LM 3 - Aggregate Output, Prices, and Economic Growth

CFA Level 1 - Economics

Dr. Mohammed Ait Lahcen

Qatar University & University of Basel

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Learning Outcomes

The candidate should be able to:

1. calculate and explain gross domestic product (GDP) using expenditure and income approaches;
2. compare the sum-of-value-added and value-of-final-output methods of calculating GDP;
3. compare nominal and real GDP and calculate and interpret the GDP deflator;
4. compare GDP, national income, personal income, and personal disposable income;
5. explain the fundamental relationship among saving, investment, the fiscal balance, and the trade balance;
6. explain how the aggregate demand curve is generated;
7. explain the aggregate supply curve in the short run and long run;
8. explain causes of movements along and shifts in aggregate demand and supply curves;

Learning Outcomes

The candidate should be able to:

9. describe how fluctuations in aggregate demand and aggregate supply cause short-run changes in the economy and the business cycle;
10. distinguish among the following types of macroeconomic equilibria: long-run full employment, short-run recessionary gap, short-run inflationary gap, and short-run stagflation;
11. explain how a short-run macroeconomic equilibrium may occur at a level above or below full employment;
12. analyze the effect of combined changes in aggregate supply and demand on the economy;
13. describe sources, measurement, and sustainability of economic growth;
14. describe the production function approach to analyzing the sources of economic growth;
15. define and contrast input growth with growth of total factor productivity as components of economic growth

Overview

Overview

Introduction to Macroeconomics

- Macroeconomics is the study of the aggregate activities of households, companies, and markets.
- Macroeconomics focuses on national aggregates, such as total investment, total consumption, employment, inflation, and the overall level of interest rates.
- Investors must be able to evaluate a country's current economic situation and to forecast its future economic environment.
- Objective is to identify asset classes and securities that will benefit from economic trends occurring within the country.

Overview

Aggregate Output and Income

- Aggregate output, called the Gross Domestic Product (GDP), is the total market value of all final goods and services produced in an economy during a specific period.
  - Only goods that are valued in the market.
  - Final goods and services only (not intermediate).
  - Rental value for owner-occupied housing (estimated).
  - Government services (at cost)—not transfers.
- Aggregate income of an economy is the value of all the payments earned by the suppliers of factors used in the production of goods and services.
- Value spent on goods and services must be equal to the value of the output produced and must accrue to the factors of production $\Rightarrow$ **aggregate output = aggregate expenditures = aggregate income**.

Measuring GDP

- GDP can be determined in two different ways:
  - Income approach: GDP is calculated as the total amount earned by households and companies in the economy.
  - Expenditure approach: GDP is calculated as the total amount spent on the goods and services produced within the economy during a given period.
- The two approaches yield similar results.
- Expenditures approach can be done using two distinct, but closely related, measurement methods:
  - Value of final output;
  - Sum of value added.

Measuring GDP: Example

- Suppose that a very simple economy produces only four goods and services: eye examinations, pizzas, shoes, and cheese. Assume that all the cheese in this economy is used in the production of pizzas. Use the information in the following table to calculate GDP for the year 2022.

PRODUCTION AND PRICE STATISTICS FOR 2022

(1) PRODUCT	(2) QUANTITY	(3) PRICE PER UNIT
Eye examinations	100	$50.00
Pizzas	80	10.00
Shoes	20	100.00
Cheese	80	2.00

Measuring GDP: Example

PRODUCT	(1) QUANTITY	(2) PRICE PER UNIT	(3) VALUE
Eye examinations	100	$50	$5,000
Pizzas	80	10	800
Shoes	20	100	2,000

- Add the value for each of the three final goods and services to find GDP.
- GDP = 7800$

Measuring GDP: Example

- The final selling price of a product must equal the sum of the values added to the product at each stage of production.

Firm	Value of Product	Value Added	Total
Cotton farmer	Value of raw cotton = \$1	Value added by cotton farmer	= \$1
Textile mill	Value of raw cotton woven into cotton fabric = \$3	Value added by textile mill = (\$3 - \$1)	= \$2
Shirt company	Value of cotton fabric made into a shirt = \$15	Value added by shirt company = (\$15 - \$3)	= \$12
L.L.Bean	Value of shirt for sale on L.L.Bean's website = \$35	Value added by L.L.Bean = (\$35 - \$15)	= \$12
-	**Total value added**		= \$35

Nominal vs. Real GDP

- Nominal GDP is the total value of all goods and services produced by an economy, valued at **current market prices**:

$$\text{Nominal GDP}_t = \sum_i P_{i,t} Q_{i,t}$$

- To evaluate the growth of the economic, it's useful to look at the growth of economic activity (quantities produced) keeping prices constant.
- Real GDP measures the output of the economy using prices from a base year, removing the effect of changes in prices:

$$\text{Real GDP}_t = \sum_i P_{i,B} Q_{i,t}$$

- Real economic growth is measured by the percentage change in real GDP.

Nominal vs. Real GDP: Example

Product	2012 Quantity	2012 Price	2022 Quantity	2022 Price
Eye examinations	80	$40	100	$50
Pizzas	90	11	80	10
Shoes	15	90	20	100

- The table shows output and prices in 2012 and 2022.
- Nominal GDP in 2012 = 5540$.
- Nominal GDP in 2022 = 7800 $.
- We choose 2012 as the base year.
- Real GDP in 2022 = 6680$

GDP Deflator

- The implicit price deflator for GDP, or simply the GDP deflator, is defined as follows:

$$\text{GDP deflator} = \frac{\text{Nominal GDP}}{\text{Real GDP}} \times 100 = \frac{\sum_i P_{i,t} Q_{i,t}}{\sum_i P_{i,B} Q_{i,t}} \times 100$$

- GDP deflator broadly measures the aggregate changes in prices across the overall economy.
- It provides a useful measure of inflation in the economy.

GDP Deflator: Example

GDP	2017	2018
Nominal GDP	\$19,485 billion	\$20,494 billion
Real GDP	\$18,051 billion	\$18,566 billion

Formula	Applied to 2017	Applied to 2018
$\text{GDP deflator} = \left(\frac{\text{Nominal GDP}}{\text{Real GDP}}\right) \times 100$	$\left(\frac{\$19,485 \text{ billion}}{\$18,051 \text{ billion}}\right) \times 100 = 107.9$	$\left(\frac{\$20,494 \text{ billion}}{\$18,566 \text{ billion}}\right) \times 100 = 110.4$

- We can use the GDP deflator to calculate the inflation rate from 2017 to 2018.
- GDP deflator inflation rate $= \left(\frac{110.4 - 107.9}{107.9}\right) \times 100 = 2.3\%$
- Based on the GDP deflator, the price level increased by 2.3% between 2017 and 2018.

