6. Aggregate Economic Activity

Learning Objectives

This summary includes a review and an analysis of the principles set forth by CFA Institute. Upon review of this summary, you should be able to:

Overview

This summary introduces macroeconomic concepts of aggregate economic activity: how they are defined, how they are measured, and how they are used to assess the overall performance of the economy.

Gross Domestic Product (GDP)

Learning Objective: Compute and discuss GDP, using expenditure and income approaches.

Learning Objective: Discuss the sum-of-value-added versus the value-of-final-output methods for calculating GDP.

GDP (Gross Domestic Product) is *the total market value of all domestically produced final goods and services for that year*. The estimation of GDP:

- includes goods and services purchased by final users. Intermediate goods purchased for resale or for the production of other goods or services are excluded to avoid double counting, since value added in the production process should be reflected in the final sale price of a good. Their value is embodied in the value of the goods purchased by the end-user.
- includes only goods produced during the current period.
- excludes financial transactions and income transfers (i.e., social security and welfare payments). GDP only counts transactions that add to the current production.

Most countries follow a standardized methodology for the measurement of GDP, as described above. There are two methods that can be used to calculate GDP.

Expenditure Approach

The **expenditure approach** *totals the amount spent on goods and services produced during the year*. According to this approach, GDP is calculated by summing:

1. **Personal consumption expenditures** - *include household spending on consumer durable and non-durable goods and services during the period*
2. **Gross private domestic investment** - *the flow of private sector expenditures on durable assets plus the addition to inventories during a period*
   Net investment is gross investment minus an allowance for depreciation and obsolescence of machinery and other physical assets during the year. Inventory investment is the change in the stock of goods and raw materials held during a period (inventories need not be sold to contribute to GDP in the current period).

3. **Government consumption, expenditures, and investment** - *include government purchases, not including transfer payments*
   Examples of government consumption include money spent on law enforcement and veterans' hospitals, and capital purchases such as missiles, highways, and dams. Government expenditures (which include transfer payments like social security) and government consumption are *not* equal.
4. **Net exports of goods and services** = *exports minus imports*
   Exports are domestically produced goods and services sold to foreigners. Imports are foreign-made goods and services purchased by domestic consumers, investors, and governments.

Calculate GDP Using the Expenditure Approach

1.	Household consumption of durable goods	$250
2.	Household consumption of non-durable goods	$600
3.	Household consumption of services	$1,200
4.	Fixed investment	$500
5.	Inventory additions	$10
6.	Depreciation	$75
7.	Government consumption	$400
8.	Government investment	$200
9.	Government expenditures	$600
10.	Imports	$60
11.	Exports	$55

GDP is calculated by summing:

1 + 2 + 3 + 4 + 5 + 7 + 8 + 11 – 10 = $250 + 600 + 1,200 + 500 + 10 + 400 + 200 + 55 – 60 = $3,155

Note: Depreciation is not included in the calculation of GDP.

Income Approach

This approach calculates GDP using the flow of costs incurred and income generated by summing the following (numbers are hypothetical):

- employee compensation (the largest component): $1,300
- self-employed labor earnings: $500
- machines, buildings, land, and other physical assets: $200
- rents, corporate profits, and interest payments: $460

- indirect business taxes (taxes imposed on the sale of a good that increase the cost of the good to the consumer, i.e., the sales tax): $400
- depreciation (the cost imposed on the producer when he or she produces output using a machine that wears out over time): $150
- GNP-GDP adjustment: $145 [The above costs sum to GNP (i.e., the income created through these costs is either domestic or abroad). To generate GDP subtract the net income that Americans earned abroad. If the net income is positive (negative), Americans earned more (less) abroad than foreigners earned in the United States.]

Total the above numbers to find GDP: $1,300 + $500 + $200 + $460 + $400 + $150 + $145 = $3,155

Sum-of-Value Added versus Value of Final Output

In calculating GDP based on expenditures, there are two related measurement methods that can be used. Using the value of final output is the most straightforward, since it relies simply on the observable final sale price of a good. On the other hand, using the sum-of-value-added method relies on adding up the values added at each stage of production. Ultimately, the choice of method shouldn't matter, because the sum of the value added at each stage should equal the final sale price.

Real versus Nominal GDP

Learning Objective: Discuss real versus nominal GDP, and compute and interpret the GDP deflator.

Calculated GDP is a more informative tool if the impacts of price movements are removed. However, changes in price level tend to be caused by inflation, and are not usually directly driven by economic activity. Real GDP measures what would be the total expenditures on goods and services if prices were unchanged over the year. Nominal GDP instead measures the value of goods and services if they are measured at current prevailing prices.

