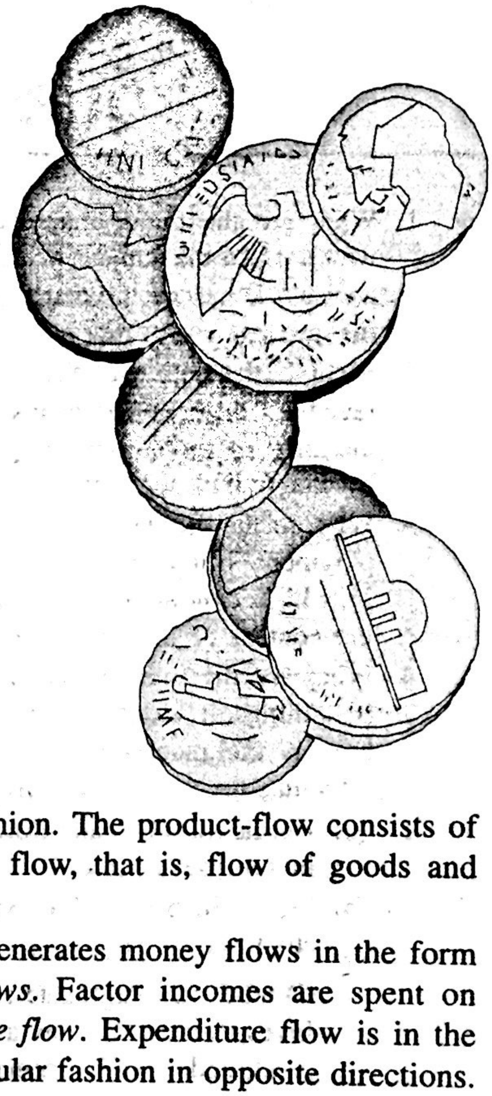
Chapter 3

The Circular Flow Models of Economy



INTRODUCTION

In Chapter 1, we have introduced macroeconomics as the study of economy as a whole. In this chapter, we introduce the economy and explain how an economy works in the form of circular flows of products and money.

An economy can be defined as an integrated system of production, exchange, and consumption. In carrying out these economic activities, people are involved in making transactions—they buy and sell goods and services. Economic transactions generate two kinds of flows: (i) product or real flow, i.e., the flow of goods and services, and (ii) money flow. Product and money flow in opposite directions in a circular fashion. The product-flow consists of (a) factor flow, that is, flow of factor services, and (b) goods flow, that is, flow of goods and services.

In a monetised economy, the flow of factors of production generates money flows in the form of *factor payments* which take the form of factor *income flows*. Factor incomes are spent on consumer and capital goods, which take the form of *expenditure flow*. Expenditure flow is in the form of *money flow*. Both product and expenditure flow in a circular fashion in opposite directions. The entire economic system can therefore be viewed as circular flows of factor incomes and expenditure. The magnitude of these flows, in fact, determines the size of national income. Since the forthcoming part of this book deals with the theory of income determination, it is useful to understand the mechanism of income and expenditure flows. How these flows are generated and how they make the system work are the subject matter of this chapter.

It may be noted at the outset that the mechanism of income and expenditure flows is extremely complex in reality. The economists, however, use simplified models to illustrate the *circular flows of income and expenditure*. To present the flows of income and expenditure, the economy is divided into four sectors: (i) household sector; (ii) business sector or the firms; (iii) government sector; and (iv) foreign sector. These four sectors are combined to make the following three models for the purpose of illustrating the circular flows of income and expenditure, and of product and money.

(i) Two-sector model including the household and business sectors;
(ii) Three-sector model including the household, business and government sectors; and
(iii) Four-sector model including the household, business, government and the foreign sectors.

3.1 CIRCULAR FLOWS IN A TWO-SECTOR MODEL

The two-sector model consists of only households and firm sectors. This model represents a private closed economy in which product and money flows generated by the government and the foreign sectors are ignored. A two-sector model is obviously an unrealistic model. However, to begin with, a two-sector economy provides a convenient starting point to analyse the circular flows. Before we analyse the circular flows, let us look at the basic features and functions of the households and the firms.

Households The *households* are assumed to possess certain specific features: (i) households are the owners of all factors of production—labour, land, capital and entrepreneurship, (ii) their total income consists of returns on their factors of production—wages, rent, interest and profits, (iii) they are the consumer of all the consumer goods and services; and (iv) they spend their total income on goods and services produced by the firms—if they save any part of their income, it flows to the firms in the form of investment.

Business Firms The *business firms,* on the other hand, are assumed to have the following features and functions: (i) firms own no resources of their own, (ii) they hire the factors of production—land, labour and capital—from the households, (iii) they use factors of produce and produce[1] and sell goods and services to the households; and (iv) they do not save, that is, there is no corporate saving.

Assumptions The following assumptions are made to specify the circular flow models.

(i) Households spend their total income on consumer and capital goods produced by the firms. They do not hoard any part of their income.
(ii) Firms produce goods and services only as much as demanded by the households. They do not maintain any *inventory*.
(iii) Firms make factor payments to the households as rent, wages, interest and profits.
(iv) There is no inflow or outflow of income or of goods and services from any outside source.

Having specified the model, we now describe and illustrate the circular flows of income and expenditure in two-sector model.

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1. The households do produce and consume certain goods and services. In their capacity as producers, they belong, functionally, to the category of firms.

3.1.1 The Circular Flows in a Two-Sector Economy: A Graphic Presentation

The working of a two-sector economy and the circular flows of incomes and expenditure are illustrated in Fig. 3.1. The households are represented by the rectangle labelled 'Households' and the business sector by the rectangle labelled 'Firms,' with their respective characteristics. A line drawn from the 'Household' to the 'Firms' divides the diagram into two parts—the upper half and the lower half. The upper half represents the ***factor market*** and the lower half represents the ***commodity market***. Both the markets generate two kinds of flows—***real*** or ***product flows*** and ***money flows***. Let us first look at the real and money flows in the factor markets.

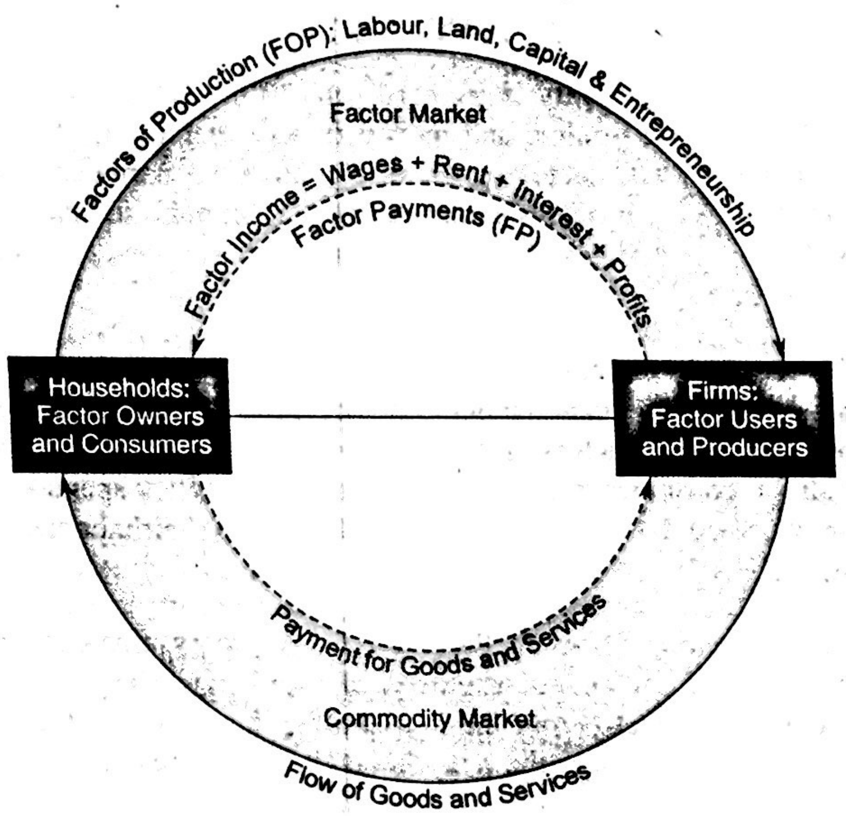


Fig. 3.1 The Circular Flows of Income and Expenditure: Two-Sector Model

In the factor market (the upper half), the arrow labelled 'FOP' shows the flow of factors of production (FOP) from the households to the firms. This makes the real or factor flow shown by a continuous arrow. The real or factor flow causes another and a reverse flow, that is, the flow of factor incomes (wages, interest, rent and profits) from the firms to the households. Since all factor payments (PF) are made in terms of money, the flow of factor incomes represents the money flow. The money flow, shown by a dashed arrow, comprises the total income (Y) of the households. Note that factor services and money flow in the opposite direction.

Let us now look at the commodity market (the lower half of the diagram). As shown in the diagram, the goods and services produced by the firms flow from the firms to the households. The payment made by the households for the goods and services creates money flow. Note again that real (goods) and money flows in the commodity market too flow in opposite direction.

When we combine the goods and money flows in the factor and goods markets and look at the flows in continuity, we find a *circularity* in the flows. By combining the continuous arrows in the goods and factor markets, we get the circular flow of goods. By the same process, we get the circular flow of money. As Fig. 3.1 shows, *goods and money flow in the opposite directions.*

Important Identities One striking feature of income and expenditure flows is that the *values* that flow are *equal*. For example, *factor payments* are equal to *factor income* and *household expenditure* equals the *value of output.* These equalities take the form of *identities* as follows.

$$Y \equiv FP$$
$$FP \equiv w + r + i + p$$
$$w + r + i + p \equiv V \equiv M$$
$$\therefore \quad V \equiv Y \equiv M$$

where Y = household income, FP = factor payments, w = wages, r = rent, i = interest, p = profits, V = value of output, and M = Money flows (at constant prices).

In the final analysis, household income = factor payments = the money value of output, i.e.,

$$Y \equiv FP \equiv V$$

This identity is important for national income determination.

3.1.2 Withdrawals, Injections and the Size of Income Flows

The magnitude of income and expenditure flows is determined by the size of the society's income and expenditure: the larger the size of income (or expenditure), the larger the size of flows and *vice versa*. In reality, however, there are ***leakages*** from and ***additions*** to the circular flows of income and expenditure. The leakages and additions are also called as ***withdrawals*** and ***injections***,[2] respectively.