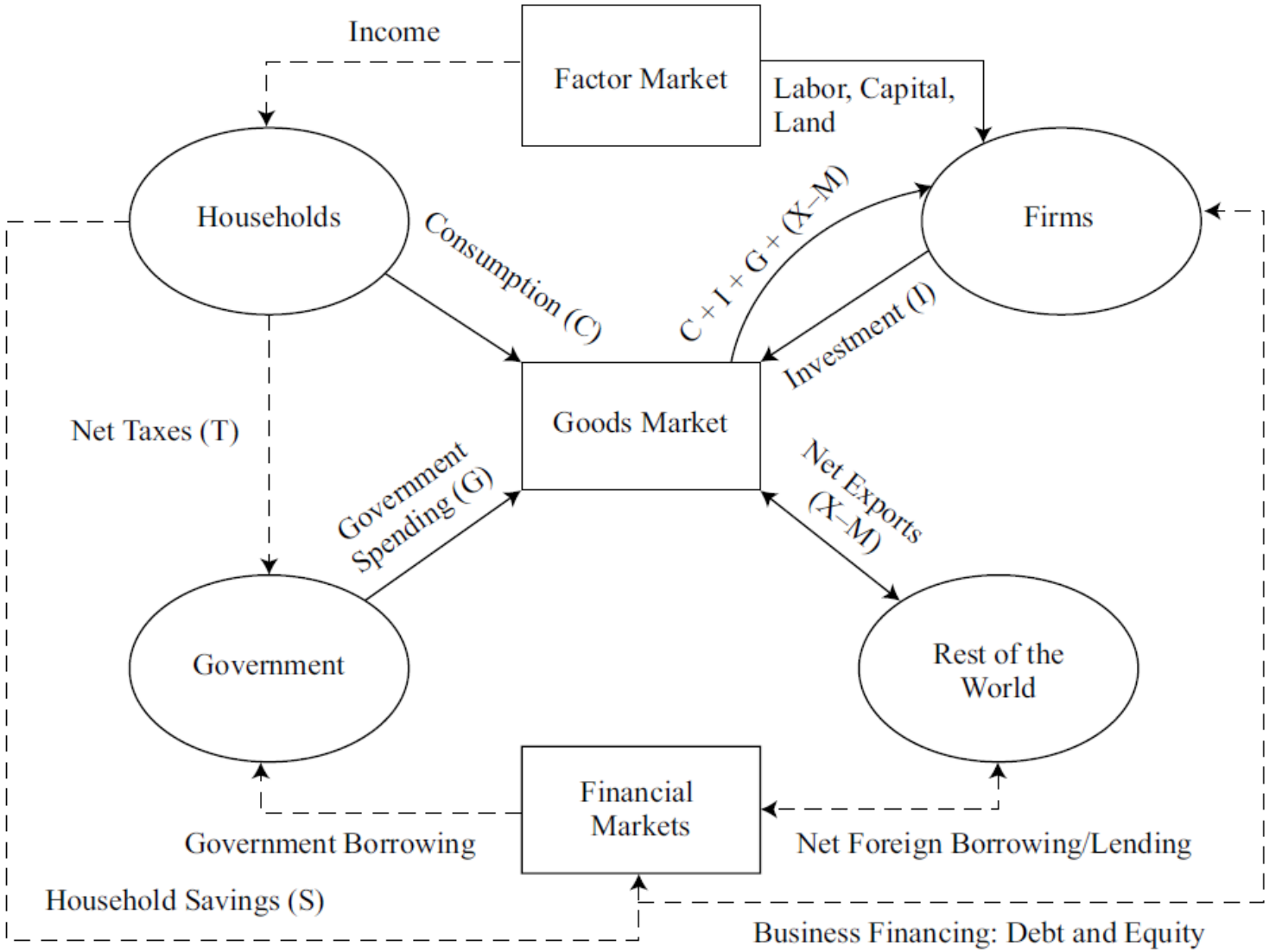
Components of GDP

- Based on the expenditure approach:

$$GDP = C + I + G + (X - M)$$
$$= (C + G^C) + (I + G^I) + (X - M)$$

  - C = consumption spending
  - I = private investment (fixed capital + change in inventories)
  - G = government purchases (consumption G^C + investment G^I)
  - X = exports
  - M = imports

Components of GDP



Savings, Investment, Fiscal Balance, and Trade Balance

- Based on the expenditure approach:

$$GDP = C + I + G + (X - M)$$

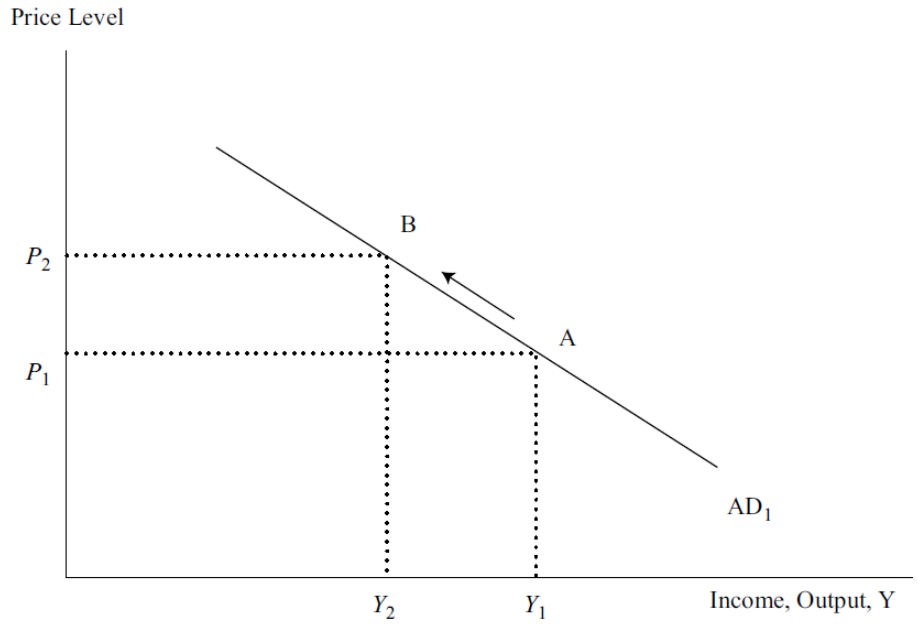
- Based on the income approach: $GDP = C + S + T$
  - S = Private savings
  - T = Net taxes
- Set the two equal: $C + S + T = C + I + G + (X - M)$
- $\Rightarrow S = I + (G - T) + (X - M)$
- Savings = Investment + Fiscal balance + Trade balance
- Rearrange to get: $(G - T) = (S - I) - (X - M)$
- These are just accounting identities!