Expenditure data is usually collected in current prices. The data would then be converted into constant prices by using a **deflator**. Each component would be deflated by a suitable price adjustment. An overall deflator can then be calculated by comparing both GDP measures. This deflator is basically a price index. Some base year would be chosen and output in each year would be valued using those prices.

Suppose nominal and real GDP at a given time are as follows:

$$\text{Nominal GDP}_t = P_t \times Q_t$$

and

$$\text{Real GDP}_t = P_b \times Q_t$$

Where:

Q_t = quantity produced in year *t*

P_t = price in current year

P_b = price in base year

The relationship between real and nominal GDP can be calculated by using the **GDP deflator**.

$$\text{GDP deflator} = \frac{\text{Value of current output at } P_t}{\text{Value of current output at } P_b} \times 100$$

$$\text{GDP deflator} = \frac{\text{Nominal GDP}}{\text{Real GDP}} \times 100$$

Finally, if increases in inflation and GDP are stated in percentage terms, the changes in real and nominal GDP can be calculated:

$$\%\,\Delta \text{ Nominal GDP} = (1 + \%\Delta \text{ real GDP})(1 + \%\Delta \text{ inflation}) - 1$$

$$\%\,\Delta \text{ Nominal GDP} \approx \%\Delta \text{ real GDP} + \%\Delta \text{ inflation}$$

Alternative Measures of Income

Learning Objective: Review the differences between GDP, national income, personal income, and personal disposable income.

As discussed before, there are two alternate methods to calculating GDP. The expenditure approach relies on final output measures, while the income method uses income derived from generation of final outputs. Both methods in theory should yield the same result, but in practice they can differ due to the use of different sources of data. This is accounted for in the use of an item called the *statistical discrepancy*. For example, an estimate of GDP by the expenditure approach is calculated as:

GDP = Consumer spending + Business investment + Government spending + Government fixed investment + Change in inventories + (Exports – Imports) + Statistical discrepancy

A GDP estimate using the income approach works similarly:

GDP = National income + Capital consumption allowance + Statistical discrepancy

National income is *income received by all factors of production used in generating all final output. It is the sum of compensation to employees, all profits (corporate and government) before taxes, interest income, rent, unincorporated business net income, and indirect business taxes less subsidies*. The capital consumption allowance is a depreciation measure for capital needed to produce output.

There are other measures of income and saving besides GDP. **Personal income** is defined as *all household income (earned or unearned)*, which makes it an important measure of how much consumers can spend. It is different from national income in that personal income excludes items that flow directly to businesses or government, like taxes and business net income/retained earnings. It also includes unearned items like unemployment or disability benefits, which are broadly called transfer payments. In short, the relationship between personal and national income is:

Personal income = National income – Indirect business tax – Corporate income tax – Undistributed business profit + Transfer payments

Personal disposable income (PDI) is simply *personal income net of personal taxes*. It is a closely watched figure, since it shows how much households actually have available for spending. Finally, household savings equals PDI less consumption expenditures, transfers to foreigners, and interest paid by consumers.

Aggregate Supply and Demand

Learning Objective: Discuss the relationship between saving, investment, the fiscal balance, and the trade balance.

Learning Objective: Describe the IS and LM curves and how they generate the aggregate demand curve.

The aggregate demand curve arises as a combination of aggregate income and current price levels, where two conditions are satisfied:

1. aggregate expenditure equals aggregate income, and
2. the available real money supply is willingly held by households and businesses.

The first condition gives rise to the IS curve, the second creates the LM curve. The two combined form the aggregate demand curve.

The relationship between domestic savings (S), investment (I), fiscal balance (government spending versus revenue/taxes, or G and T respectively) and trade balance (exports less imports, or X – M) is:

$$S = I + (G - T) + (X - M)$$

The above equation suggests that there are three ways to use or consume private savings:

1. investing
2. financing government deficits (where T > G)
3. running trade deficits (M > X)

Similarly, the implications of fiscal deficits, as given by the same equation, are that a country must sustain them by having greater savings than investment rates and/or by running trade deficits.

More importantly, this equation comes into play when explaining the behavior of aggregate demand. Some points to consider are as follows:

1. An increase in real income or a decrease in taxes will increase aggregate consumption.
2. Investment decisions depend on the level of real interest rates and aggregate output/income.
3. Government spending tends to be independent of economic factors such as interest rates and economic activity.
4. Taxes collected depend on the level of economic activity so that net taxes are positively related to aggregate income.
5. Similar to taxes, net exports are also related to aggregate income, where higher income leads to greater demand for imports.

Let's now rearrange the earlier equation:

$$S - I = (G - T) + (X - M)$$

Higher aggregate income levels will increase net taxes and imports. Therefore, the fiscal balance and the trade balance (represented by G – T and X – M respectively) both decline as income rises. Further, assuming people will tend to save more than invest, the left-hand term S – I increases with income. The level by which S exceeds I depends on the real interest rate: higher rates will induce people to save more, while lower rates will induce more investing as it is less beneficial to save in a low-rate environment. *This relationship that equates income and expenditures with interest rates is known as the* **IS curve**.