In the two-sector model, *a withdrawal is the amount that is set aside by the households and firms and is not spent on the domestically produced goods and services over a period of time.* For example, if households set aside a part of their income as a provision for old age or as a provision against the loss of job, and so on, and do not spend it unless required, it is a *withdrawal.* It is important to note that *saving is a withdrawal.* But when savings are ultimately spent in the form of investment, they take the form of injections. The withdrawals are comparable to the concept of hoarding.[3] Similarly, firms may also withhold a part of their total receipts and may not return it to the circular flows in the form of factor payments, say, in anticipation of depression. *Such withdrawals reduce the size of the circular flow.*

On the other hand, *an injection is the amount spent by households and firms in addition to their regular incomes and receipts.* An injection by the households is the expenditure that they make in addition to what they receive from the firms as factor incomes. The injections by the households may be in the form of spending inherited savings, own hoardings, or by borrowing and spending

2. The terms 'withdrawals' and 'injections' were perhaps used first by R. G. Lipsey in his text, *An Introduction to Positive Economics,* 3rd edn., 1963.

3. Hoarding has been a practice prevalent in backward countries for lack of institutional facilities like banking system for liquidity and safety of money.

on consumer goods. And, an injection by the firms is the expenditure which they make in addition to what they receive from the sale of goods and services. Firms can inject money into the economy by spending their past savings or by borrowing from the outside of the model economy. *Injections increase the size of the flow.*

The withdrawals and injections in the two-sector model are illustrated in Fig. 3.2. The lower half of the figure shows the withdrawals and injections by the households and the upper half shows the withdrawals and injections by the firms.

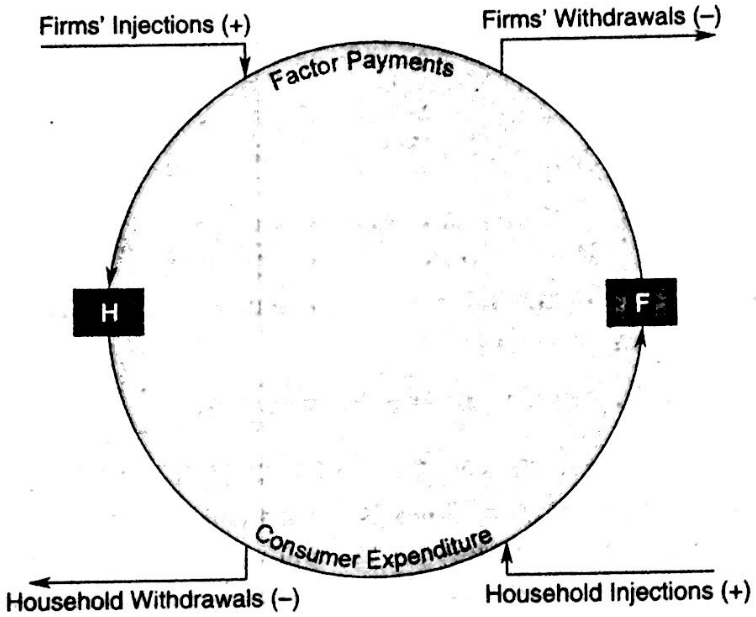


Fig. 3.2 Withdrawals and Injections in the Circular Flows

The Two-Sector Model with Savings We have hitherto assumed that households supply finances directly to the firms. In reality, however, household do save a part of their income for investment. In order to explain the role of saving on the circular flows, we assume that *all savings are made by the households* and extend the two-sector model to include the financial sector. The financial sector (known also as financial market and capital market) is constituted of a large variety of institutions involved in collecting household savings and passing it on to the business sector. In our simplified two-sector model, however, the financial sector includes only banks and financial intermediaries (FIs), like insurance companies, industrial finance corporations, which accept deposits from the households and invest it in the business sector in the form of loans and advances. The circular flows of income and expenditure in a two-sector model with the capital market is illustrated in Fig. 3.3.

Note that the flow of factors of production and factor payments in Fig. 3.3 are the same as in Fig. 3.1. In Fig. 3.3, a new sector, labelled as 'Capital Market' has been added. The movement of the dashed arrow, labelled *S*, shows the flow of household savings to the capital market, i.e., to the banks and financial intermediaries (FIs) in the form of deposits. The banks and FIs use the deposits to buy shares and debentures of the firms which is investment (*I*). The investment flow is shown by the dashed arrow labelled *I*.

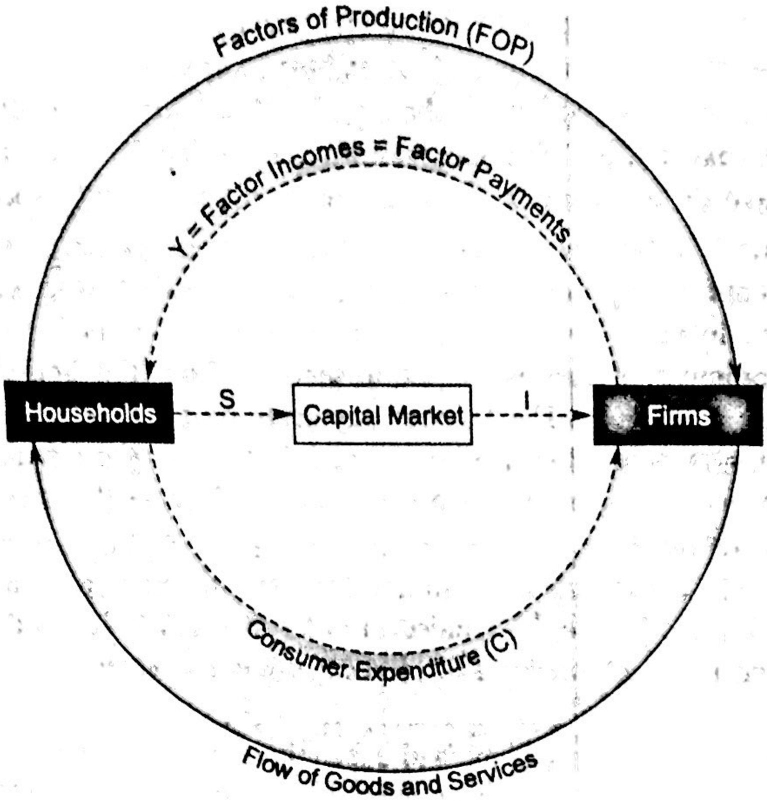


Fig. 3.3 Circular Flows in Two-Sector Model with the Capital Market

With the inclusion of the financial sector, the households incomes (Y) is divided into two parts: (i) consumption expenditure (C), and (ii) savings (S). As shown in Fig. 3.3, C and S take different routes to reach the business sector. The consumption expenditure (C) flows directly to the firms, whereas savings (S) are routed through the financial sector. Note that savings (S) take ultimately the form of investment (I). In the final analysis, we find that the entire money income generated by the firms flows back to the firms which flows back again to households as factor payments.

3.2 CIRCULAR FLOWS IN THREE-SECTOR MODEL: A MODEL WITH GOVERNMENT INCOME AND EXPENDITURE

The three-sector model is formed by adding the government sector to the two-sector model. A three-sector model depicts a more realistic economy as it includes the government which plays an important role in the economy. The economic role of the government has increased tremendously during the post-World War II period. In India, for example, the percentage of central government expenditure to *GDP* increased from around 5 percent in 1950-51 to 17.2 percent in 1990-91, and then 18.7 percent in 2007-08. The percentage of tax revenue of the central government increased from 5 percent in 1950-51 to nearly 10 percent in 2007-08 (RE). The ratio of the total government (central and state) expenditure to *GDP* has risen from about 8 percent in 1950-51 to over 40 percent in the early 1990s, and the percentage of tax revenue to *GDP* increased from 7 percent to over 20 percent during this period. These ratios are much higher in many developed countries.

The inclusion of the government into the model requires adding and analysing the effects of government's fiscal operations—taxation and expenditure. However, in our simple analysis here, we will include only two fiscal transactions to the circular flows, *viz*. (i) taxation—direct and indirect taxes, (ii) government expenditure on goods and services, subsidies and transfer payments. These fiscal transactions have different kinds of effects on the income and expenditure flows.

Taxes are withdrawals from the income flows because they reduce private disposable income and, therefore, consumption expenditure and savings. On the other hand, government expenditure is an injection into the income stream. The government expenditure adds to the aggregate demand in the form of government purchases of factor services from the households and goods and services from the business sector. The transfer payments by the government (e.g., old age pensions, subsidies, unemployment allowance, etc.) are injections to the circular flows. They add to the household income which leads to increase in household demand for consumer goods.

The circular flows of incomes and expenditures in three-sector model are shown in Fig. 3.4. This figure presents only the money flows to and from the government. The real (or goods) flow from and to the government has been excluded in order to avoid overcrowding of the diagram. It must be borne in mind that each money flow (except transfer payments) has a counterflow in the form of goods flow.

In Fig. 3.4, the circular flows of income and expenditure are the same as in Fig. 3.1. However, it is important to bear in mind that the magnitude of flows between the households and the firms

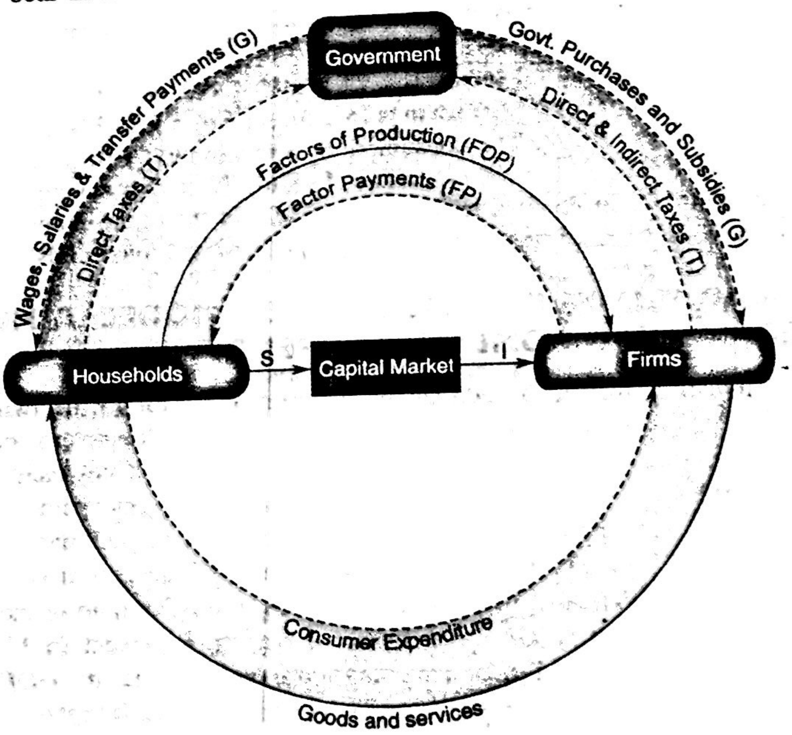


Fig. 3.4 Circular Flows of Incomes in a Three-Sector Model

gets reduced because a part of their incomes flows to the government sector. As the figure shows, a part of the household income is claimed by the government in the form of direct and indirect taxes. Similarly, a part of the firms' earning is taxed away in the form of corporate income tax. The indirect taxes are collected by the firms from the households and passed on to the government. The government spends a part of its tax revenue on wages, salaries and transfer payments to the households and a part of it on purchases from the firms and payment of subsidies. Thus, the money that flows from the households and the firms to the government in the form of taxes, flows back to these sectors in the form of government expenditure.

