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1. Learning Outcomes

After studying this module, you shall be able to

- Understand the three approaches to measuring national income
- Reason why the three approaches must arrive at the same figure of national income
- Identify the need to measure real GDP
- Learn how to measure other important aggregates
- Learn how to measure several price indices
- Know how to measure inflation
- Compare different price indices that are in use

2. Introduction

Now, that we appreciate the need to measure GDP or national income and also understand its definition and coverage, the present module goes on to explain how to measure it. The circular flow of income suggests that there are two sides of a transaction: income (or output) and expenditure. Accordingly, GDP can be measured from any of these approaches. These are discussed in detail in what follows.

3. Three methods of measuring National Income

3.1 Value Added Method

In this method, value added of each production unit is added to arrive at the total value of production. The economy is classified into few broad sectors (agriculture and allied activities, manufacturing, mining and quarrying, electricity, gas and water supply, construction, services such as trade, hotels, transport and communication, insurance and other business services). The value added in each sector is summed to arrive at GDP figures.

3.2 Expenditure Method

According to this method, GDP is computed as the sum of consumption expenditure, investment, government purchases of goods and services and net exports. Writing in equation form,

$$\text{GDP} = C + I + G + (X - M) \quad (1)$$

Consumption expenditure is consumers spending on durable (automobiles, computers etc.) as well as non-durable consumption goods (drinks, food, clothing etc.) and services (health, transport, education, haircuts etc.), both on domestic and foreign produce.

Investment includes addition or accumulation of physical capital such as new buildings, business plants and machinery as well as change in inventories. In case of inventory investment, additions to stock of inventory are included in GDP as it is a part of current production.

Investment is, therefore, something that adds to productive capacity of the economy. In this sense, investment in human resources in the form of education and training should be thought of to be a part of investment expenditures. However, the expenditure on private education is considered as private consumption expenditure while public expenditure on education is a part of government expenditure. Further, investment does not include buying bonds or shares of a company.

However, residential spending on housing is a part of total investment as it continues to serve households for a large number of years. In case of rented houses, rent reflects the value of the service provided by the house. However, in the case of owner occupied houses imputed rent is included. This is done based on the assumption that the owner is renting the house to himself.

The categorization of a spending as consumption or investment is to a large extent matter of what has been conventionally followed and may sometimes seem like a paradox. For an economy, it does not matter if a household owns the extra stock of cheese or the dairy shop builds up the extra stock of cheese. However, in the former case personal consumption expenditure would rise while in the latter case inventory investment (which is a part of investment) rises. In the latter case, the national income accounting treats these unsold stocks of inventory as purchased by the firm itself. The logic of this treatment ensures that production and expenditure will always be equal in national income accounts.

Finally, the investment listed here is “gross”, i.e. without deducting depreciation. To compute net investment, we would deduct depreciation. In the course of production, it is normal for capital to become obsolete or used and some wear and tear to take place. Therefore, to get an accurate measure of net production (which determines economy’s production capacity) during a year, depreciation is subtracted from GDP. If net investment is positive only then the accumulation of capital is positive implying an increase in productive capacity.

Government expenditure includes purchases of goods and services (domestic and foreign) by government such as defense expenditure, creation and maintenance of infrastructure, salaries of government employees etc. However, it does not include government expenses on transfer payments such as social security, pension, medical benefits, unemployment benefits, subsidies and interest on public debt as these do not represent a demand for currently produced goods and services.

Net exports or the trade balance is exports minus imports. Exports are currently produced goods that are purchased by foreigners. Exports add to demand of domestically produced goods. Imports are purchases of foreign goods made by domestic buyers and should not be counted in GDP. However, imports are included in C, I and G. Therefore, imports are subtracted to compute GDP. Net exports are positive if exports are larger than imports and negative if imports are greater than exports.

Both these methods (expenditure and value added) look at the production side of GDP. One could also look at GDP from the incomes earned by different factors of production (labour income, capital income, profits, rental income etc.). This leads to third method of calculating GDP.

3.3 Income method

GDP is the sum of all factor earnings made from current production of goods and services including profits earned by producers and taxes paid to government. By this method, GDP is computed as sum of compensation of employees, corporate profits, proprietor's income, rental income of household, current surplus of government sector units and net interest.

