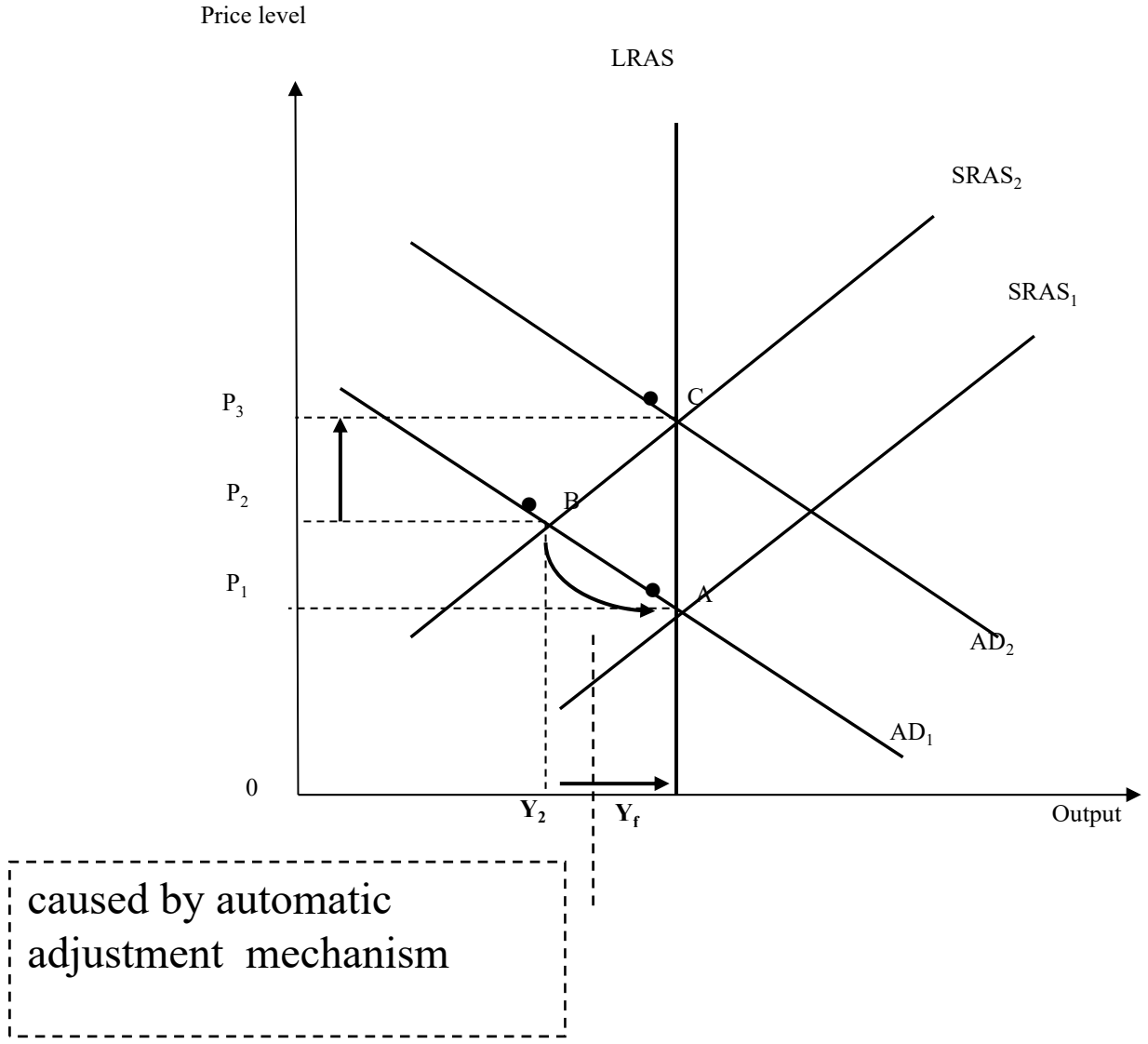


Figure 9 Effects of a leftward shift of the SRAS curve

Hints:

It is not difficult to use the AS-AD model to analyse changes in price and output levels in the short run if students are able to follow the four steps:

① Determine whether the *AD* or *SRAS* curve would shift caused by the event.

② Determine whether the curve concerned shifts to the left or right.

③ Use AD-AS diagram to see how the shift changes output and price levels in the short run.

④ Use AD-AS diagram to see how economy moves from the new short run equilibrium to the new long run equilibrium.

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Thank you!