Is the government tax revenue (T) always equal to the government expenditure(G)? In Fig. 3.4, total tax revenue is assumed to be equal to the total government spending. In reality, however, the two variables may not be necessarily equal. It depends on the government budgetary policy. If the government adopts a *balanced budget policy*, then $G = T$. If the government adopts a *deficit budget policy*, then $G > T$. And, if the government follows *surplus budget policy*, then $G < T$. A *deficit budget policy implies* ***net injections*** into the economy. Therefore, these kinds of budget policies expand the circular flows. On the contrary, a *surplus budget policy amounts to* ***net withdrawal*** from the economy which reduces the size of the circular flows.

3.3 CIRCULAR FLOWS IN A FOUR-SECTOR MODEL: A MODEL WITH THE FOREIGN SECTOR

In this section, we describe the circular flows of income and expenditure in four-sector model. The four-sector model is formed by adding foreign sector to the three-sector model. The foreign sector consists of two kinds of international transactions: (i) foreign trade, that is, exports and import of goods and services, and (ii) inflow and outflow of capital. The inter-country transactions make a complex system. For simplicity sake, however, we make the following assumptions.

(i) The external sector consists of only exports and imports of goods and services;
(ii) The export and import of goods and non-labour services are made only by the firms; and
(iii) The households export only labour.

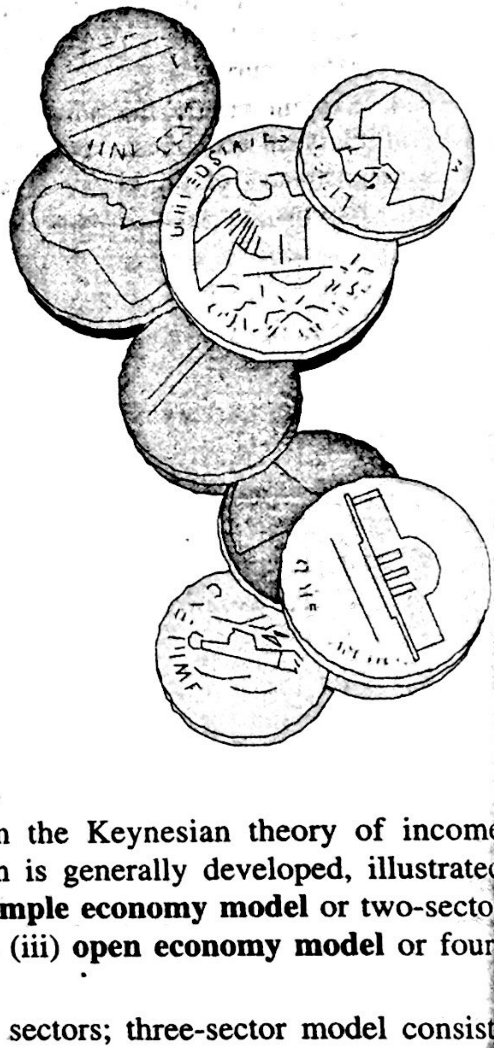
The circular flows of income and expenditure in a four-sector model is illustrated in Fig. 3.5. Like Fig. 3.4, this figure too shows only the money flows. It must be borne in mind that each money flow has its counterpart goods flow in the opposite direction. The lower part of this figure shows circular flows of money in respect of foreign trade. Exports (X) make goods and services flow out of the country and make money (foreign exchange) flow into the country in the form 'receipts from export.' This is, in fact, flow of foreign incomes into the economy. ***Exports (X) represent injections into the economy***. Similarly, imports (M) make inflow of goods and services and flow of money (foreign exchange) out of the country. This is flow of expenditure out of the economy. ***Imports (M) represent withdrawals from the circular flows.***

Another inflow of income is generated by the 'export of manpower' by the households. The export of manpower brings in 'foreign remittances' in terms of foreign exchange. This is another inflow of income. These inflows and outflows go on continuously so long as there is foreign trade and export of manpower.

So far as the effect of foreign trade on the magnitude of the overall circular flows is concerned, it depends on the *trade balance*, which equals $X - M$. Recall that X represents injections and M

Chapter 6

Keynesian Theory of Income Determination: A Simple Economy Model



INTRODUCTION

Keynes had developed his theory of income determination in his endeavour to formulate a new theory of employment in contrast to the classical theory of employment. While classical economists had emphasized the role of supply, Keynes emphasized, in contrast, the role of demand in the determination of output and employment. Briefly speaking, the Keynesian theory of income determination states that the equilibrium level of national income is determined at the level where aggregate demand for goods and services equals their aggregate supply.

In this and the two succeeding chapters, we will explain the Keynesian theory of income determination. The Keynesian theory of income determination is generally developed, illustrated graphically and algebraically, in three different models: (i) a **simple economy model** or two-sector model; (ii) **closed economy model** or three-sector model, and (iii) **open economy model** or four sector model.

The two-sector model includes only households and firms sectors; three-sector model consists of households, firms and the government sectors; and the four-sector model is constructed by adding foreign sector to the three-sector model. In this chapter, we present the Keynesian theory of income determination in a two-sector model.

It is **important** to note here that throughout the Keynesian theory of income determination, *prices are assumed to remain constant* even if aggregate demand and aggregate supply change. This assumption applies to all the three models of income determination in the subsequent chapters.

Before we discuss the Keynesian theory of income determination, let us look at the basic concepts, definitions and functions used in his theory of income determination. The concepts and functions that are crucial to the discussion on the Keynesian theory of income determination are: (i) the aggregate supply function, (ii) the aggregate demand function, (iii) the aggregate consumption function, (iv) the aggregate saving functions, and (v) the constant investment.

6.1 THE CONCEPTS AND FUNCTIONS

6.1.1 The Aggregate Supply[1] Function

Aggregate supply refers to the total supply of goods and services in an economy. The derivation of Keynesian aggregate supply function is illustrated in panel (b) of Fig. 6.1. Keynes used the classical production function to derive his aggregate supply function. It may be recalled that the classical production function is given as:

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

Given the production function and technology, the level of real income (Y) depends on the supply and use of the productive resources, *viz.*, capital (K) and labour (L). In the short run, the stock of capital, K, is fixed. Therefore, short-run output depends on the level of employment (L). Thus, the short-run production function may be written as:

$$Y = f(L) \tag{6.1}$$

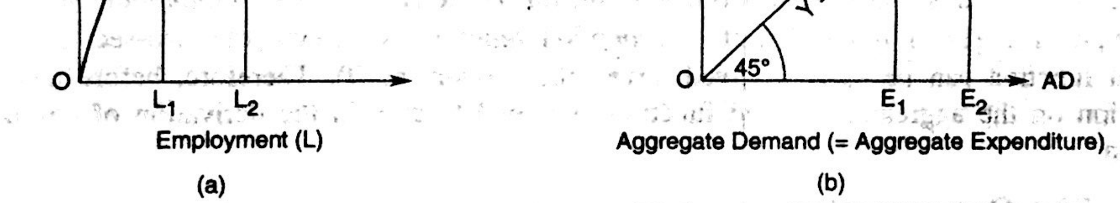


Fig. 6.1 Derivation of the Aggregate Supply Curve

[1] The concepts of aggregate supply and aggregate demand were first used by T. R. Malthus to contradict the classical proposition that there cannot be overproduction or underproduction in the long run. Malthus had shown, *though not rigorously, that aggregate demand might fall short of the aggregate supply leading to overproduction.* Keynes developed this idea further and used it to develop his theory of income and employment determination.

The production function (6.1) is presented graphically in panel (a) of Fig. 6.1 by the curve marked $Y = f(\bar{K}, L)$. As the curve shows, real output (Y) increases with increase in labour employment though $MPP_L = \Delta Y/\Delta L$ goes on decreasing. This relationship between the labour employment and the real output forms the basis of the Keynesian aggregate supply curve. Let us see how.

The logic behind the increase in real output and employment is given as follows. The value of real output (Y), measured on Y-axis, equals the aggregate *supply price*, that is, the price which producers expect to realize when total output is sold at a given price. As shown in panel (a) of Fig. 6.1, if producers expect a demand equal to OY_1, they will employ OL_1 labour to produce output OY_1. If they expect a demand OY_2, they will employ labour OL_2, and supply goods and services worth OY_2, and so on. It means that the *aggregate supply* (AS) is always equal to the *aggregate demand* (AD) for output, i.e., $AD = AS$ at all the levels of output. This relationship between the AD and AS forms the basis of Keynesian aggregate supply function. In panel (b) of Fig. 6.1, Y-axis measures the aggregate supply (AS) and X-axis measures the aggregate demand (AD) in terms of aggregate expenditure (E). The relationship between aggregate demand and aggregate supply is shown by a 45° line, AE. The 45° aggregate supply line implies that aggregate demand equals aggregate supply at all the levels of output[2]. The aggregate supply line AE represents the Keynesian aggregate supply function.

6.1.2 The Aggregate Demand Function: Two-sector Model

In a simple two-sector economy in which there is no government and no foreign trade, aggregate demand (AD) consists of only two components: (i) aggregate demand for consumer goods (C), and (ii) aggregate demand for investment goods (I). Of the two, consumption expenditure accounts for the highest proportion[3] of the GDP. Thus, in a simple economy,

$$AD \equiv C + I \tag{6.2}$$

In Eq. (6.2), the variable I is assumed to be determined *exogenously* and to remain constant in the short run. The short-run aggregate demand function can thus be written as

$$AD \equiv C + \bar{I} \tag{6.3}$$

(where $\bar{I}$ = constant investment).

Equation (6.3) implies that, in the short-run, AD depends largely on the aggregate consumption expenditure. It means that the short-run AD *function* is the function of *consumption function* plus a constant ($\bar{I}$). This implies that if *consumption function* is known, the two-sector aggregate demand function can be easily derived, given the investment ($\bar{I}$). Therefore, before any further discussion on the aggregate demand function, we need to explain the derivation of consumption function.