Compensation of employees is the income of workers (but excludes self-employed income) consisting of wages, salaries, other employee benefits and employer's contribution to pension schemes and other social security schemes. Corporate profits are residual incomes earned by corporations after making payment of wages, interest, rents and other cost. These corporate profits are then utilized for tax, dividend payments and finally kept as retained earnings. The proprietor's income is the earnings of unincorporated self-employed. The rental income includes income earned by landowners, royalty income by authors or artists.

An example would show how the national income is computed using these three methods.

Example 1: The following example shows how the three approaches result in identical measure of national income. Suppose in an economy there are two firms: Tomato Ltd. and Ketchup Ltd. Tomato Ltd. produce tomatoes and sell it directly to consumers as well as to Ketchup Ltd. Ketchup Ltd. sells its output to final consumers only. Table 1 provides an account of transactions of these firms.

Table 1: Income and Expenditure Statements(Amount in Rs)

Tomato Inc		Ketchup Inc	
Wages paid	15,000	Wages paid	10,000
Taxes paid	5,000	Taxes paid	2,000
Sales Revenue	35,000	Cost of inputs (tomatoes)	25,000
from final sales	10,000	Sales Revenue	40,000
from Tomato Inc	20,000		

Value Added or Product Approach: According to this approach, the national income in the economy is the sum of value created in the two firms. If we add the receipts from sale of final output of both the firms (Rs 35,000 + 40,000), the national income is 75,000. However, this involves adding the value of tomatoes twice resulting in double counting. To avoid this, we should add value added in each stage (or by each firm). The value added by Tomato Ltd. is 35,000 (assumed it does not use any intermediate inputs). The value added by Ketchup Ltd. is (value of final output minus cost of intermediate inputs i.e. 40,000-25,000= 15,000). Accordingly, the national income in such a hypothetical economy is

$$\begin{aligned} \text{National Income} &= \text{Value created by Tomato Ltd.} + \text{Value created by Ketchup Ltd.} \\ &= 35,000 + 15,000 \\ &= \text{Rs. } 50,000 \end{aligned}$$

Expenditure Approach: According to this approach, national income is the sum of final expenditures incurred in the domestic territory. In the above example, the households spend 10,000 on tomatoes from Tomatoes Ltd. and 40,000 on final product from Ketchup Ltd. Therefore, national income by expenditure method is Rs 50,000.

Income Approach: This approach sums income received by all factors of production. In this example, the profits of Tomato Ltd. are its revenue generated minus wages i.e. 20,000 (35,000-15,000) and profits of Ketchup Ltd. are revenue minus intermediate inputs and wages i.e. 5,000 (40,000-25,000-10,000). The wage income of the economy is 25,000 (15,000 and 10,000 of Tomato Ltd. and Ketchup Ltd. respectively.)

$$\begin{aligned} \text{National Income} &= \text{Wage Income} + \text{Profits Income} \\ &= 25,000 + 25,000 \\ &= 50,000 \end{aligned}$$

The above three aspects outline the measurement of national income using three different but identical measures of national income (excluding the incomplete or wrongly reported data). The national income by these methods is always identical because whatever is *produced* in the economy an equivalent amount of *income* is generated and an equivalent *expenditure* takes place. Though these approaches give identical value of national income but provide a different perspective of working of an economy that completes the understanding of different forces at play. Apart from these there are other aspects requiring elaboration. These are discussed in the remaining sections.

4. Other Aggregates

4.1 Personal and Personal Disposable Income

Personal income is the measure of total income received by households from all sources. If personal tax payments are deducted from personal income, we get personal disposable income, which is the income available to spend for private sector.

$$\text{Personal Income} = \text{National Income} - \text{Corporate Profits Tax payments} - \text{undistributed profits (retained earnings)} - \text{contributions to social security} + \text{transfer payments to households} + \text{personal interest income} \quad (2)$$

$$\text{Personal Disposable Income} = \text{Personal income} - \text{Personal taxes} \quad (3)$$

Further, the part of income not available for the private sector is the government's income.

$$\text{Government Income} = \text{Taxes} - \text{Transfers} - \text{Interest Payments on the government debt} \quad (4)$$

4.2 National Wealth, Private Savings and Government Savings

Apart from current income, household's wealth is an important indicator of its standard of living. **Wealth** may be defined as the value of its assets less value of its liabilities. Similar to an individual, wealth for a nation (termed as **National Wealth**) is the difference between what the nation owns (its assets) minus what it owes (its liabilities). The rate at which national wealth increases depends upon the rate of savings in an economy. Higher savings would imply higher rate of wealth accumulation. There are two main sources of savings: private sector and government sector.