The IS curve does not consider what is the appropriate level of interest rates (only how they impact savings and investment), nor does it consider price levels in the market. This requires considering the supply and demand in financial markets. *Assuming the real money supply is constant, an increase in real income must create an increase in real interest rates, so as to keep demand for money equal to supply. This relationship is known as the* **LM curve**.

The IS curve slopes downward (inverse relation between saving and investing), while the LM curve has a positive slope (positive relationship between income and rates). The intersection of the two curves creates the *aggregate demand curve*: an inverse relationship between price level and real income. This relationship is not constant; in other words, the slope of the aggregate

demand curve can vary, depending on relative sensitivities between investment, saving, money demand, income, and interest rates. For example, the income level will be *less* sensitive to changes in price level (a *flatter* aggregate demand curve) if *investments are sensitive to rate changes or if the savings rate is not sensitive to income, or if money demand is insensitive to either income or interest rates*.

Learning Objective: Discuss the aggregate supply curve in the short and long run.

To understand what price and output level will prevail in current economic conditions, aggregate demand must be combined with aggregate supply. The aggregate supply curve is the level of output that companies will produce at various prices. Unlike with the demand curve, supply curves can be viewed as short-term or long-term, with various factors affecting each differently. For example, in the short run, it is assumed that capital and technology are essentially fixed, so the short-run aggregate supply curve is affected by resource prices and production costs, inflation, and supply shocks. The long-run curve does not make the same assumptions about capital and technology, so the long-run aggregate supply curve is impacted by changes to the supply of resources (including labor), improvements to productivity and technology, and institutional changes that improve efficiency of resource use.

Shifts in Aggregate Supply and Demand

Learning Objective: Discuss what causes shifts in and movements along aggregate demand and supply curves.

- Scarcity necessitates rationing; a limited amount of desired resources necessitates a mechanism for distributing such resources. Prices serve to "ration" or allocate scarce goods and resources to those people who are willing to pay the highest price.
- Scarcity results in competition. Scarce resources promote competition among individuals since all demand cannot be satisfied. When the rationing criterion is price, able individuals engage in income-generating activities that enhance their ability to pay the price. A different rationing mechanism (i.e., politics) encourages other types of behavior.

The fact that consumers are willing to buy more of a good when the price goes down, and less when the price goes up is called the **law of demand**. The law simply states that *a rise in the price of a good will cause consumers to buy less of the good because they now have a greater incentive to seek and use substitutes*. The converse is also true.

The demand for factors of production, like labor and capital, are **derived demand** since *demand is derived from the demand for goods and services*.

The aggregate production function is:

$$Y \text{ (quantity of GDP supplied)} = F(L,K,T)$$

Where:

L = labor quantity

K = capital

T = technology

The long-run aggregate supply shows the relationship between the quantity of real GDP supplied and the price level over the long run, when real GDP = potential GDP.

Long-Run Aggregate Supply (LAS)

Increases in the LAS are caused by:

- an increase in the supply of resources
- an improvement in technology and productivity
- institutional changes that increase the efficiency of resource use

Decreases in the LAS are caused by:

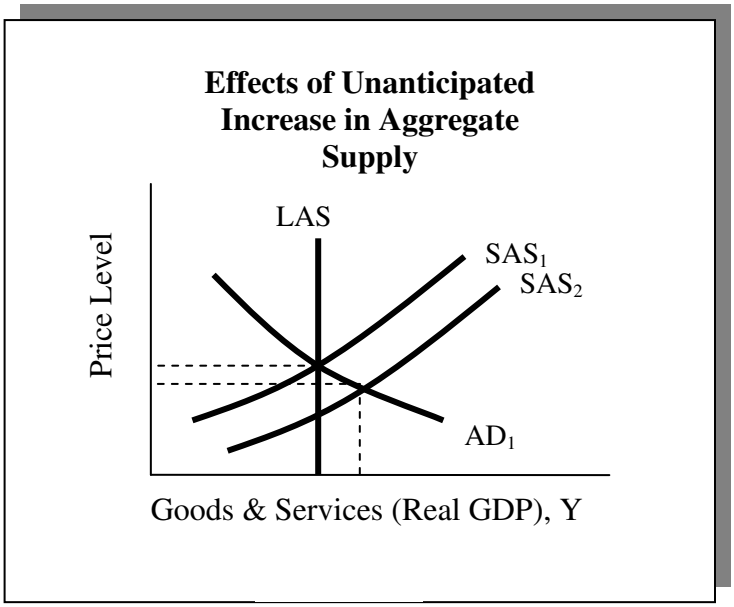
- a decline in resources (including labor)
- a decline in the level of technology available
- a shift in institutional arrangements that reduce productivity and the efficiency of resource use

Productivity is defined as *the average output produced per worker in a certain time frame*. It is usually measured in terms of output per hour worked.