6.1.3 The Consumption Function

The *consumption function* is one of the most important functions used in macroeconomics and the most important function used in the Keynesian theory of income determination. A consumption function is a functional statement of relationship between the consumption expenditure and its

2. This relationship is based on the assumption that prices remain constant even if cost of production increases.
3. In India, for instance, consumption expenditure accounts for over 65% of its GDP.

deteminants. Although consumption expenditure of households depends on a number of factors—income, wealth, interest rate, expected future income, life style of the society, availability of consumer credit, age and sex, etc.—'income is the primary determinant of consumption and saving'[4]. Given this dictum, the most general form of consumption function is expressed as:

$$C = f(Y),\ \Delta C/\Delta Y > 0 \tag{6.4}$$

where C = consumption expenditure, and Y = disposable income.

The consumption expenditure is a positive function of income, i.e., consumption increases with increase in income. According to Keynes, this relationship between income and consumption is based on a "fundamental psychological law" that "men are disposed, as a rule and on average, to increase their consumption as their income increases, but not as much as the increase in their income"[5], i.e., $\Delta C/\Delta Y$ goes on decreasing in case of individual households.

A question arises here: Does consumption increase proportionately, less than proportionately or more than proportionately? Keynes and Keynesians have different views on this issue. Their views on this issue are explained by using the concept of ***marginal propensity to consume***.

Marginal Propensity to Consume (MPC) The marginal propensity to consume (*MPC*) refers to the relationship between marginal income and marginal consumption. The marginal propensity to consume is also expressed symbolically as $\Delta C/\Delta Y$. In the opinion of Keynes, $\Delta C/\Delta Y$ decreases with the increase in income. In plain words, as income increases, people tend to consume a *decreasing* proportion of the marginal income. This kind of income-consumption relationship represents the Keynesian consumption function. The Keynesian theory of consumption produces a *non-linear consumption function* as shown in Fig. 6.2.

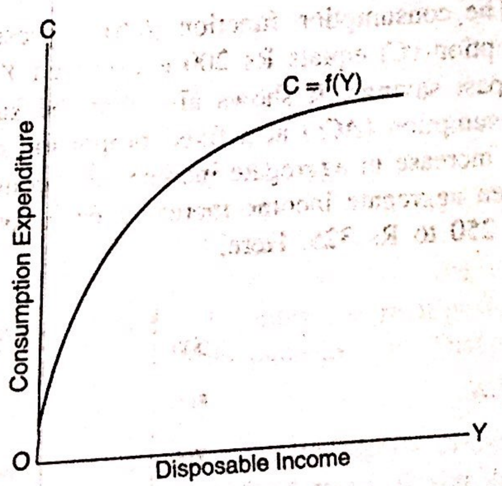


Fig. 6.2 Non-Linear Consumption Function

It is important to note here that the Keynesian consumption function is relevant for individual household's consumption behaviour—not for the economy as a whole or at the aggregate level. Keynesian economists have, however, estimated empirically the consumption function for the economy as a whole which take the form of a *linear consumption function*. The Keynesians have used a linear consumption function in reconstructing Keyne's theory of income determination. Let us therefore look at the linear consumption function.

The Linear Aggregate Consumption Function Although Keynes postulated a non-linear consumption function, it is now a convention in the modern interpretation and analysis of Keynesian macroeconomics to use a linear aggregate consumption function of the following form.

$$C = a + bY \tag{6.5}$$

4. Samuelson, P.A. and Nordhaus, W.D., *Economics*, 11th Edn., 1995, p.424.
5. For details, see *The General Theory of Employment, Interest and Money*, Ch. 5.

In consumption function, as given in Eq. (6.5), C = aggregate consumption expenditure; Y = total disposable income. Intercept a is a positive constant. It denotes the level of consumption at zero level of income. The consumption at zero level of income is called *autonomous consumption*, supposed to be financed out of past savings. In Eq. (6.5), b is a positive constant. Mathematically, it represents the *slope* of a linear consumption function. It denotes a constant $MPC = \Delta C/\Delta Y$. The MPC is less than unity but greater than zero, that is, $0 < b < 1$.

Given the function (6.5), it can be shown that $b = \Delta C/\Delta Y$.

If
$$C = a + bY$$
then
$$C + \Delta C = a + b(Y + \Delta Y)$$
$$\Delta C = -C + a + bY + b\Delta Y$$

Since $C = a + bY$, the terms $(-C)$ and $(a + bY)$ cancel out. Then,

$$\Delta C = b\Delta Y, \text{ and}$$
$$\Delta C/\Delta Y = b.$$

6.1.4 Graphical Presentation

Let us suppose that an empirically estimated linear aggregate consumption function is given as:

$$C = 200 + 0.75Y \qquad (6.6)$$

The consumption function (6.6) is presented graphically in Fig. 6.3. As Fig. 6.3 shows, consumption (C) equals Rs 200 even when $Y = 0$. This consumption is assumed to be financed out of past savings. It shows also that the subsequent increases in income (ΔYs) induce additional consumption (ΔCs) at a fixed proportion of 75%. That is, aggregate consumption increases with the increase in aggregate income, at a constant rate of 75% of the marginal income. For example, when aggregate income increases from Rs 200 to Rs 300, aggregate consumption increases from Rs 250 to Rs 325. Here,

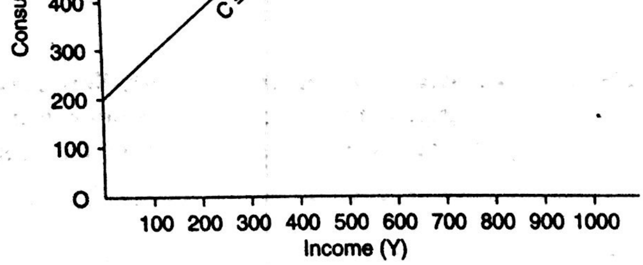


Fig. 6.3 The Linear Aggregate Consumption Function

$$\Delta Y = 300 - 200 = 100$$

$$\Delta C = 325 - 250 = 75$$

Therefore, $\Delta C/\Delta Y = 75/100 = 0.75$ (or 75%).

And, when income (Y) increases from Rs 300 to Rs 400, C increases from Rs 325 to Rs 400. In this case,

$$\Delta Y = 400 - 300 = 100$$

$$\Delta C = 400 - 325 = 75$$

and $\Delta C/\Delta Y = 75/100 = 0.75$ (or 75%).

This shows that, in our example, the marginal propensity to consume (MPC) is constant at 75% at the aggregate level.

6.1.5 Average Propensity to Consume (APC)

The average propensity to consume (APC) is defined as

$$APC = \frac{C}{Y} \tag{6.7}$$

Given the consumption function, $C = a + bY$,

$$APC = \frac{a + bY}{Y} \tag{6.8}$$

If consumption function is assumed to be of the form $C = bY$, then,

$$APC = \frac{bY}{Y} = b$$

It implies that if $C = bY$, then $APC = MPC$.

6.1.6 Saving Function

The saving function is the counterpart of the consumption function. It states the relationship between income and saving. Therefore, saving is also the function of disposable income. That is,

$$S = f(Y) \tag{6.9}$$

We know that $Y = C + S$. Thus, consumption and saving functions are counterparts of one another. Therefore, if one of the functions is known, the other can be easily derived. Given the consumption function as $C = a + bY$, saving function can be easily derived as follows. Since, $Y = C + S$, savings (S) can be defined as

$$S = Y - C \tag{6.10}$$

By substituting consumption function, $C = a + bY$, for C in Eq. (6.10), we get,

$$S = Y - (a + bY) \tag{6.11}$$

$$= -a + (1 - b)Y$$

The term $1-b$ in function (6.11) gives the *marginal propensity to save (MPS)*, where $b = MPC = \Delta C/\Delta Y$.

The saving function can be derived algebraically as follows. By substituting consumption function, $C = 200 + 0.75Y$ for C in Eq. (6.10), we get the saving function as

$$\begin{aligned} S &= Y - (200 + 0.75Y) \\ &= Y - 200 - 0.75Y \\ &= -200 + (1 - 0.75)Y \\ &= -200 + 0.25Y \end{aligned} \qquad (6.12)$$

The saving function (6.12) is presented graphically in Fig. 6.4. As the figure shows, savings are negative till income rises to Rs 800. At income of Rs 800, savings equal to zero. Positive savings take place only after income rises above Rs 800. Savings increase at the rate of 25% of the marginal income.

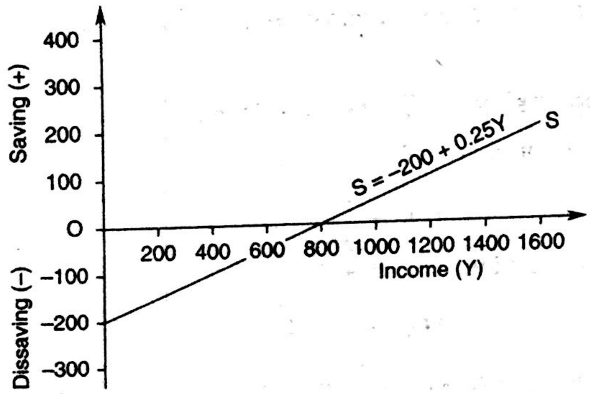


Fig. 6.4 The Saving Function

6.1.7 Aggregate Demand Function

Now that we have explained the consumption and saving functions, we can present aggregate demand function, assuming that investment (I) remains constant. Recall aggregate demand (AD) and consumption (C) functions given as

$$\begin{cases} AD = C + \bar{I} & : \text{(Eq. 6.3)} \\ C = a + bY & : \text{(Eq. 6.5)} \end{cases}$$

and

By substituting $a + bY$ for C, we get

$$AD = a + bY + \bar{I} \qquad (6.13)$$

Recall our estimated hypothetical consumption function $C = 200 + 0.75Y$ (See Eq. 6.6) and assume that $\bar{I} = 100$. By substitution, the estimated aggregate demand function (6.13) can be written as

$$AD = 200 + 0.75Y + 100 \qquad (6.14)$$

...f the aggregate demand function is shown in Fig. 6.5. In Fig. 6.5, constant

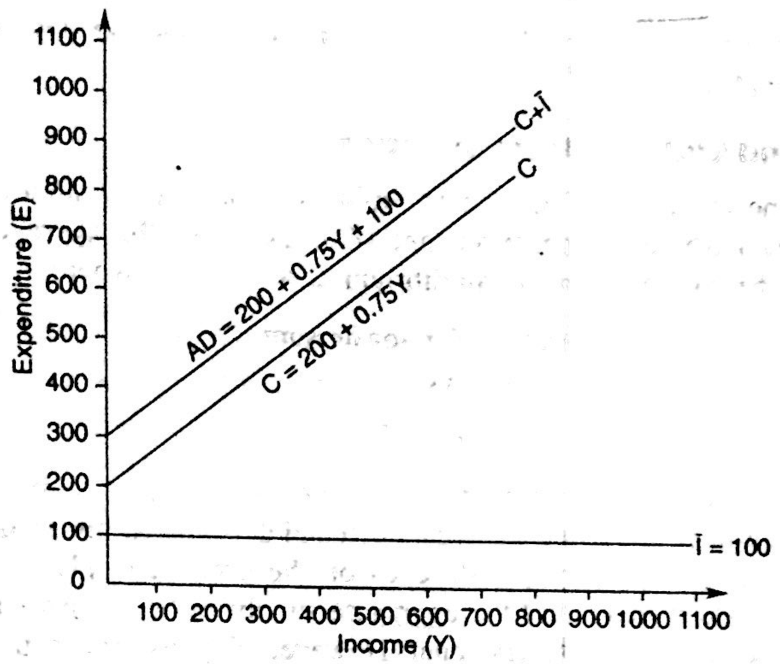


Fig. 6.5 The Aggregate Demand Function

6.2 INCOME DETERMINATION IN SIMPLE ECONOMY MODEL

In the preceding section, we have explained the basic concepts and introduced the important functions used in the Keynesian theory of income determination. The stage is now set for the formal presentation of the theory of income determination in a simple economy model. As already mentioned, simple economy model includes two sectors including the household sector and the business sector. An economy of this kind does not exist in reality. But, this hypothetical economy provides a simple and a very convenient starting point in understanding the Keynesian theory of income determination. The determination of income and output in realistic models will be discussed in the subsequent chapters. To begin with, let us specify the model with its assumptions.