Computation of private sector saving is based on the logic that whatever is not consumed is saved for future. Therefore, Private Savings is equal to private disposable income minus consumption. That is,

$$\begin{aligned} \text{Private Sector Savings (S}_{\text{pvt}}) &= \text{private disposable income} - \text{consumption} \\ &= (\text{GDP} + \text{net factor income from abroad} - \text{taxes} + \text{transfers} + \\ &\quad \text{interest payments}) - \text{consumption expenditure} \\ &= (\text{GDP} + \text{NFI} - \text{T} + \text{TR}) - \text{C} \end{aligned} \quad (5)$$

Investment expenditure by households is a part of spending but since these are adding to future's productive capacity, these goods are not subtracted to compute private sector savings. The rate of private sector savings is computed by dividing private savings by private disposable income. The government saving (S_{govt}) or budget surplus is measured as net government income less government purchases of goods and services. That is,

$$\begin{aligned} S_{\text{govt}} &= \text{government income} - \text{government expenditure} \\ &= (\text{taxes} - \text{transfer payments} - \text{interest payments}) - \text{government expenditure} \\ &= (\text{T} - \text{TR} - \text{INT}) - \text{G} \end{aligned} \quad (6)$$

When revenue receipts are greater than its expenditure then government runs into budget surplus and when expenses exceed government revenue then government runs into deficit. As stated above, national savings are the sum of government and private savings.

$$\begin{aligned} S_{\text{nat}} &= S_{\text{pvt}} + S_{\text{govt}} \quad (7) \\ &= (\text{GDP} + \text{NFI} - \text{T} + \text{TR} + \text{INT} - \text{C}) + (\text{T} - \text{TR} - \text{INT} - \text{G}) \quad (8) \\ &= \text{GDP} + \text{NFI} - \text{C} - \text{G} \quad (9) \end{aligned}$$

This equation illustrates that savings in a nation are equal to total national income (domestic and net foreign income from abroad) minus spending by consumers and government. The private saving can be put to a number of uses such as investment, lending to government and foreigners. To understand the uses of private spending consider the income-expenditure identity, $Y = C + I + G + \text{NX}$ and substitute in the last equation. This gives,

$$\begin{aligned} S &= (\text{C} + \text{I} + \text{G} + \text{NX}) + \text{NFI} - \text{C} - \text{G} \quad (10) \\ &= \text{I} + (\text{NX} + \text{NFI}) \quad (11) \end{aligned}$$

The term in brackets is current account balance (CA), which is the sum of net exports and net factor income from abroad. We will explain the concept of current account balance later in Module 5.

Substituting,

$$S = \text{I} + \text{CA} \quad (12)$$

Now, subtracting S_{govt} from both sides of this equation, we get

$$S - S_{\text{govt}} = \text{I} - S_{\text{govt}} + \text{CA} \quad (13)$$

$$S_{\text{pvt}} = \text{I} - S_{\text{govt}} + \text{CA} \quad (14)$$

This equation is uses of savings identity. This identity suggests that savings in an economy are used in three ways:

1. Investment (I)
2. For financing government deficit
3. For supporting the current account balance

4.3 Net Foreign Assets (NFA) and Current Accounts Balance (CA)

The concept of Net foreign assets (NFA) is linked to the Balance of Payments (BOP) situation of a country. We will read more about BOP in the later Modules. NFA is defined as the value of assets held by a country abroad minus the value of domestic assets held by foreigners. The current account balance (again this will be discussed in detail in later modules on BOP) is equal to change in net foreign assets. A surplus (positive balance) in current account would increase NFA while a deficit (negative balance) in current account would decrease NFA.