Overview

Aggregate Demand and Aggregate Supply

- We are going to study a simple and very influential model of the macroeconomy: the AD-AS model.
- Aggregate demand (AD) represents the quantity of goods and services that households, businesses, government, and international customers want to buy at any given level of prices.
- Aggregate supply (AS) represents the quantity of goods and services that producers are willing to supply at any given level of prices.
- Shifts in AD and AS determine the short-run fluctuations in economic activity.

Aggregate Demand



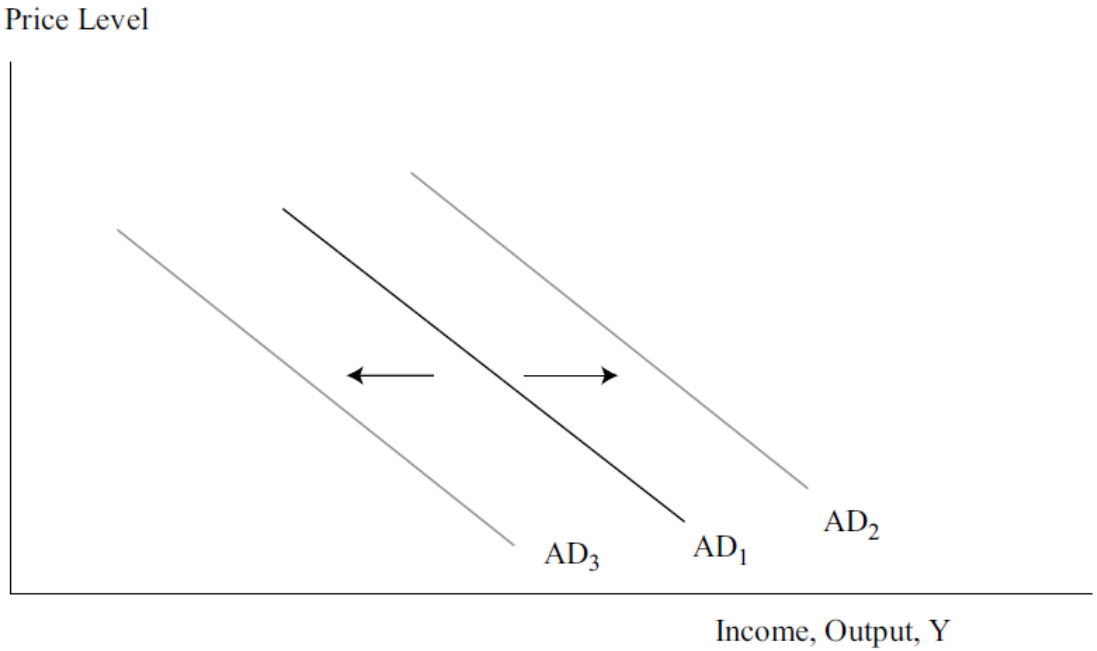
- The AD curve shows the relationship between the overall price level and real aggregate income.
- A movement along the AD curve will occur when the price level changes, and the change is not caused by a component of real GDP.
- A shift of the AD curve will occur when some component of real GDP changes.

Movements along the AD curve

The AD curve is negatively sloped due to three main effects:

- Wealth effect: lower prices increase consumers' real wealth which increases demand for goods and services.
- Interest rate effect:
  - With higher prices, consumers' demand for money increases.
  - With constant nominal money supply, interest rates must increase to restore money market equilibrium.
  - Higher interest rates, decrease consumer spending and business investment in assets.
- Real Exchange Rate Effect:
  - Increase in price level increases real price of exports in turn decreasing exports.
  - Increase in price level decreases real price of imports in turn increasing imports.
  - A fall in net exports (X – M) decreases aggregate demand.

Shifts in the AD curve



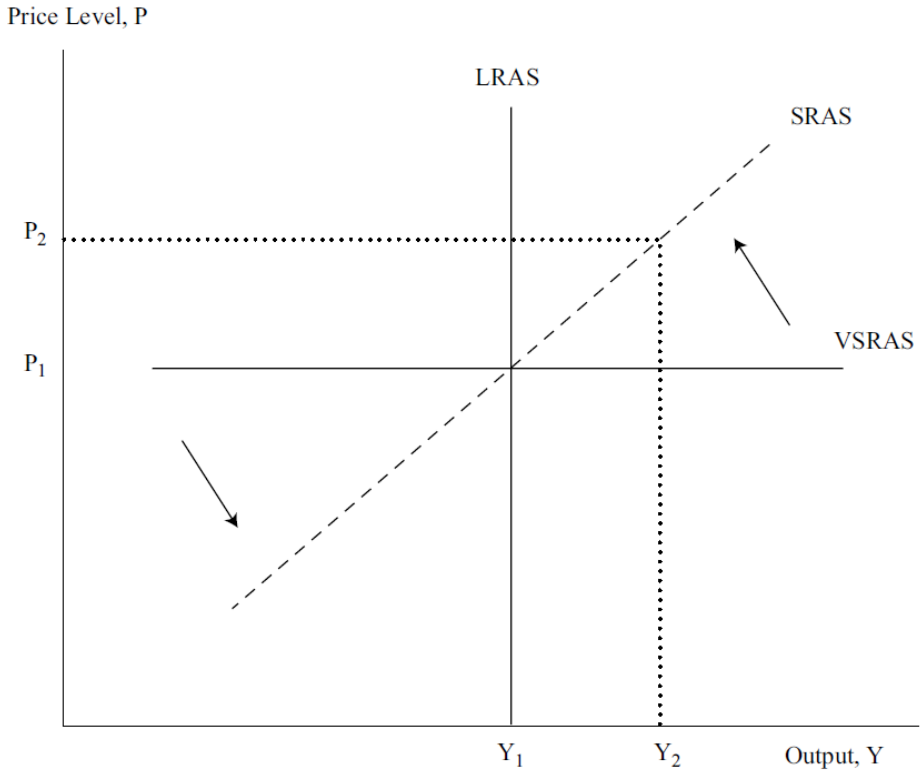
- Factors that influence the aggregate level of expenditures in the economy will cause the AD curve to shift.
- A shift to the right represents an increase in aggregate demand at any price level (e.g. AD_1 to AD_2).
- A shift to the left represents a decrease in aggregate demand at any price level (e.g. AD_1 to AD_3).