Short-Run Aggregate Supply (SAS)

The short-run aggregate supply shows the relationship between the quantity of real GDP supplied and the price level. Short-run aggregate supply (SAS) increases are due to:

- a decrease in resource prices/production costs
- a reduction in the expected rate of inflation
- favorable supply shocks



Economic growth causes both SAS and LAS to shift outward (to the right). Output expands while unemployment stays at its natural rate. If the monetary authorities do not increase the money supply, the price level falls.

The above changes refer to anticipated changes in aggregate supply. Unanticipated changes lead to different outcomes for the economy.

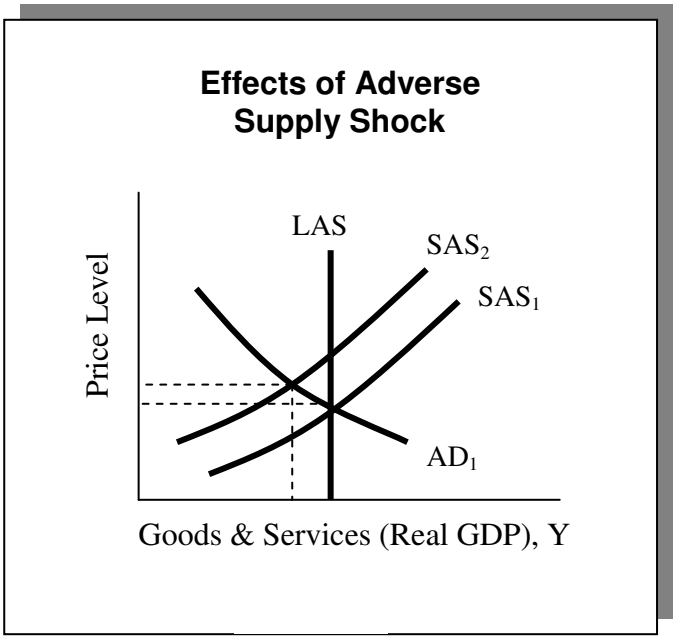
Example

If adverse weather conditions strike North America, the aggregate supply of agricultural output will decline. This is an example of an adverse supply shock since the bad weather is temporary and normal output levels will be restored with better weather.

Unanticipated Increases in Short-Run Aggregate Supply

An unanticipated increase in aggregate supply lowers the price level and increases current GDP. In the long run, a*ggregate supply does not increase* because the impetus to the supply rise is not expected to be repeated. Decision makers save a large proportion of their temporarily higher real income, which expands the supply of loanable funds. The interest rate falls and expenditures on interest-sensitive capital goods and consumer durables rise. Aggregate supply eventually returns to its long-run potential.

Consider the following example:



If there is an unanticipated temporary decline in supply, output declines (SAS shifts left) and all prices rise.

Resource prices eventually fall due to lower demand. This helps aggregate supply to expand toward its long-run potential. Thus, SAS_2 shifts outward again. If the decline in supply is permanent, LAS contracts, along with SAS, forcing the economy to stabilize at a new, lower output equilibrium.

Note: The above assumes the economy is at its long-run potential at the time of the supply contraction.

The graphs assume that actual and expected inflation is zero at first. If there is persistent inflation, it will be incorporated into long-term contracts, which affect production costs in the short run. If actual and expected inflation rates are equal, then there will, in turn, be persistent price increases for both goods and resources. If decision makers anticipate a particular inflation rate, they will build it into long-term contracts. If actual inflation is less than expected, this is equivalent to a reduction in the price level when there is price stability, or zero inflation. This will in turn lead to higher real resource prices, causing firms to cut back on output and employment.

The opposite is true if the inflation rate is greater than anticipated. This will be the equivalent of an increase in the price level. This means that goods and services prices will increase relative to resource prices, with firms expanding output and employment.