Assumptions The simple economy model makes the following assumptions.

1. There are only two sectors in an economy, *viz.*, (i) the households, and (ii) the business firms—there is no government and no foreign trade.
2. In simple economy model, aggregate demand consists of (i) aggregate consumer demand (C) and aggregate investment demand (I). Thus, aggregate demand (AD) equals $C + I$. There is no leakage or injection.
3. Since there is no government and, therefore, there is no tax and no government expenditure. Even if some form of government exists, it does not tax and it does not spend.
4. The two-sector economy is a closed economy—there is no foreign trade nor is there any external inflow or outflow.
5. In the business sector, there is no corporate savings or retained earnings. The total profit is distributed as dividend.
6. All prices, including factor prices, remain constant.
7. The supply of capital and technology are given.

Having specified the two-sector model, we now turn to analyse the determination of the equilibrium level of national income.

6.2.1 Income and Output Determination

According to the Keynesian theory of income determination, the equilibrium level of national income is determined at a level where aggregate demand $(C + I)$ equals the aggregate supply of income $Y = C + S$. That is, the national income equilibrium is determined where:

$$\text{Aggregate demand} = \text{Aggregate supply}$$
$$AD = AS$$
$$C + I = C + S$$

Keynes argued that there is no reason for the aggregate demand to be always equal to the aggregate supply. According to Keynes, aggregate demand depends on households' plan to consume and to save and invest. Aggregate supply depends on the producers' plan to produce goods and services. For the aggregate demand and the aggregate supply to be always equal, the households' plan must always coincide with producers' plan. However, Keynes argued that there is no reason to believe:

(i) that consumers' consumption plan always coincides with producers' production plan; and
(ii) that producers' plan to invest matches always with households' plan to save.

Therefore, there is no reason for $C + I$ and $C + S$ to be always equal and national income to be in equilibrium at all the levels of income. According to Keynes, there is a unique level of output and income at which the aggregate demand equals the aggregate supply. This unique point exists where consumers' plan matches with producers' plan and savers' plan matches with firms' plan to invest. It is here that the equilibrium level of income and output is determined. A formal model of income and output determination is given below.

Formal Model of Income Determination In this section, we present a formal analysis of income determination in a two-sector model. Recall the Keynesian theory of income determination that the equilibrium level of national output is determined where aggregate demand $(C + I)$ equals the aggregate supply $(C + S)$. As mentioned above, the condition for national income equilibrium can thus be expressed as:

$$AD = AS$$
$$C + I = C + S \qquad (6.15)$$

Since C is common to both the sides of Eq. (6.15), C on both sides gets cancelled out. Thus, the equilibrium condition for the national income can also be expressed as:

$$I = S \qquad (6.16)$$

Given the Eqs. (6.15) and (6.16), there can be two approaches to explain the Keynesian theory of national income determination, viz.,

(i) *AD-AS* approach, and
(ii) *S-I* approach.

Let us first explain the theory of income determination by *AD-AS* approach.

(i) ***AD-AS Approach*** According to the *AD-AS* approach, national income equilibrium is determined where

$$C + I = C + S$$

Equation (6.15) tells that at equilibrium level of national income,

$$Y = C + I \tag{6.17}$$

We have assumed above that $C = a + b\,Y$ and I is constant at $\bar{I}$. By substituting $a + bY$ for C and $\bar{I}$ for I in Eq. (6.17), the equilibrium level of national income can be expressed as:

$$Y = a + bY + \bar{I} \tag{6.18}$$

Eq. (6.18) may now be solved to find the equilibrium level of national income (Y) and consumption (C). Let us first solve Eq. (6.18) for Y. As given in Eq. (6.18),

$$Y = a + bY + \bar{I}$$

$$Y - bY = a + \bar{I}$$

$$Y(1 - b) = a + \bar{I}$$

$$Y = \frac{a + \bar{I}}{1 - b}$$

$$Y = \frac{1}{1 - b}(a + \bar{I}) \tag{6.19}$$

Determination of consumption Having obtained the equilibrium level of Y, that is, the total personal income in our two-sector model, we can work out the equilibrium level of consumption as follows. Given the consumption function as

$$C = a + bY$$

By substituting Eq. (6.19) for Y in the consumption function, we get

$$C = a + b\left[\frac{1}{1 - b}\right](a + \bar{I})$$

$$C = a + \frac{b}{1 - b}(a + \bar{I}) \tag{6.20}$$

Numerical Example The equilibrium level of Y and C can be determined numerically by assuming a hypothetical consumption function and a given level of $\bar{I}$. Let us suppose the consumption function is given as:

$$C = 100 + 0.75Y \tag{6.21}$$

and

$$\bar{I} = 200$$

Given the consumption function (6.21) and $\bar{I} = 200$, there are two methods of finding the value of C at equilibrium level of Y. One method is to substitute the numerical value for a, b and I in Eq. (6.20). The second method is to first calculate equilibrium Y and find the value of C through Eq. (6.21).

Using the **first method,**

$$C = 100 + \frac{0.75}{1-0.75}(100 + 200)$$
$$= 100 + 3\ (300)$$
$$= 1000.$$

By using the **second method**, the value of Y can be obtained by substituting the numerical values for C and $\bar{I}$, respectively, in Eq. (6.18). We get equilibrium level of Y as follows.

$$Y = 100 + 0.75Y + 200 \tag{6.22}$$
$$Y\ (1 - 0.75) = 100 + 200$$
$$Y = \frac{1}{1-0.75}\ (300)$$
$$Y = 1200$$

Thus, given the consumption function as $C = 100 + 0.75Y$ and $\bar{I} = 200$, the equilibrium level of national income is determined at 1200.

Once the equilibrium level of national income is determined, the equilibrium level of consumption (C) can be obtained by substituting 1200 for Y in the consumption function (6.21). Thus,

$$C = 100 + 0.75\ (1200) \tag{6.23}$$
$$= 1000$$

Incidentally, since we have computed the equilibrium values of Y and C, we can easily obtain the equilibrium level of saving (S) as follows.

$$S = Y - C \tag{6.24}$$

By substituting the actual values of Y and C in Eq. (6.24), we get

$$S = 1200 - 1000$$
$$= 200$$

The final picture of equilibrium in the two-sector model may now be presented as given below.

Aggregate Demand = Aggregate Supply = National Income

$$C + \bar{I} = C + S = Y$$
$$1000 + 200 = 1000 + 200 = 1200$$

Graphical Presentation of Income Determination The determination of national income in a two-sector model based on the numerical example given above is presented graphically in Fig. 6.6. The AS-schedule represents the aggregate supply curve. It gives a hypothetical *growth path* of national income on the assumption that the society spends its entire income on consumer and capital goods, that is, the aggregate expenditure is always equal to the aggregate supply. In reality, however, the households consume a part of their income and save a part of it. Their savings may not always find a way to investment. For, households' plan to save may not always match with firms' plan to invest. Therefore, savings may not always be equal to investment. This means that the aggregate demand may not always equal the aggregate supply.

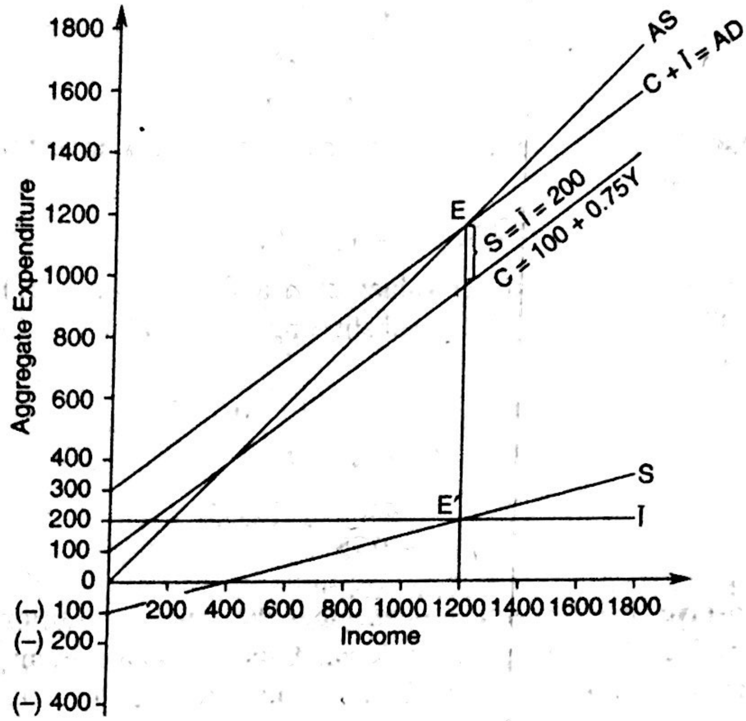


Fig. 6.6 Equilibrium of the National Income and Output: The Two-Sector Model

The $C + I$-schedule drawn on the basis of Eq. (6.22) represents the aggregate demand (AD). The AD schedule intersects the AS schedule at point E. The intersection of the AD and AS schedules is also called "the Keynesian cross"—a term coined by Samuelson in his *Economics*. The point of intersection between the AD and AS schedules is the point of equilibrium of the national income. The equilibrium point E determines the equilibrium level of national income at 1200 which is the same as obtained in the numerical example [see Eq. (6.22)]. The equilibrium level of income will remain stable so long as there is no change in the aggregate demand, given the aggregate supply.