Shifts in the AD curve

Key factors that cause the AD curve to shift include:

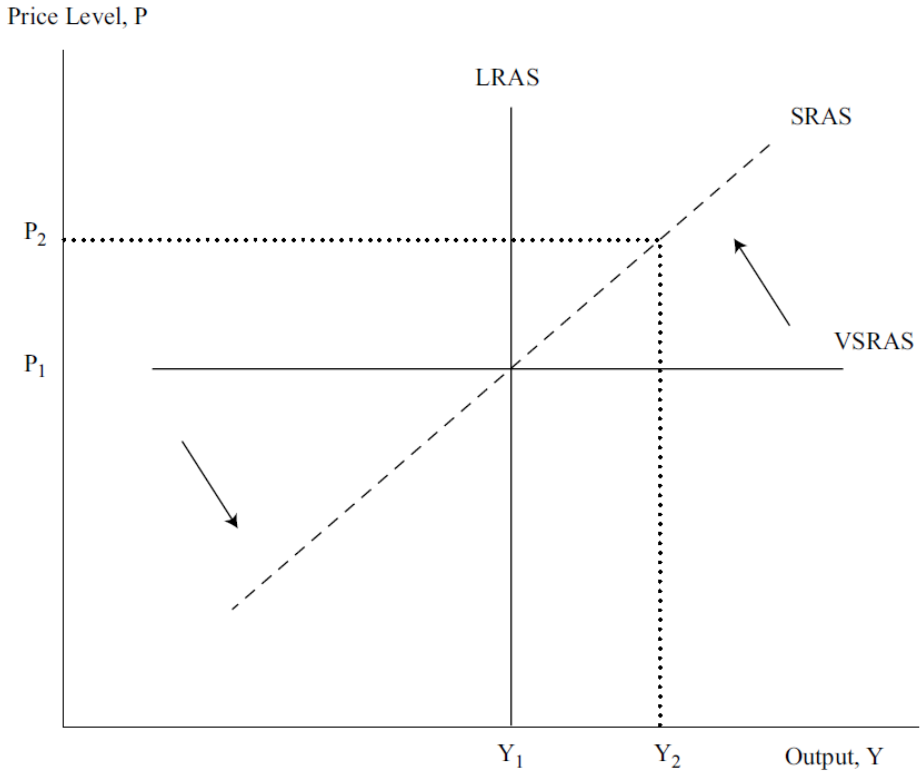
- Increases in HH's wealth increase C.
- Increases in expectations for economic growth increase C, I.
- Higher capacity utilization ($> 85\%$) increases I.
- Increases in tax rates decrease disposable income and C.
- Increases in government spending, G.
- Increases in the money supply reduce real rates and increase I, C.
- Depreciation of currency increases net exports $X - M$.
- Growth of foreign GDP relative to domestic GDP increases net exports $X - M$.

Aggregate Supply



- The aggregate supply (AS) curve represents the level of domestic output that companies will produce at each price level.
- Economists distinguish between the short-run and long-run AS curves, which differ with respect to how wages and other input prices respond to changes in final output prices.

Aggregate Supply

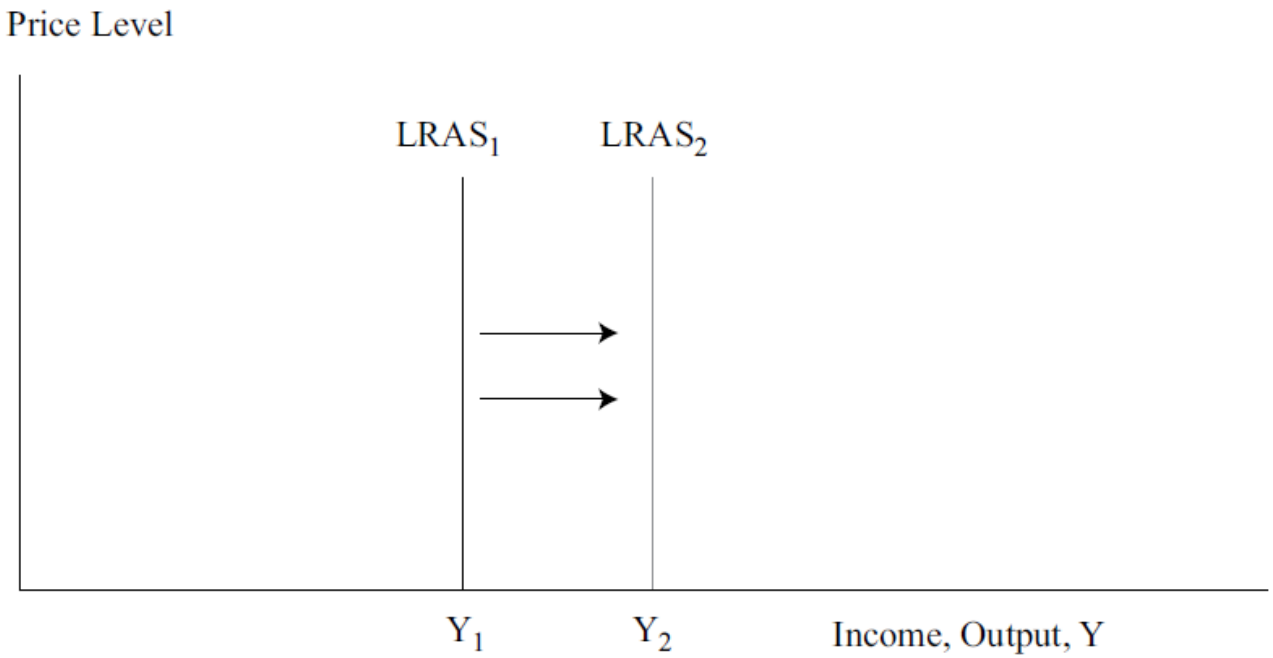


- In the very short run: AS is elastic (input prices are fixed).
- In the short run: Input prices are fixed so businesses expand real output when (output) prices increase.
- In the long run: AS is fixed at full-employment or potential real GDP.

Shifts in SR Aggregate Supply

- Factors that increase the SRAS curve:
  - Decreases in input prices;
  - Improved expectations for economic growth;
  - Decreases in business taxes;
  - Increases in business subsidies;
  - Currency appreciation that reduces the cost of imported inputs.
- In addition, factors that shift the LRAS curve will also shift the SRAS curve.