The aggregate demand (AD) curve isolates the impact of the price level on the quantity of goods and services through consumption (C), investment (I), and net exports (X).

$$Y = C + I + G + X - M$$

Where:

Y = quantity of real GDP demanded

C = real consumption expenditure

I = investment

G = government expenditures

X = exports

M = imports

It is impacted by:

- inflation (price levels)
- expectations about the future
- global economic conditions
- fiscal and monetary policy

The AD curve shifts to the right due to changes in C, I, and X caused by:

- an increase in real wealth (greater wealth increases the demand for all goods)
- a lower interest rate (when borrowing is cheaper investment increases)
- increased optimism about the future (current investment increases)
- an increase in expected future inflation (people have an incentive to spend now)
- an increase in income abroad (increases export demand)
- a decrease in the exchange rate (increases export demand)

The AD curve will shift to the left (inward) under the following conditions:

- real wealth declines
- an increase in the real interest rate
- pessimism concerning future demand
- a decline in expected future inflation
- a decline in foreign incomes abroad

- an increase in the exchange rate

Consider the example of the U.S. and Canada:

Year	Exchange Rate	Demand
20x5	$1US/$1.34CD	100
20x6	$1US/$1.50CD	85

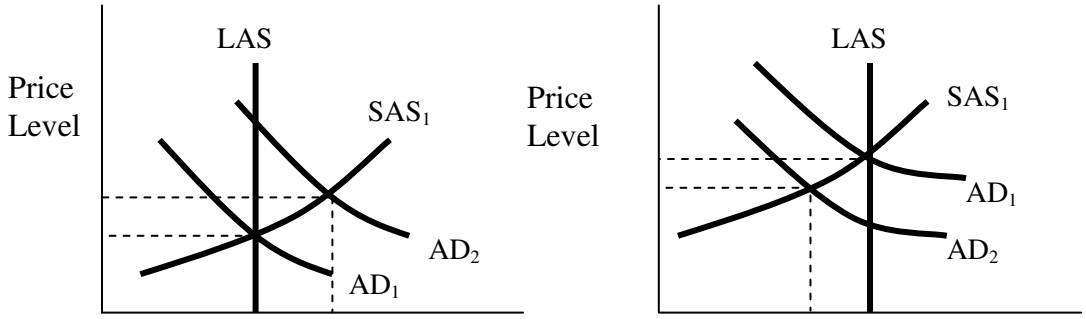
In 20x5, the exchange rate between these two countries was $1US/$1.34CD. At this exchange rate, Canadians demanded 100 U.S. cars. If the exchange rate in 20x6 increases to $1US/$1.50CD, demand for U.S. cars by Canadians will fall to 85 since U.S. cars are now more expensive to Canadians. Aggregate demand for U.S. goods falls when the exchange rate increases.

Unanticipated Changes

Decision makers cannot instantaneously adjust to unanticipated changes.

Unanticipated aggregate demand increases cause output to increase and unemployment to fall because of the time lag between the increased demand and an increase in resource prices. This lag increases profits and leads businesses to expand output. Resource prices eventually "catch-up," shifting aggregate supply inward. A new equilibrium is established at a higher price level, at the natural rate of unemployment, and at the economy's *long-run* potential output.

Effects of Unanticipated Shifts in Aggregate Demand



For example, an unanticipated decline in aggregate demand has the following effects:

1. resource prices "lag" ahead of falling prices
2. output contracts below long-run potential
3. unemployment rises above the natural rate

As decision makers incorporate the lower price level and excess supply into their behavior:

1. resource prices fall
2. output increases to its *long-run* potential
3. unemployment returns to the natural rate

The above assumes that prices (including wages) are downward flexible.

The following will cause the aggregate demand (AD) curve to shift; these items are treated in isolation and disregard any interaction among two or more factors:

- *Household wealth* - Increases in wealth create an increase in demand, shifting the AD curve to the right. Reduced wealth has the opposite effect. This is known as the **wealth effect**.
- *Consumer and business expectations* - Consumers that are confident about job prospects or their income will spend more, which increases demand and shifts the AD curve to the right.
- *Capacity utilization* - High utilization means that companies seeking to increase production are forced to invest in their operations. Higher investment shifts the AD curve to the right.
- *Fiscal policies* - Higher government spending will shift the AD curve to the right. Higher taxation rates will instead lower demand and shift the AD curve to the left.
- *Monetary policy* - Raising interest rates means draining bank reserves and reducing the money supply. This shifts the AD curve to the left.
- *Exchange rates* - A depreciating currency will make exports cheaper and imports more expensive, which will help net exports and shift the AD curve to the right.
- *Growth in global economy* - Global growth will tend to boost demand for a country's exports. This will shift the AD curve to the right.

The following factors will cause shifts in the short-run aggregate supply (SRAS) curve:

- *Nominal wages* - Increases to nominal wages result in an increase to production costs, reducing supply and shifting the SRAS curve to the left.
- *Change in input price* - Higher price of raw materials increases the costs of production, reducing supply and shifting the SRAS curve to the left.

- *Future price expectations* - If companies expect the prices of their own outputs to rise, they will respond by increasing the supply and shifting the SRAS curve to the right. The impact in this case tends to be modest and temporary.
- *Changes to business tax and subsidies* - Higher taxes increase the cost of production, which will result in a shift of the SRAS curve to the left. Subsidies are a form of incentive payment from governments to producers, so higher subsidies reduce production costs and shift the SRAS curve to the right.
- *Changes in exchange rates* - Shifts in exchange rates will impact aggregate supply. Appreciation of a country's currency will lower production costs to that country's producers, which in turn shifts the AS curve to the right.