The saving-investment approach to income determination The equilibrium level of income can also be determined by using only S and I schedules. This is called the saving-investment approach. The saving-investment approach can be derived directly from the national income equilibrium condition based on AD-AS approach. We know that, at equilibrium, $AD = AS$, i.e., where

$$C + \bar{I} = C + S$$

Since C is common to both the sides of this equation, it gets cancelled out. Then, the equilibrium condition can be written as:

$$\bar{I} = S \tag{6.25}$$

Investment (I) is assumed to remain constant at $\bar{I}$. But saving is the function of income, i.e., $S = f(Y)$. So we need to derive the saving function. We know that

$$S = Y - C \tag{6.26}$$

and

$$C = a + bY.$$

By substituting $a + bY$ for C in Eq. (6.26), we get

$$S = Y - (a + bY)$$

or
$$S = Y - a - bY$$
$$S = -a + Y - bY$$
$$S = -a + (1 - b)Y$$

Given the saving function, the equilibrium condition by saving-investment approach can be written as:

$$\bar{I} = -a + (1 - b)Y$$

In our example, $\bar{I} = 100$ and, given the values of a and b in Eq. (6.21), saving function can be written as $S = -100 + (1 - 0.75)Y$. By substituting these values in Eq. (6.25), we get the equilibrium level of Y as:

$$200 = -100 + (1 - 0.75)Y$$
$$300 = (1 - 0.75)Y$$

and
$$Y = \frac{300}{1-0.75} = 1200$$

Note that the saving-investment approach determines the same equilibrium level of the national income (1200) as determined by the aggregate demand and aggregate supply approach. The determination of national income equilibrium through saving-investment approach is presented graphically in Fig. 6.7.

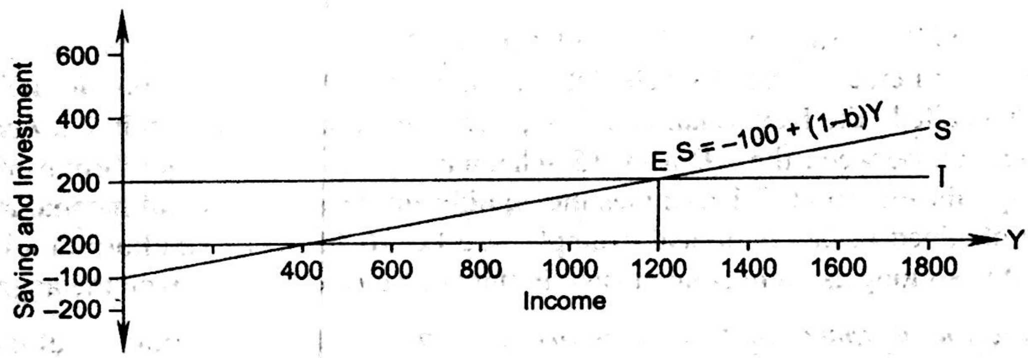


Fig. 6.7 Income Determination: Saving and Investment Approach

As Fig. 6.7 shows, investment ($\bar{I}$) is given at 200 and is shown by a horizontal straight line. Saving function $S = -100 + (1 - b)Y$ is shown as a rising function of income. It can be seen in Fig. 6.7 that $\bar{I}$ and S schedules intersect at point E determining the equilibrium level of income at 1200, where $S = \bar{I} =$ Rs 200.

6.3 THE CHANGE IN AGGREGATE DEMAND AND THE MULTIPLIER

6.3.1 Change in Aggregate Demand: An Overview

In the preceding sections, we have explained the Keynesian theory of income and output determination in a simple two-sector model. It may be inferred from the income determination analysis that a change in aggregate spending will shift the equilibrium from one point to another and a shift in the equilibrium will reflect change in the level of national income. An increase in aggregate spending makes the aggregate demand schedule shift upward. As a result, the equilibrium point would shift upward along the *AS* schedule causing an increase in the national income. Likewise, a fall in the aggregate spending causes a fall in the national income. This relationship between the aggregate spending and the national income is simple and straightforward. However, our analysis so far tells us only the direction of change in the national income resulting from the change in the aggregate demand. It does not quantify the relationship between the two variables, i.e., it does not tell us the magnitude of change in the national income due to a given change in the aggregate spending.

The two specific questions that need to be answered are: (i) Is there any specific relationship between the change in aggregate demand and the change in the national income? and (ii) If yes, then what determines this relationship and the magnitude of change in the national income? The answer to these questions is provided by the theory of **multiplier**. The theory of multiplier occupies a very important place in the analysis of national income behaviour in response to the changes in its determinants. It is also an important tool to analyse the effects of changes in the monetary and budgetary policies of the government.

Before we begin our discussion on the multiplier theory, let us note that a shift in the aggregate demand in a modern economy may be caused by the change in business investment, government spending, taxes, export and import. Accordingly, we have *investment multiplier, government expenditure multiplier, tax multiplier, balanced budget multiplier, fiscal multiplier, export multiplier* and *import multiplier*. In this section, we are concerned with change in aggregate demand due to change in business investment and *investment multiplier*. Other kinds of multipliers will be discussed in the following chapters.

6.3.2 Change in Investment and Multiplier

In our two-sector model, a change in aggregate demand may be caused by a change in consumption expenditure, or a change in business investment, or a change in both. Consumption expenditure is however a more stable function of income. Therefore, consumption spending changes only with change in income. But when an economy is in equilibrium, income level is fixed and, therefore, consumption level is also fixed.

As regards business investment, it is determined exogenously by such factors as expansion in business prospects, innovation and invention of new products, opening up of new markets, fall in the interest rate, etc. We will therefore assume a change in the aggregate demand function due to a change in business investment. Besides, a change in investment may be in the form of either a decrease or an increase in the investment. However, for our purpose here, we assume an increase in investment and an upward shift in the investment schedule causing an upward shift in the aggregate demand function.

Figure 6.8 illustrates an upward shift in the investment schedule from I to $I + \Delta I$, causing an upward shift in the aggregate demand function from $C + I$ to $C + I + \Delta I$. The increase in investment may be the result of an autonomous investment. In Fig. 6.8, point E_1 marks the equilibrium of the national income prior to the increase in investment.

When investment increases from I to $I + \Delta I$, as shown by upward shift in the I-schedule, it causes an upward shift in the aggregate demand schedule from $C + I$ to $C + I + \Delta I$. Due to upward shift in the aggregate demand schedule, the equilibrium point shifts from point E_1 to E_2 and, as a result, national income increases from OY_1 to OY_2.

It is **important** to note here that the increase in national income implies that point E_1 represented a less than full employment situation. It is only under this condition that equilibrium point E_1 can shift to point E_2.

The increase in the national income (ΔY) can be obtained as:

$$\Delta Y = Y_2 - Y_1 = Y_1 Y_2$$

This increase in income (ΔY) is the result of ΔI. It can be seen in Fig. 6.8 that $\Delta Y > \Delta I$. This point can be proved as follows. Note that $\Delta Y = E_1 M$ and since points E_1 and E_2 are both on the 45° line, $E_1 M = E_2 M$. That is, $\Delta Y = E_2 M$. Note also that $\Delta I = E_2 K$ and that $E_2 M > JK$. It proves

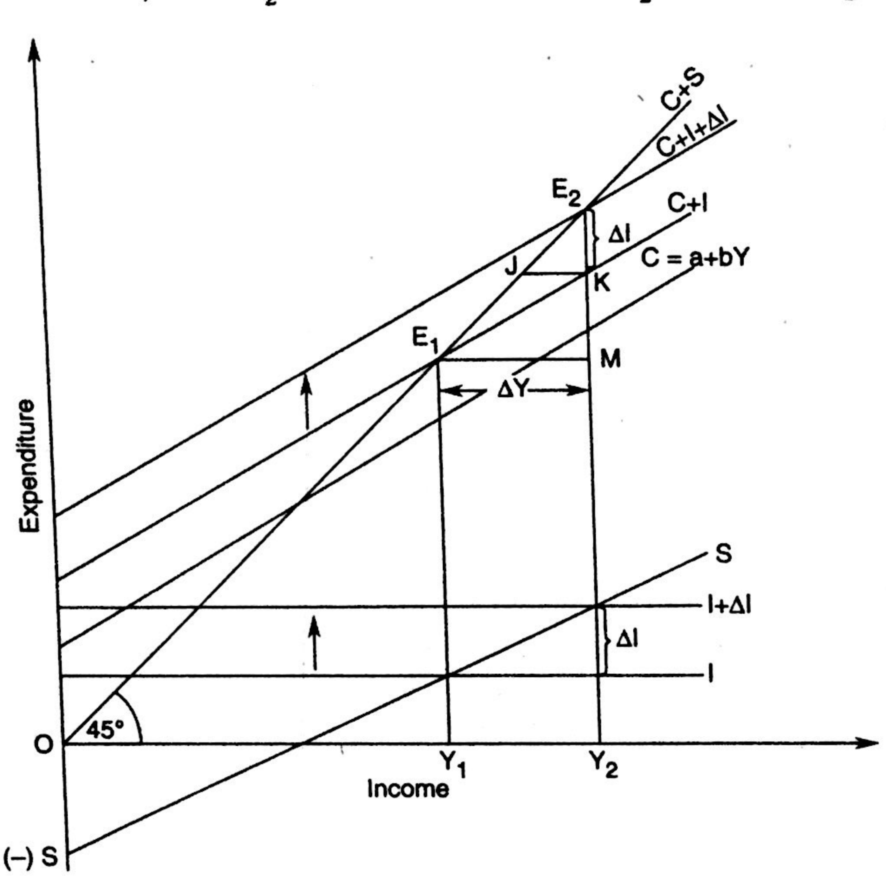


Fig. 6.8 Increase in Investment Demand and National Income Determination

that $\Delta Y > \Delta I$. It means that when ΔI takes place, the resulting ΔY is some multiple of ΔI. The multiple (m) can be obtained as:

$$m = \frac{\Delta Y}{\Delta I} \tag{6.27}$$

In Eq. (6.27), 'm' is the ***investment multiplier***. Since $\Delta Y > \Delta I$, multiplier (m) is greater than 1. It implies that when investment increases in an economy, national income increases by more than the increase in investment. How greater is ΔY than ΔI depends on the *MPC*.

How Multiplier Process Works Suppose an economy is in equilibrium and *autonomous* business investment increases by Rs 100 million. As a result, an additional income of Rs 100 million has been generated in the form of wages, interest and profits. This makes the first round of income generation by the additional investment. Those who receive the additional income spend a part of it on consumer goods and services depending on their *MPC*. Assuming their *MPC* to be 0.8, they would spend Rs 100 million × 0.8 = Rs 80 million on consumer goods and services. This expenditure generates income worth Rs 80 million in the second round for those who supply goods and services. Those who earn Rs 80 million spend Rs 80 × 0.8 = Rs 64 million on consumption. This results in an additional income Rs 64 million to the society in the third round. Note that additional income generated in each successive round goes on decreasing. This process of income generation continues round after round until additional income generated tends to zero. At the end of this process, total additional income equals Rs 500 million. The process of income generation by an additional investment of Rs 100 million is shown in Table 6.1.