Shifts in LR Aggregate Supply

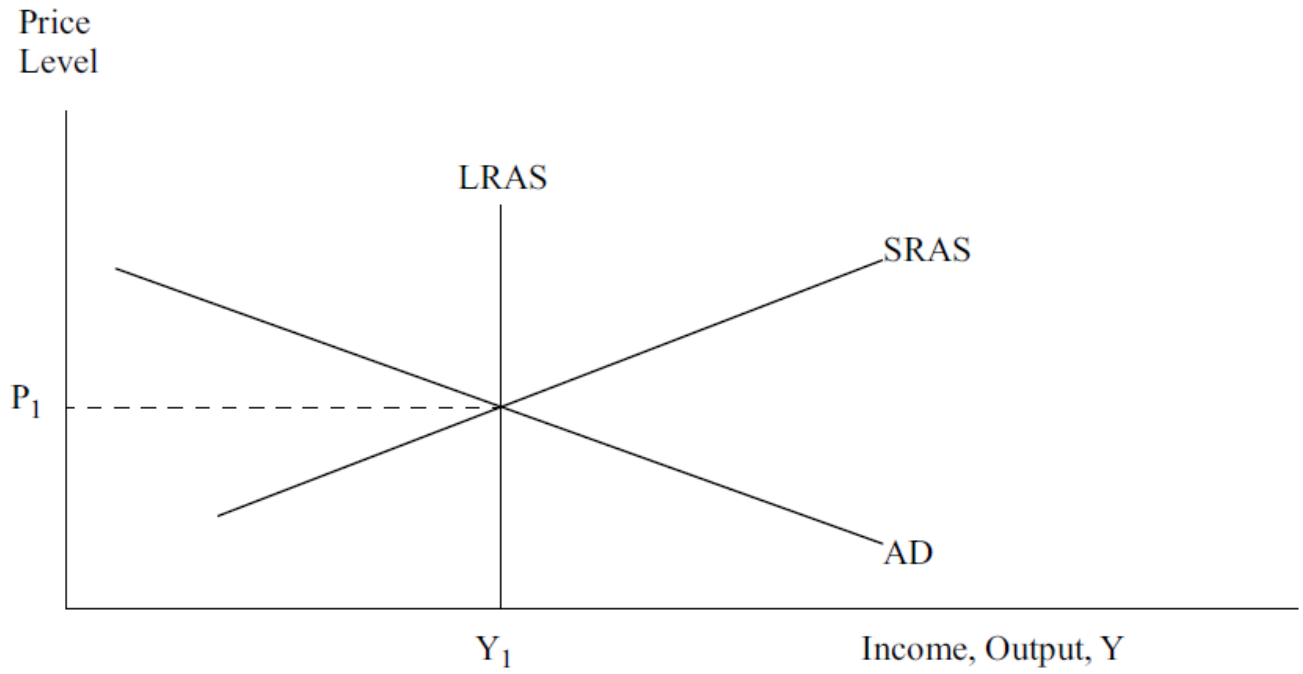


- Factors that increase the LRAS curve:
  - Increase in labor supply;
  - Increased availability of natural resources;
  - Increased stock of physical capital;
  - Increased human capital (labor quality);
  - Advances in technology/labor productivity.

Equilibrium GDP and Prices

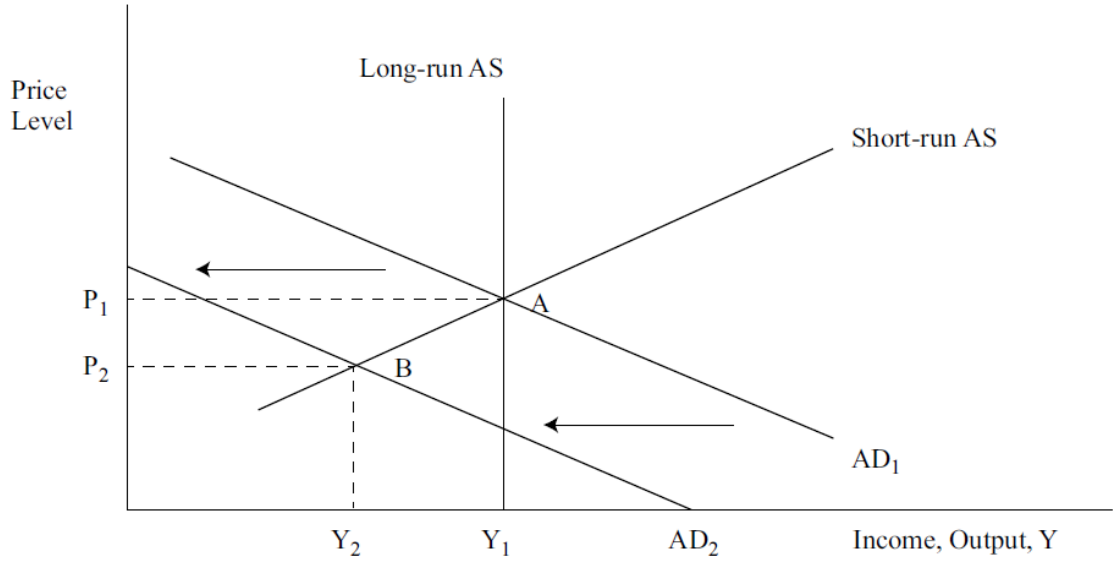
- We can combine AD and AS curves to determine the real level of GDP and the price level.
- Equilibrium occurs where the AD and AS curves intersect.
- Short-run macroeconomic equilibrium may occur at a level above or below full employment.
- We consider four possible types of macroeconomic equilibria:
  - Long-run full employment;
  - Short-run recessionary gap;
  - Short-run inflationary gap;
  - Short-run stagflation.

Long-Run Full Employment



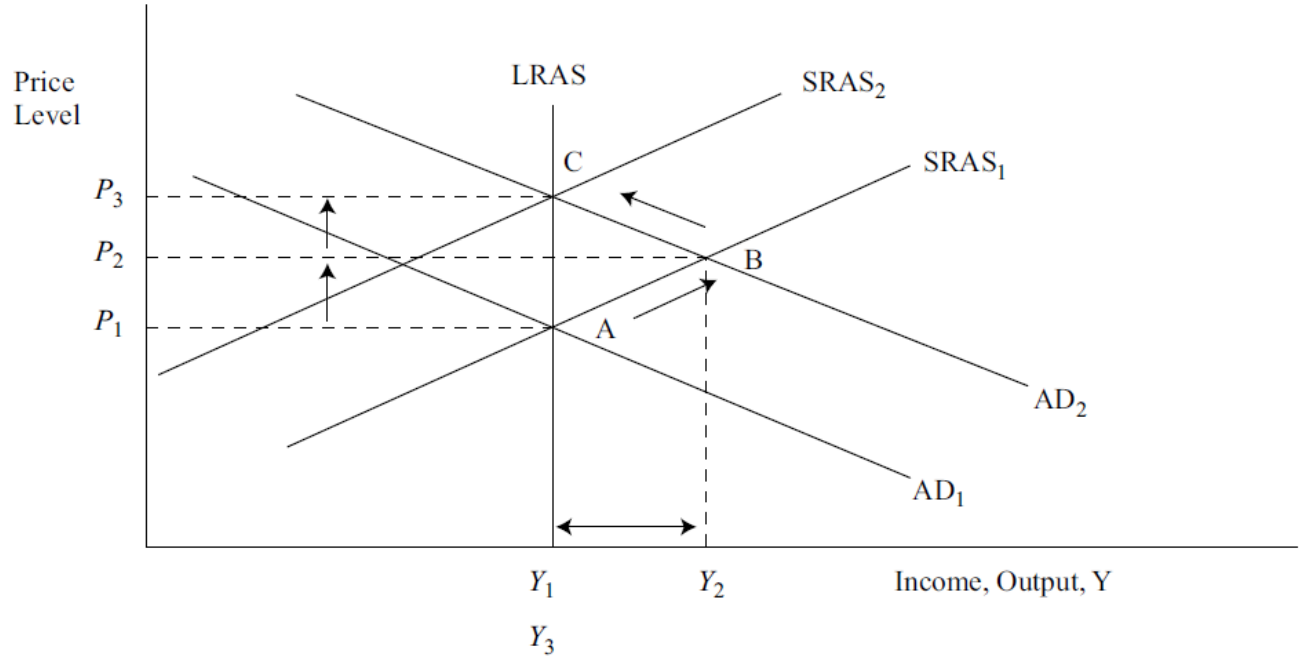
- Long-run full employment equilibrium occurs where the AD curve intersects the SRAS curve at a point on the LRAS curve.