All of the factors affecting the long-run aggregate supply (LRAS) will also impact the short-run aggregate supply, but the opposite does not hold, as wages and other short-term inputs do not have an impact on the long-run aggregate supply. Over the long run, input costs adjust to changes in output prices, so optimal output levels are not affected. Changes in price level do not impact long-run aggregate supply; instead, LRAS is determined by the level of potential GDP. The following factors cause shifts in the LRAS:

- *Supply of labor* - Larger sources of labor will improve production and shift the LRAS curve to the right.
- *Natural resources* - Access to new sources or improved access to existing sources results in higher production and shifts the LRAS curve to the right.
- *Physical capital* - Growth in business investment improves the supply of physical capital, which in turn will boost production and shift the LRAS curve to the right.
- *Human capital* - Improving the quality of the workforce will boost production and shift the LRAS curve to the right.
- *Technology* - Technological improvements will boost the productivity of the workforce, thus shifting the LRAS curve to the right.

Learning Objective: Discuss how changes in aggregate demand and supply cause short-run changes in the economy and the business cycle.

Learning Objective: Discuss short-run macroeconomic equilibria that occur at levels above or below full employment.

Learning Objective: Explain how the economy is affected by changes in both aggregate supply and demand.

The point of long-run GDP equilibrium occurs where the aggregate demand and supply curves meet. It is assumed that both labor and capital are fully utilized at equilibrium, so that in the long run, *equilibrium GDP equals potential GDP*.

Any of the items discussed previously will cause shifts in either the AD or AS curve, which will in turn affect the equilibrium level. For example, a shift in the AD curve to the left means that

real GDP will contract and price levels will in turn decline. This is indicative of an economic downturn, where aggregate demand has fallen, leading to lower company stock valuations and higher unemployment. In the short term, *equilibrium GDP declines below potential GDP*. In time, this can correct itself, due to the willingness of people to accept lower wages, which is due to the ability to buy goods and services at the reduced price levels prevailing at the new equilibrium GDP level. This self-correction can be very slow, however, so the government may intervene via stimulative fiscal policy (lower taxes/higher spending) or monetary policy (lower interest rates/higher money supply growth).

- *Consumption demand is generally stable throughout the business cycle*. Consumer demand stabilizes the economy and aggregate demand by increasing less than income during an economic boom, and decreasing less than income during an economic recession.
- *Changes in real interest rates help to stabilize aggregate demand and correct economic fluctuations*. Consumer optimism provokes greater current spending and a decrease in the supply of loanable funds. This causes the interest rate to rise, investments to diminish, and aggregate demand to shrink. Under business pessimism, the demand for investment funds decreases, depressing the real interest rate. As a result, current consumption rises and the opportunity cost of investment falls. These two outcomes stimulate aggregate demand and revive an economy in an economic contraction.

Real resource price changes can help correct economic fluctuations. If output is temporarily greater (SAS_1) than the economy's full employment (FE) capacity, prices rise, supply falls to SAS_2, and the economy is restored to FE at higher prices [Figure 5a].

If output is temporarily operating at less than capacity [SAS_1], excess supply and high unemployment reduce resource prices so supply rises to SAS_2, and output rises to FE with lower prices [Figure 5b].

Self-Correcting Mechanisms

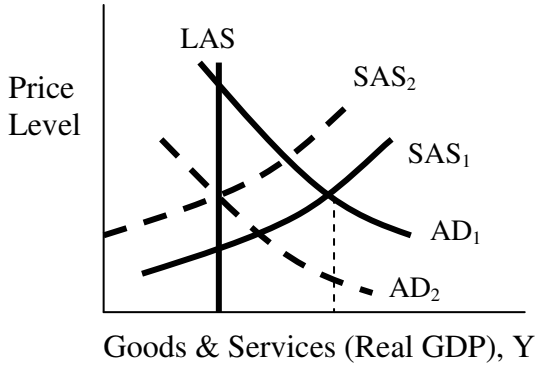


Figure 5a

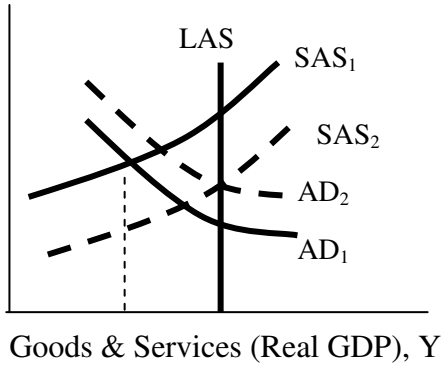


Figure 5b

The economy's self-correcting mechanisms are effective in moving the economy toward full employment but require time; thus many governments use discretionary monetary and fiscal policy to smooth the business cycle.