Table 6.1 Working of Multiplier Process

Rs in million

Rounds of income generation	*Consumer spending*	*Income generation*
First round	---	100.00
Second round	80.00	80.00
Third round	64.00	64.00
Fourth round	51.20	51.20
Fifth round	40.96	40.96
....	...	....
....	...	....
Last round	...	0.00
Total income		500.00

6.4 A SIMPLE MODEL OF INVESTMENT MULTIPLIER

The investment multiplier model presented below answers the questions: Is there a definite relationship between ΔY and ΔI? If yes, what determines this relationship? The model given below provides an algebraic method of working out the investment multiplier.

Let us recall that the equilibrium level of income is given by

$$Y = C + I \tag{6.28}$$

Now, let investment increase by ΔI. When ΔI takes place it results in ΔY and ΔY induces ΔC. Thus, the post-ΔI *equilibrium level* of income can be expressed as follows.

$$Y + \Delta Y = C + \Delta C + I + \Delta I \tag{6.29}$$

Subtracting Eq. (6.28) from Eq. (6.29), we get

$$\Delta Y = \Delta C + \Delta I \tag{6.30}$$

Given the consumption function as $C = a + bY$,

$$C + \Delta C = a + bY + b\Delta Y.$$

Therefore,

$$\Delta C = b\Delta Y \tag{6.31}$$

By substituting Eq. (6.31) for ΔC in Eq. (6.30) we get

$$\Delta Y = b\Delta Y + \Delta I \tag{6.32}$$

$$\Delta Y\,(1 - b) = \Delta I$$

$$\Delta Y = \frac{1}{1-b}\,\Delta I$$

$$\frac{\Delta Y}{\Delta I} = \frac{1}{1-b} = m \tag{6.33}$$

Thus, the term $\frac{1}{1-b}$ gives the value of the investment multiplier (m).

Recall that, in Eq. (6.33), $b = MPC$ and $1 - MPC = MPS$. Therefore, multiplier (m) can also be expressed as:

$$m = \frac{\Delta Y}{\Delta I} = \frac{1}{1-b} = \frac{1}{1-MPC} = \frac{1}{MPS} \tag{6.34}$$

The last term in Eq. (6.34) indicates that m = reciprocal of MPS.

6.4.1 An Alternative Method of Working Out the Multiplier

The multiplier can be alternatively worked out by using the expanded form of the aggregate demand equations at the points of national income equilibria before and after ΔI takes place. As shown in Fig. 6.8, pre-ΔI national income equilibrium takes place at point E_1, where

$$Y_1 = C + I$$

Since $C = a + bY_1$, the pre-ΔI equilibrium level of income (Y_1) may be rewritten as:

$$Y_1 = a + bY_1 + I \tag{6.35}$$

$$= \frac{1}{1-b}\,(a + I)$$

Similarly, at post-ΔI equilibrium point E_2 in Fig. 6.8,

$$Y_2 = C + I + \Delta I \tag{6.36}$$

$$= a + bY_2 + I + \Delta I$$

$$= \frac{1}{1-b}\,(a + I + \Delta I)$$

By subtracting Eq. (6.35) from Eq. (6.36), we get

$$\Delta Y = \frac{1}{1-b}\,(a + I + \Delta I) - \frac{1}{1-b}\,(a + I)$$

$$\Delta Y = \frac{1}{1-b}\,\Delta I \tag{6.37}$$

n (6.37) yields the relationship between ΔY and ΔI, that is, ΔY equals $1/(1-b)$ times ΔI. $1/(1-b)$ is the investment multiplier (m). Thus,

$$\text{Investment multiplier } (m) = \frac{1}{1-b} \tag{6.38}$$

rical Example of the Multiplier Model The multiplier model presented above lustrated with a numerical example. Let us recall our two-sector model of income deter- (see Eq. 6.21). In the model,

$$\begin{aligned} C &= 100 + 0.75Y \\ I &= 200 \end{aligned} \tag{6.39}$$

this model, the pre-ΔI equilibrium level of income (Y_1) may be expressed as:

$$\begin{aligned} Y_1 &= C + I \\ &= 100 + 0.75\,Y_1 + 200 \\ &= \frac{1}{1-0.75}(100 + 200) \\ &= \frac{1}{0.25}(300) \end{aligned} \tag{6.40}$$

let us suppose that exogenous investment increases by 100. Thus, the total investment may ssed as:

$$I + \Delta I = 200 + 100$$

post-ΔI equilibrium level of income can now be expressed as:

$$\begin{aligned} Y_2 &= 100 + 0.75\,Y_2 + 200 + 100 \\ &= \frac{1}{0-0.75}(100 + 200 + 100) \\ &= \frac{1}{0.25}(400) \end{aligned} \tag{6.41}$$

ubtracting Eq. (6.40) from Eq. (6.41), we get

$$\begin{aligned} \Delta Y &= Y_2 - Y_1 \\ &= \frac{1}{0.25}(400) - \frac{1}{0.25}(300) \\ &= \frac{1}{0.25}(100) = 400 \end{aligned}$$

e $\Delta Y = 400$ and $\Delta I = 100$,

$$m = \frac{\Delta Y}{\Delta I} = \frac{400}{100} = 4$$

ay now be concluded that if $MPC = 0.75$, the investment multiplier (m) equals 4. It implies $m = 4$, then any additional investment will generate an additional income equal to four times all other things remaining the same.

What Determines the Value of Multiplier? The numerical value of the multiplier is determined by numerical value of *MPC*. This is evident from the multiplier formula given in Eq. (6.34), reproduced below.

$$m = \frac{1}{1 - MPC}$$

It is obvious from this formula that the numerical value of the multiplier is determined by the value of *MPC*, all other things being given. This relationship is illustrated in the following table:

MPC	$m = 1 / (1 - MPC)$	*Multiplier* (m)
0.00	$m = 1 / (1 - 0.00)$	1.00
0.10	$m = 1 / (1 - 0.10)$	1.11
0.50	$m = 1 / (1 - 0.50)$	2.00
0.75	$m = 1 / (1 - 0.75)$	4.00
0.80	$m = 1 / (1 - 0.80)$	5.00
0.90	$m = 1 / (1 - 0.90)$	10.00
1.00	$m = 1 / (1 - 1.00)$	∞

6.5 STATIC AND DYNAMIC MULTIPLIER

Depending on the purpose of analysis, sometimes a distinction is made between the *static* multiplier and the *dynamic* multiplier. The static multiplier is also called 'comparative static multiplier,' 'simultaneous multiplier,' 'logical multiplier,' 'timeless multiplier,' 'lagless multiplier' and 'instant multiplier'.

The concept of **static multiplier** implies that change in investment causes change in income instantaneously. It means that there is no ***time lag*** between the change in investment and the change in income. It implies that the moment a rupee is spent on investment projects, society's income increases by a multiple of Re 1. The concept of multiplier explained in the preceding section is that of static multiplier. Let us explain the concept of the dynamic multiplier also known as 'period' and 'sequence' multiplier.

The concept of **dynamic multiplier** recognises the fact that the overall change in income as a result of the change in investment is not instantaneous. There is a gradual process by which income changes as a result of change in investment or other determinants of income. The process of change in income involves a ***time lag***. The multiplier process works through the process of income generation and consumption expenditure. The dynamic multiplier takes into account the dynamic process of the change in income and the change in consumption at different stages due to change in investment. The dynamic multiplier is essentially a stage-by-stage computation of the change in income resulting from the change in investment till the full effect of the multiplier is realized.

The process of **dynamic multiplier** is described below. Suppose $MPC = 0.80$ and autonomous investment increases by Rs 100 (i.e., $\Delta I = 100$), all other things remaining the same. When an autonomous investment expenditure of Rs 100 is made on the purchase of capital equipment and labour, the income of the equipment and labour sellers increases by Rs 100, in the first instance. Let us call it ΔY_1. Those who receive this income, spend Rs 80 (= 100 × 0.80). As a result, income of those who supply consumer goods increases by Rs 80. Let it be called ΔY_2. They spend a part

80 × 0.80 = Rs 64. This creates ΔY_3. This process continues until additional income and e are reduced to zero. The whole process of the computation of the total increase in Y) as a result of ΔI = Rs 100 can be summarised as follows.

$$\Delta Y = \Delta Y_1 + \Delta Y_2 + \Delta Y_3 + \ldots + \Delta Y_{n-1}$$

erical terms,

$$\begin{aligned}\Delta Y &= 100 + 100\ (0.8) + 100\ (0.8)^2 + 100\ (0.8)^3 + \ldots + 100\ (0.8)^{n-1} \\ &= 100 + 80 + 64 + 51.20 + \ldots + \rightarrow 0 \\ &= 499.999 = 500\end{aligned}$$

aving calculated the total income effect (ΔY), the multiplier can be calculated as:

$$\frac{\Delta Y}{\Delta I} = \frac{500}{100} = 5$$

that $\Delta Y_1 = \Delta I$. So the process of dynamic multiplier can be generalised as follows.

$$\begin{aligned}\Delta Y &= \Delta I + \Delta I(b) + \Delta I(b)^2 + \Delta I(b)^3 + \ldots + \Delta I(b)^{n-1} \qquad \textbf{(6.42)} \\ &= \Delta I\ (1 + b + b^2 + b^3 + \ldots + b^{n-1}) \\ &= \Delta I\ \frac{1}{1-b}\end{aligned}$$

42) gives the working of the dynamic multiplier.[6]

---

proof of dynamic multiplier is given below. As Eq. (6.42) shows, the series of income generated by ΔI is n as:

$$\Delta Y = \Delta I\ (1 + b + b^2 + b^3 + \ldots + b^{n-1}) \qquad \text{(i)}$$

v let the terms in the parentheses of Eq. (i) be summed up as:

$$S = 1 + b + b^2 + b^3 + \ldots + b^{n-1} \qquad \text{(ii)}$$

ng by the rule of adding geometric progression, when we multiplying both sides of Eq. (ii), by a factor 'b' get

$$bS = b + b^2 + b^3 + b^4 \ldots + b^n \qquad \text{(iii)}$$

subtraction Eq. (iii) from Eq. (ii), we get

$$\begin{aligned}S - bS &= 1 - b^n \\ S\ (1 - b) &= 1 - b^n \\ S &= \frac{1-b^n}{1-b} \qquad \text{(iv)}\end{aligned}$$

ce $b^n \rightarrow 0$ when $n \rightarrow \infty$, the term b^n in Eq. (iv) can be omitted. Then, Eq. (iv) can be written as:

$$S = \frac{1}{1-b} \qquad \text{(v)}$$

substituting Eq. (v) into Eq, (i), for the terms in the parentheses, we get

$$\Delta Y = \Delta I\ \frac{1}{1-b}$$

multiplier (m) can then be written as:

$$m = \frac{\Delta Y}{\Delta I} = \frac{1}{1-b}$$

e that, in the ultimate analysis, both static and dynamic multipliers turn out to be the same.