The gross national product (GNP) is the sum of gross domestic product (GDP) and net factor income from abroad (NFI).

$$GNP_t = GDP + \text{net factor income from abroad} \quad (15)$$

Substituting the income-expenditure identity in place of GDP,

$$GNP_t = C_t + I_t + G_t + (NX_t + NFI) \quad (16)$$

$$GNP_t = C_t + I_t + G_t + (CA_t) \quad (17)$$

where, CA_t is the current account balance

This provides another interpretation of GNP in terms of domestic spending for consumption expenditure, investment and government (referred to as 'absorption') and current account balance. If we take absorption term ($C_t + I_t + G_t$) to the left hand side an important interpretation can be derived. For a country, where GNP is less than absorption, the current account will be in situation of deficit.

5. Measuring Price Indices

5.1 Nominal versus Real GDP

The nominal GDP (or GDP in current prices) is defined as the value of total production of goods at their current prices. In this case, GDP could increase either due to increase in quantities or prices or both. But improvement in living standards depends on increase in quantities rather than prices. In order to eliminate the effect of price changes, we estimate real GDP. To arrive at real GDP figure (GDP at constant prices or GDP adjusted for inflation), the production of final goods is valued at some constant prices (base year).

Let us understand the concept of nominal and real GDP using an example. Suppose the economy produces 2 goods: computers and printers. The prices in year 1 are Rs 30,000 and Rs 5,000. We

assume year 1 is the base year. In year 1, the economy produces 10 computers and 5 printers. Therefore,

$$\text{GDP in year 1} = 30,000 * 10 + 5,000 * 5 = 3,00,000 + 25,000 = 3,25,000$$

In year 2, the production of computers and printers doubles to 20 and 10 respectively. The prices have also increased to 32,000 and 6,000 respectively. Therefore,

$$\text{GDP in year 2} = 32,000 * 20 + 6,000 * 10 = 6,40,000 + 60,000 = 7,00,000$$

The GDP has increased from Rs 3,25,000 to 7,00,000. However, not all of this can be attributed to increase in quantities of computers and printers. To estimate the increase in physical production from year 1 to year 2, we compute real GDP in year 2 at year 1's price.

$$\text{Real GDP in year 2} = 32,000 * 10 + 6,000 * 5 = 3,20,000 + 30,000 = 3,50,000$$

$$\begin{aligned} \text{The percentage growth of real GDP} &= (3,50,000 - 3,25,000) / 3,25,000 \\ &= 25,000 / 3,25,000 \\ &= 7.69\% \end{aligned}$$

Thus, the real GDP is almost 8% higher in year 2 than in year 1.

In an economy, where nominal GDP increases at a rate faster than real GDP, the prices must be rising. To measure this rise in prices or inflation, GDP deflator (P_t) is computed:

$$\text{GDP Deflator, } P_t = \frac{\text{Nominal GDP}}{\text{Real GDP}} \quad (19)$$

In the base year, real GDP equals nominal GDP and hence price level or GDP deflator is one. It is also known as the implicit price index as the change in prices is computed from the GDP measures computed at current and constant prices. On the other hand, an explicit price index measures the average movements in prices explicitly (consumer price index and wholesale price index). The rate of change in GDP deflator, $(P_t - P_{t-1}) / P_{t-1}$, is used to measure the general level of price rise over time, i.e. the rate of inflation. An example would explain how a GDP deflator is computed.

Table 2: Example of Price Index

Year	Price of Bread in current year (P_1)	Price of Bread in Base Year (P_0)	Price Index $P_t = (P_1/P_0) * 100$
2010	16	16	100
2011	18	16	112.5
2012	20	16	125

Table 2 gives an example of price of bread in the years 2010-12. Suppose we have to compute the price index in each year using the base year prices of 2010. In the base year, the bread was sold at

Rs 16. This increased to 18 in 2011 and further to 20 in 2012 (column 2). The price index is computed in column 4. In the base year, the price index is 100. In fact, the price index in the base year is always 100. The index rises to 112.5 in the year 2011, indicating that the prices are 12.5% higher in 2011 than in 2010. Further, it rises to 125 in the year 2012, indicating that the prices increase by 25% in 2012 over the base year. The computation of price index enables a quick and easy comparison of price change with the base year.