Recessionary Gap



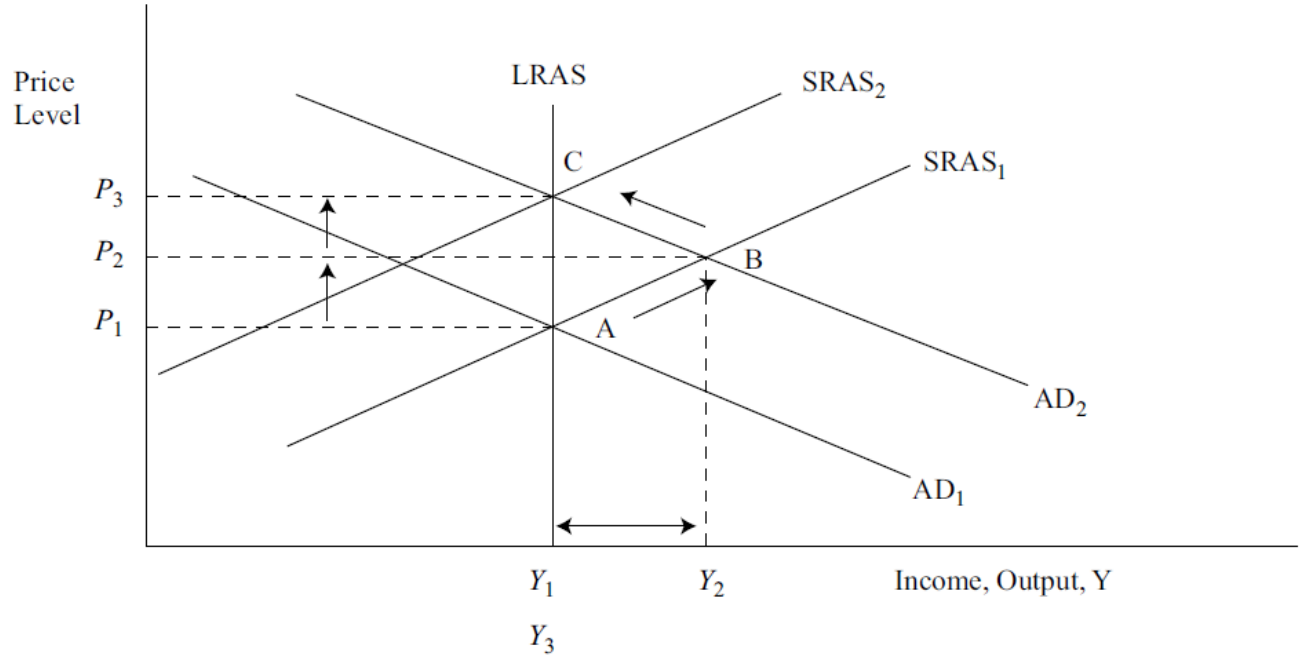
- A decline in AD results in lower GDP and lower prices.
- If the decline drives demand below potential GDP, the economy goes into a recession.
- Recessionary gap is the amount by which equilibrium output is below potential GDP.

Inflationary Gap



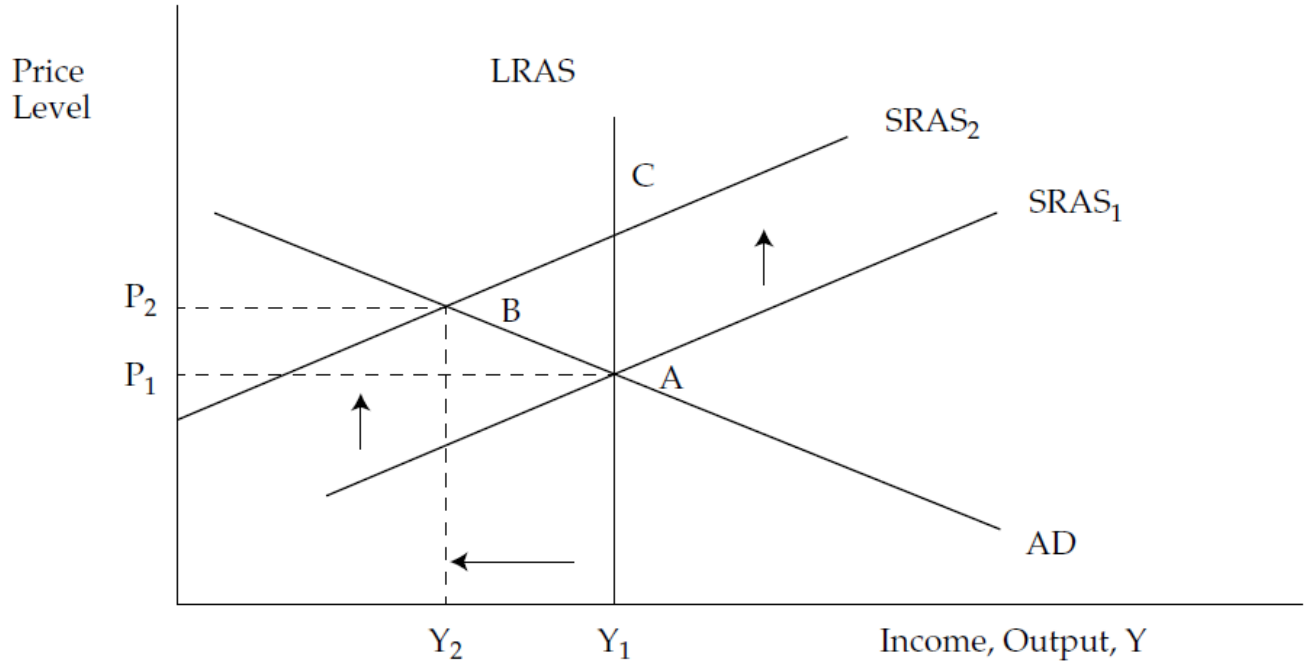
- Increases in AD lead to economic expansions as real GDP and employment increase.
- If the expansion drives the economy beyond its production capacity, inflation will occur.
- Inflationary gap is the amount by which equilibrium output exceeds potential GDP.