Equilibrium

Learning Objective: Differentiate between long-run full employment, short-run recessionary gap, short-run inflationary gap, and short-run stagflation equilibria.

Short-run equilibrium is achieved when the quantity of real GDP demanded is equal to real GDP supplied. There is long-run equilibrium when real GDP is equal to potential GDP. If both aggregate supply and demand increased at the same rate, then there would be real GDP growth without inflation. In the long run, aggregate demand is primarily affected by the growth rate in the quantity of money. If the quantity of money experiences a fast increase, then aggregate demand does as well, and there is high inflation. The U.S. economy does not grow at a steady rate. GDP varies depending on the business cycle. There is a business cycle because aggregate demand and short-run supply vary, but the money wage rate cannot adapt fast enough to keep real GDP at potential GDP. An equilibrium below full employment is one in which potential GDP is greater than real GDP. GDP is impacted by:

- *Economic growth* - Potential GDP and economic growth are impacted by the same forces, including growth in the quantity of labor, human and physical capital, and technological advances.
- *Inflation* - Inflation is fueled by that fact that there is a tendency for aggregate demand to rise more quickly than increases in long-run supply. Growth in the quantity of money is the primary reason for a persistent increase in aggregate demand and inflation.
- *The business cycle* - Business cycles occur because aggregate demand and supply don't move at the same, steady pace.

The condition *where equilibrium GDP drops below potential GDP* is called a **recessionary gap**. Likely impacts to the economy will be reduced corporate profits, lower commodity prices, and lower interest rates and demand for borrowing. *The best investment strategy in this environment will be to favor defensive companies, reduce exposure to cyclicals and commodities, seek low-credit-risk investments, reduce riskier/more speculative investments, and favor longer maturity investments over shorter maturities*.

Just as decreases in AD create a recessionary gap, an increase in AD will shift the curve to the right, *creating a short-term GDP equilibrium that exceeds the potential GDP* as long as supply does not increase. This suggests demand has increased and economic prospects have improved, raising production and employment, increasing wages, and finally raising prices (inflation). *When the equilibrium GDP is greater than the potential GDP*, this creates an **inflationary gap**. Like before, this is a temporary situation that will in time correct itself, but it can take a long time. Should the government intervene before self-correction takes place, it will be through higher taxes/lower spending, and/or through higher interest rates/reduction of money supply growth.

During inflationary gap periods, the typical economic impacts will be higher profits, higher commodity prices, higher rates, and inflation. *The best investment strategy will be to favor cyclicals and commodities, reduce fixed-income investments (especially longer maturity), increase exposure to riskier investments overall, and reduce defensive investments.*

Shifts in the AS curve tend to cause more extreme economic conditions than AD curve shifts. For example, increases in aggregate supply cause the GDP equilibrium to favorably shift above potential. The result is high economic growth and very low inflation. However, if aggregate supply drops instead, this can give rise to a condition called **stagflation**, where both high unemployment and high inflation prevail. As before, the economy can self-correct in time, but this can be particularly slow in the case of supply curve shifts.

Investment implications from a decline in the AS are to favor equities and reduce fixed-income exposure as higher prices tend to raise interest rates, and raise exposure to commodities. An increase/shift in the AS to the right, on the other hand, tends to favor most assets except commodities.

Finally, there is the likely scenario that both curves will shift, creating any of four possible situations:

1. **Both curves increase** - Real GDP and employment will rise, however the impact to prices depends on which curve increases more. If AD increases more than AS, prices will rise; if AS instead increases more, prices will fall.
2. **Both curves decrease** - Real GDP and employment will decline. Like before, price impacts depend on which curve shift dominates. If AD decreases more than AS, prices will fall; if instead the AS decreases more, prices will rise.
3. **AD increases, AS decreases** - Prices will rise in this scenario but the impact to GDP is harder to determine. If AD increases more than AS decreases, GDP rises; if AS decreases more than AD increases, GDP falls.
4. **AD decreases, AS increases** - Prices will decline in this scenario but the impact to GDP is again harder to determine. If AD decreases more than AS increases, GDP will decline; if AS increases more than AD decreases, GDP increases.

Economic Growth

Learning Objective: Discuss economic growth in regard to its sources, measurement, and sustainability.

Learning Objective: Discuss the production function approach to analyzing economic growth sources.

Learning Objective: Discuss input growth versus growth of total factor productivity as components of economic growth.

Economic growth is defined as *the annual percentage change in real GDP*. It is an important measure because rapid GDP growth can quickly turn a poor nation into a rich one. Similar to compounding growth of a portfolio, incrementally small changes in GDP maintained over an extended period can lead to large gains for a country. However, there is the risk of growing GDP too quickly. A country's GDP should grow without relying on excessive consumption and while avoiding excessive inflation. A country's sustainable rate of growth then depends on the growth of potential GDP.