5.2 Consumer Price Index

The GDP deflator is based on the final goods and services produced in an economy. To the consumers, it may of interest to see the rise in prices of the goods they consume as they directly affect their cost of living. This information is provided by consumer indexes such as Consumer Price Index (CPI) and Wholesale Price Index (WPI) that are computed in most countries such as United States, United Kingdom, Italy, India etc. In India, one WPI index and four different measures of CPI are computed:

1. Consumer price index for industrial workers (CPI-IW)
2. Consumer price index for agricultural labourers (CPI- AL)
3. Consumer price index for rural labourers (CPI- RL)
4. Consumer price index for urban non-manual employees (CPI-UNME)

There are a number of differences between CPI and GDP deflator. The CPI measures the retail prices of a fixed basket of goods and services consumed by households. While GDP deflator is based on the prices of a wider group of goods CPI is based on purchases representative of consumers. Secondly, GDP deflator is based on actual production of a product in economy (basket changes from year to year) while CPI is based on a fixed basket of goods. Thirdly, CPI includes all goods (domestic and imports) that are consumed by the households while deflator includes only domestically produced goods.

Most government payments such as pensions, social security benefits and dearness allowances are based on CPI. WPI on the other hand, measures the wholesale price of large number of items. Generally, the consumer price index and GDP deflator will move in tandem. The CPI may follow movements in WPI. Further, for the reason explained above, in years where the price of imported good (such as oil) increases, the CPI is likely to be higher than GDP deflator.

There are a number of problems with these price indices. The quality of almost all products has been continually improving over time. The price increase in some of the goods may be because of this improvement in quality. This indicates a *quality bias* in CPI, as CPI does not account for any such improvement in quality of products over time. Accordingly, there have been attempts made to consider these quality adjustments in the CPI.

Due to another reason CPI is expected to overestimate inflation. The CPI is computed over a fixed basket of goods and services consumed by a typical consumer. However, not all products in this basket will experience same percentage change over time. This implies that the relative prices will change over time which will result in shift of consumer demands towards lower priced products and away from higher priced products. This change in consumer demands alters the consumption basket of consumers. However, CPI does not take into account these changes immediately as it continues to hold this basket constant over a long period of time. In fact, it only includes an item in the market basket after it has become widely used. All this might lead to overestimation of inflation. The estimates suggest that this overestimation could be about 1

percent per year. Since CPI is a widely used measure, such overestimation distorts the calculation of measures dependent on it such as wages.

6. National Income Estimation in India

India has a well-developed system of measuring national income accounts. The national income in India is estimated by Central Statistical Organisation (CSO). It classifies economic activities into:

- Primary sector consisting of agriculture, animal husbandry, forestry, fishing, mining and quarrying;
- Secondary sector consisting of manufacturing, electricity, gas and water supply and construction;
- Tertiary sector consisting of trade, hotel and restaurant, transport, storage and communication, finance and real estate and community and personal services.

The CSO provides estimates of GDP quarterly at both current and constant prices. For estimating national income the base year 2004-05 is used since Jan, 2010. It estimates national income using the product method, value added method and expenditure method. The data for estimating national income is gathered from several sources such as National Sample Survey Organization (NSSO) for agricultural statistics and Annual Survey of Industries (ASI) for manufacturing.

7. Summary

- There are three approaches to measuring national income: value added method, income and expenditure method.
- The value added method computes national income by adding value added by each production unit.
- The income approach measures national income by summing total income earned by all factors of production in the economy.
- The expenditure method computes national income by summing consumption, investment, government expenditure and net exports.
- All the three methods result in identical results as they are different ways of looking at the same transactions.
- Personal income is the measure of total income received by households from all sources.
- If personal tax payments are deducted from personal income, we get personal disposable income, which is the income available to spend for private sector.
- There are three uses of private savings: Investment, for financing government deficit and current account balance.
- In order to compare performance of an economy over time, it is important to compute real GDP.
- India has a well-developed system of measuring national income. The task of measuring national income in India is entrusted with Central Statistical Organization (CSO).