Inflationary Gap



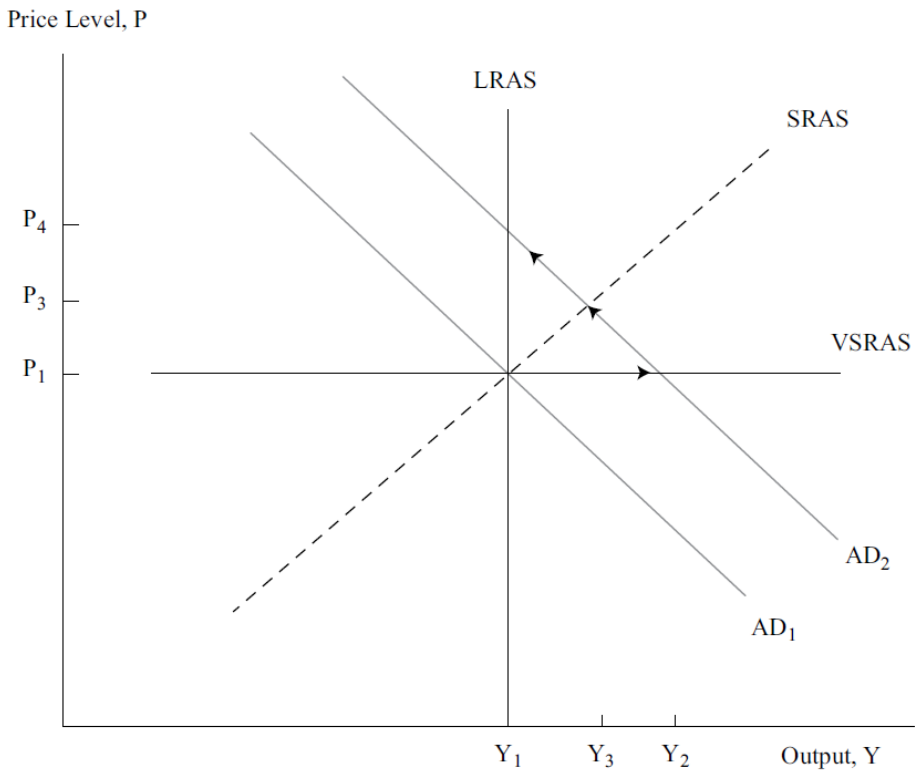
- The increase in the general price level and input prices will set in motion the process of returning the economy back to potential GDP.
- Higher wages and input prices shift the *SRAS* curve to the left (from $SRAS_1$ to $SRAS_2$), moving the economy to Point *C*.
- This self-correcting mechanism may work slowly.

Stagflation



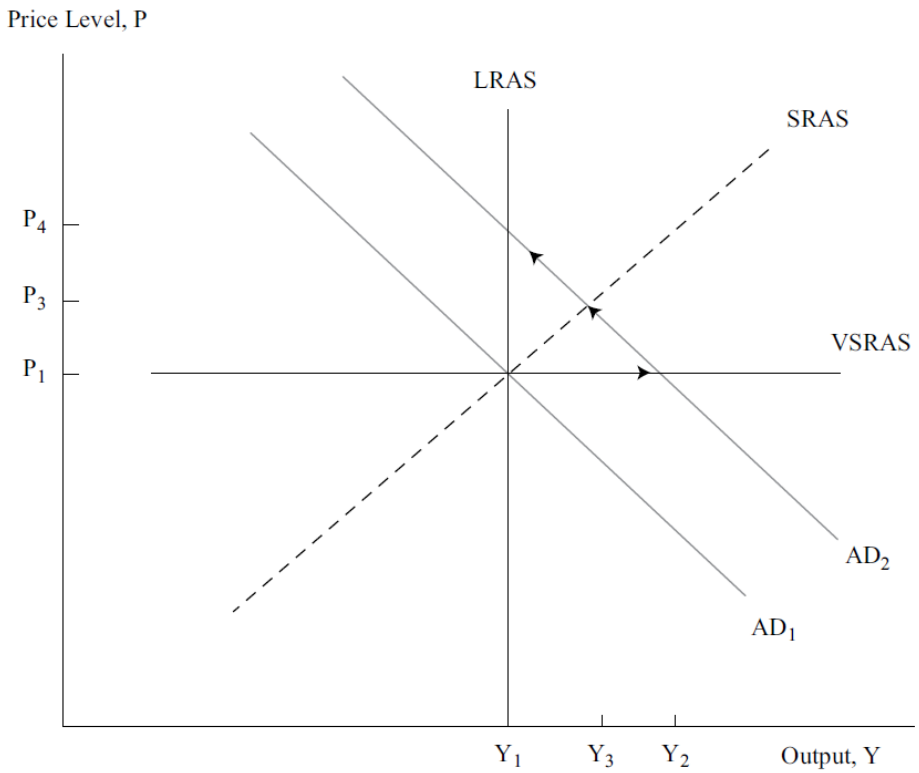
- Declines in AS cause stagflation, i.e. high unemployment and increased inflation.
- This decline can be caused by an increase in input prices (e.g. oil).
- Policy problem:
  - Increasing AD to increase GDP would increase inflation.
  - Decreasing AD to reduce inflation would further reduce real GDP.

Monetary Expansion



- Suppose the central bank expands the money supply in an attempt to stimulate demand when the economy is already in long-run equilibrium
- The expansionary policy will shift the AD curve to the right.

Monetary Expansion



- In the very short run, output will expand without an increase in the price level.
- With time, prices will increase and real output will decline.

Combined Shift in AD and AD

Change in AS	Change in AD	Effect on Real GDP	Effect on Aggregate Price Level
Increase	Increase	Increase	Indeterminate
Decrease	Decrease	Decrease	Indeterminate
Increase	Decrease	Indeterminate	Decrease
Decrease	Increase	Indeterminate	Increase

Overview

Economic Growth

- Economic growth is calculated as the annual percentage change in real GDP or the annual change in real per capita GDP.
- Growth in real GDP measures how rapidly the total economy is expanding.
- Growth in per capita GDP, defined as real GDP divided by population, measures the evolution of standard of living.
- Sustainable rate of economic growth is measured by the rate of increase in the economy's productive capacity or **potential GDP**.

Neoclassical Model of Economic Growth (Solow Model)

- Framework used to understand and analyze the underlying sources of growth for an economy.
- The model shows that potential GDP increases for two reasons:
  - Accumulation of production inputs such as capital, labor.
  - Discovery and application of new technologies that make these inputs more productive
- The cornerstone of the Solow model is the neoclassical production function.