There are five main drivers of growth for an economy:

1. **Labor supply** - Also called quantity of workforce, it measures the number of people available for work and is an important source of growth, particularly for developing nations. The input of labor to growth is measured by total hours worked: Total hours worked = Labor force × Average hours worked per worker
2. **Human capital** - Quality of labor is as important as labor supply. Human capital measures the knowledge base of workers derived from education and experience. In general, higher-quality workers are more productive and more flexible. Countries will tend to invest in their human capital through education and health infrastructure.
3. **Physical capital** - This refers to the property and equipment used to produce goods and services. Generally, countries with higher rates of investment in capital exhibit higher GDP growth. This has been used by countries like China to sharply drive up GDP growth.
4. **Technology** - Advances in technology make it possible to produce new types of goods, or to produce more or higher-quality existing goods, without changes to inputs. Technology becomes crucial for countries to overcome existing limits to GDP growth such as low labor supply or limited access to natural resources. As a result, this driver is particularly important to developed countries. Total factor productivity (TFP) is the component that measures the impact of technology when attempting to assess the growth in GDP.
5. **Natural resources** - These are the raw materials needed for growth. They can be renewable, like water or lumber, or non-renewable, like fossil fuels. They provide several countries with distinct advantages for boosting GDP, but they are not a prerequisite for high growth and income.

The production function provides the framework for estimating sources of economic growth and their overall impact to GDP. This framework specifies that the two main sources of growth are:

1. the accumulation of necessary inputs such as capital, labor, and natural resources, and
2. new technology that improves efficiency of use of inputs.

In its simplest form, the production function can be stated as:

$$Y = A \times F(L,K)$$

Where:

Y = the overall economic output

A = the total factor productivity (TFP) which serves as a proxy measure for technological progress

L = the quantity of labor

K = the amount of capital

The production function has two main assumptions. First, it has constant returns to scale, meaning that if all inputs increase by the same percentage, then final output will increase by that percentage. Second, each input has diminishing marginal productivity. This means that as the amount of any one input increases (while others remain constant), the impact to final output will be incrementally smaller with time, eventually reaching the point where adding labor or capital will no longer produce any benefit in output. *The main implications resulting from the diminishing marginal productivity assumption are that sustainable growth cannot rely solely on increasing capital investments, and that the incomes of developed and developing countries will eventually converge*. The only way to sustain long-term GDP growth will be through TFP, or technological progress.

The production function leads to the following model for estimating growth in potential GDP, known as the **growth accounting equation**:

$$\text{Potential GDP growth} = \text{TFP growth} + W_L(\text{Labor growth}) + W_C(\text{Capital growth})$$

Where W_L and W_C are the relative shares of labor and capital respectively in national income, and where generally $W_L + W_C = 1$. Note that for many countries, including the U.S., the share of labor is larger than the share of capital, so increasing the growth rate of labor will have a far larger impact on GDP growth than an equivalent increase to the growth rate of capital.

The growth accounting equation can be modified to focus on per capita GDP growth, so that it can be used to estimate the purchasing power of the average person. The growth accounting equation in per capita terms is:

$$\text{Per capita potential GDP growth} = \text{TFP growth} + W_C(\text{Growth in capital-to-labor ratio})$$

The capital-to-labor ratio measures capital available per worker, weighted by their share of capital in national income. The equation further confirms that technological improvements are the bigger driver in improving GDP.

Sustainability of Growth

Gauging the sustainability of GDP growth is important; ideally, a country's economy is growing at a slow and steady rate over many years. However, there is no direct way to observe changes in potential GDP. As an alternative, economists use labor productivity, for which there is readily available and reliable data. **Labor productivity** is *the quantity of goods and services that a worker produces in one hour*. The calculation is:

$$\text{Labor productivity} = \text{Real GDP} / \text{Aggregate hours}$$

Therefore, potential GDP can be estimated as:

$$\text{Potential GDP} = \text{Aggregate hours worked} \times \text{Labor productivity}$$

Changing this into growth rates:

$$\text{Potential growth rate} = \text{Growth rate of labor force} + \text{Growth rate of labor productivity}$$

Determining what drives productivity of labor will then explain the drivers of real GDP: skill and education of workers, physical capital available, and technology. The production function can be used to gauge output per worker. By taking the function as described earlier and dividing both sides by a factor of L:

$$Y/L = A \times F(1,K/L)$$

This shows that output per worker relies on a technology-driven level of productivity and inputs like human and physical capital.

Labor productivity is important for measuring the health and sustainability of an economy's growth. It has also been shown to be a key differentiator among various countries' living standards.

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