Neoclassical Production Function

- Simplest form:

$$Y = Af(L, K)$$

  - Y: level of aggregate output.
  - L: quantity of labor.
  - K: capital stock.
  - A: total factor productivity (TFP).
- TFP captures the effect of technological change and other factors on output beyond the measured contribution of the capital and labor inputs.
- TFP is not directly observed but is estimated.

Growth Accounting

- Growth accounting equation for GDP:

$$\text{Growth in potential GDP} = \text{Growth in TFP} + W_L(\text{Growth in L}) + W_K(\text{Growth in K})$$

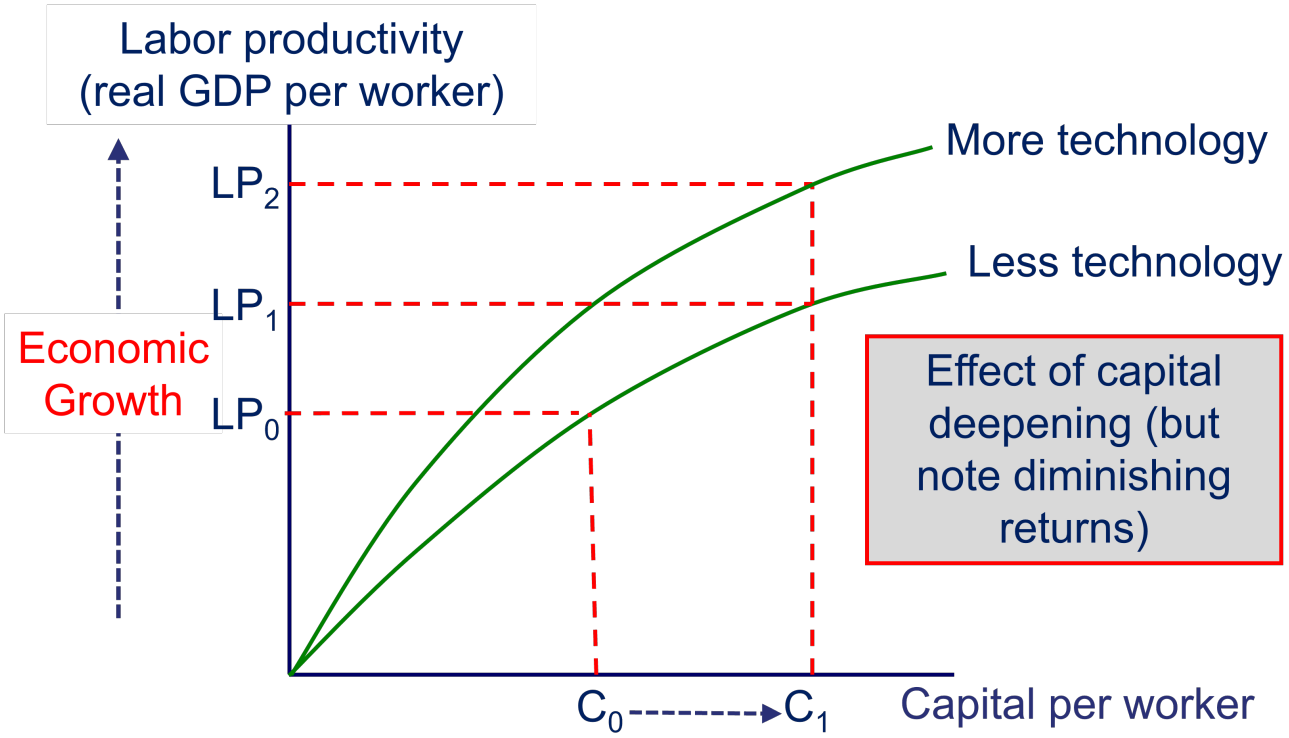
  - W_L and W_K are the relative shares of capital and labor in national income.
  - For many developed countries, W_L and W_K are roughly 0.7 and 0.3, respectively.

- Growth accounting equation for GDP per capita:

$$\text{Growth in per capita potential GDP} = \text{Growth in TFP} + W_K(\text{Growth in K/L})$$

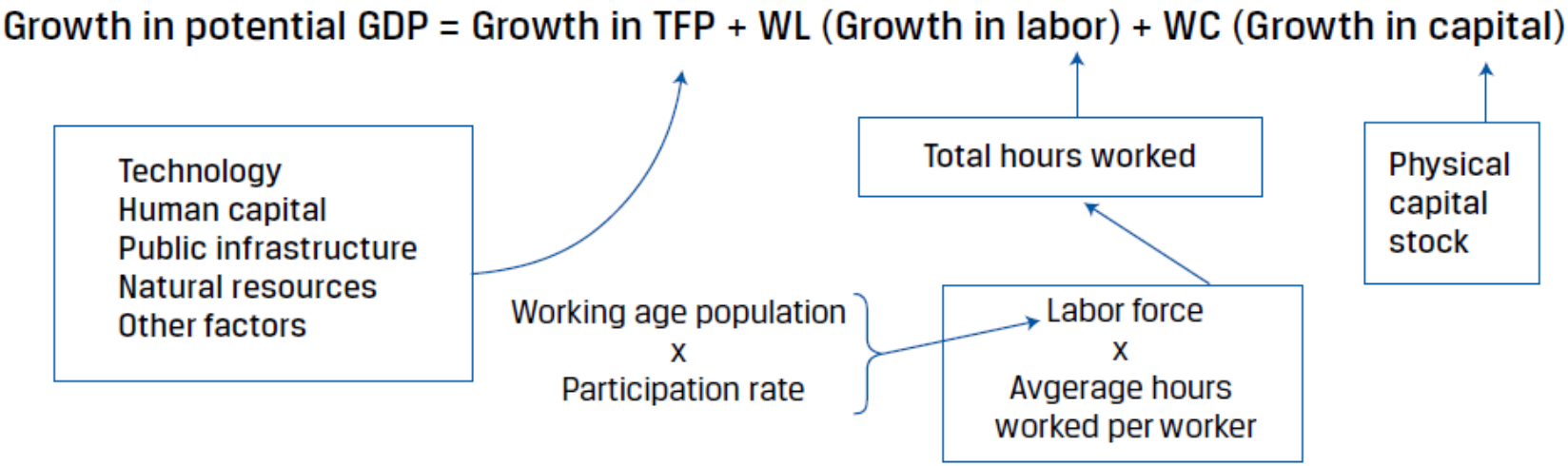
  - K/L: measures the amount of capital available per worker.

Productivity and Economic Growth



- In developed countries, K/L is already high and growth must come from TFP. In developing countries, growth comes from both.

Sources of Economic Growth



- Increase in labor supply.
- Increased availability of natural resources.
- Increased stock of physical capital.
- Increased human capital (labor quality).
- Advances in technology/labor productivity.