6.6 THE USES AND LIMITATIONS OF MULTIPLIER

6.6.1 The Uses of Multiplier

The concept of multiplier occupies an important place in macroeconomic planning and project and in the assessment of possible effects of the changes made in the fiscal policy of the governr and also of its foreign trade policy. These uses will be discussed in the subsequent chapter the two-sector model, its role is limited to:

(a) the assessment of the overall possible increase in the national income due to 'one- increase in investment or due to a 'single injection' of investment, and
(b) to plan economic growth of the country.

The use of the multiplier concept in determining the investment requirement for a certain pla growth in the national income over time can be illustrated with an example. Suppose a countr an income of Rs 100 billion and its *MPC* is 0.8 (or 80%). The value of multiplier for the co will be 5. Suppose also that the country plans to double its national income over a period of through a 'one-shot' investment. That is, it wants to increase its national income by ΔY = R million. The investment requirement of the two-sector country can be easily worked out as fol

$$\begin{aligned}\text{Planned growth } (\Delta Y) &= \text{Rs 100 billion}\\ \text{Multiplier } (m) &= 5\\ \text{Investment Requirement } (\Delta I) &= \Delta Y/m\\ &= 100/5\\ &= \text{Rs 20 billion}\end{aligned}$$

In means that increasing national income by Rs 100 million requires an additional investn Rs 20 million, all other things given.

6.6.2 Limitations of the Multiplier

The foregoing illustration of the usefulness of the multiplier in investment planning gives an i sion that an exact assessment of investment requirement for a targeted growth of a coun be made if its *MPC* is known. However, the theory of multiplier does not work in practi does in theory. The reasons are given below.

(A) Leakages from the Income Stream

The multiplier theory assumes that those who earn income as a result of certain auto investment would continue to spend a certain (constant) proportion of additional income, de on the aggregate *MPC*. In practice, however, this assumption does not hold in reality becaus tend to spend their additional income on many other non-consumption and non-investmer Such expenses are known as ***leakages*** from the income stream in the working proces multiplier. The leakages reduce the value of multiplier. Some important kinds of leakages a effect on the multiplier are given below.

(i) *Payment of the past debts* When income earners use a part of their additional income their past debts, and those who recover their loans, use it to repay their own debts ir consuming it. When this process continues, the marginal propensity to consume decrea reduces the generation of additional income over the working process of the multiplier. As a result, the value of multiplier is reduced depending on the leakage from ΔY on this account.

(ii) ***Purchase of existing wealth*** Another kind of leakage in the multiplier process arises when people spend the whole or a part of their newly-earned income on purchasing existing wealth and property, for instance, land, building, second-hand consumer durables, and purchase of shares and bonds from the share and bond holders, and so on. If money spent on such items keeps circulating on sale and purchase of old assets and never returns to the consumption stream, then the value of multiplier is reduced.

(iii) ***Import of goods and services***[7] The part of newly earned income spent on imported goods and services, is one of the most important leakages from the income stream created by the additional investment. It is quite likely that income used to repay old debts and money spent on purchase of old assets and consumer durables returns to the consumption stream sooner or later, but the income spent on imported goods and services flows out of the country and has little chance to return to the income stream of the country. The imports which make incomes flow out of the country reduce the value of multiplier.

(B) Non-availability of Consumer Goods and Services

Another limitation of multiplier arises due the lack of adequate and instant supply of consumer goods and services. The multiplier theory assumes an instant and matching supply of consumer goods and services. But, in general, the supply of goods does not follow instantly the rise in demand. There is always a time lag. During the lag period, newly earned income creates additional demand for goods and services which builds, in turn, demand pressure. As a result, prices of consumer goods go up, leading to inflation. Inflation eats away a part of consumption expenditure. This reduces the real consumer expenditure which constrains the multiplier effect.

(C) Full Employment Situation

The multiplier principle does not work in case of full employment. When resources of the country (capital and labour) are fully or near-fully employed, further production will not be possible. Therefore, additional investment will only lead to inflation, not to the generation of additional real income.

6.7 APPLICABILITY OF MULTIPLIER THEORY TO LDCs

According to the multiplier theory, the higher the *MPC*, the higher the rate of multiplier. It is equally true that the lower the income, the higher the *MPC*. The World Bank's Development Reports show that the less developed countries (*LDCs*) have a lower per capita income and lower rates of saving and investment compared to the developed countries (*DCs*). The lower rate of saving indicate that *LDCs* have a relatively higher *MPC*. This implies that multiplier must be higher in *LDCs* than in developed countries (*DCs*). And, therefore, a given amount of autonomous investment should result in a much higher employment and output in *LDCs* than in *DCs*. It follows that the rate of economic growth resulting from additional investment must be much higher in the *LDCs* than in *DCs*. In reality, however, this is not true: the multiplier and the rate of growth are both lower in *LDCs*

7. This aspect is not relevant in two-sector model. However, for the sake of completeness of the limitations of the multiplier theory we take note of this aspect also.

compared to those in *DCs*. This creates a paradoxical situation which is called 'Keynes's *MPC* and the multiplier paradox.' It is, therefore, generally agreed that *the logic of Keynesian multiplier does not apply to the LDCs*.

The reason for non-applicability of the multiplier theory to the *LDCs* is that the assumptions and conditions under which Keynes had formulated his theories do not apply for the *LDCs*. Keynes had developed his theories in the background of the Great Depression during the early 1930s. The Great Depression had affected mostly the developed countries, that is, the countries which had grown beyond the stage of, what Rostow called, 'take-off.' Besides, Keynesian theory of multiplier assumes: (i) a high level of industrial development, (ii) involuntary unemployment, (iii) existence of excess capacity, and (iv) elastic supply curves. It is a widely known fact that most of these assumptions do not hold in the *LDCs*.

V.K.R.V. Rao[8] had examined the issue of applicability of the Keynesian multiplier in the case of India, then a typical *LDC*, in the early 1950s. He found that the assumptions under which multiplie theory was developed do not hold for the underdeveloped countries. Instead, as he pointed out, a underdeveloped country is characterised by:

(i) a predominant agricultural sector,
(ii) a vast disguised unemployment,
(iii) low level of capital equipment,
(iv) low level of technology and technical know how,
(v) a small proportion of wage employment to the total,
(vi) a vast non-monetised sector, and
(vii) a vast sector producing for self-consumption.

"Under these circumstances, the multiplier principle does not work in the simple fashion visualis by Keynes primarily for the industrialised economies."[9]

Besides, he adds that the very nature of the agricultural economy makes agricultural supp relatively inelastic. Even in the industrial sector, supply of good and services is constrained limited production capacity, limited supply of inputs and long gestation lag of new production pla There is therefore a considerable time leg between the increasing demand and forth coming supp "This tends to widen the difference between the multiplier linking up increments of money inve ment with increments of money income and that linking up increments of investment with inc ments of total output with the result that money incomes and prices rise much faster than r income and output". For this reason too the multipier theory does not apply to *LDCs* in *real* ter though it does work in *monetary* terms.

This however should not mean that the multiplier theory applies to the developed countr exactly as construed in theory. The application of the multiplier theory has its limitations developed countries also, as pointed out above. For instance, given the saving rate of about percent in the US during the 1990s, the value of multiplier should theoretically be 5. But, in rea it has been found to be 1.4[10]. Furthermore, the multiplier theory has been found to work

8. Rao, V.K.R.V., "Investment, Income and Multiplier in an Underdeveloped Economy", *Indian Economic Revi* Vol. 1, No.1, 1952.

9. Rao, V.K.R.V., *ibid.*

10. Karl E. Case and Ray C. Fair, *Principles of Economics*, (Pearson Education Asia, 6th Edn. 2002), p.450

countries more vigorously in the early stages of recovery from depression because of
icity than during the period of boom.

E PARADOX OF THRIFT AND THE MULTIPLIER

close our discussion on the theory of multiplier, let us look at the "paradox of thrift" Keynes (*The General Theory*, p. 358). It is widely believed that "saving is a virtue" and aved is a penny earned". In simple words, those who save and invest become prosper- rule may be taken to be applicable for the country as a whole. However, Keynes d this widely held belief. In his opinion, these beliefs may be true in case of individual , but not for the society as a whole. Keynes argued that when all or most households ifty, i.e., they decide to consume less and save more, the level of income and savings on tends to decline. This is what he calls the 'paradox of thrift'. The paradox of ustrated in Fig. 6.9 using the saving-investment approach to income determination.

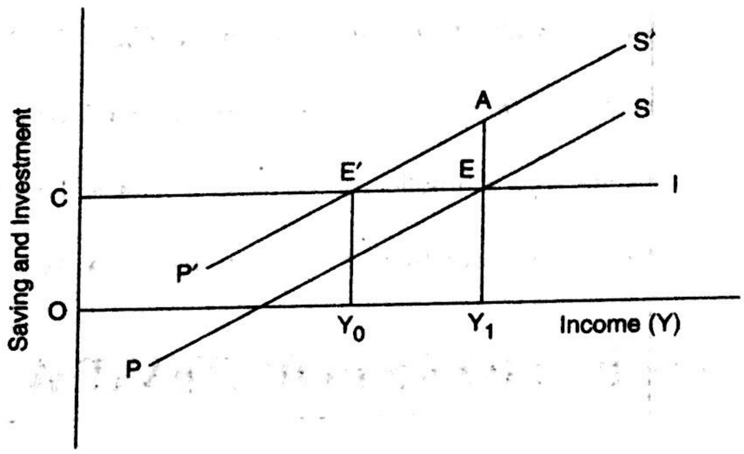


Fig. 6.9 The Paradox of Thrift

6.9, the schedule marked *CI* shows the constant investment (in line with our earlier h) and the schedule marked *PS* shows the normal planned saving schedule. The invest- saving schedules intersect at point *E*, determining the equilibrium level of income at OY_1. uilibrium level of income, $S = I = EY_1$. Now let the society decide to become thrifty, i.e., wn consumption and increase savings, say, by *AE*. As a result, saving schedule shifts $P'S'$ intersecting investment schedule at point *E'*. Consequently, the point of equilibrium n point *E* to *E'* and the equilibrium level of income fall from OY_1 to OY_0. As the figure planned savings too falls from AY_1 to $E'Y_0$. Note that $E'Y_0 < AY_1$. The decline in the n level of saving shows the paradox of thrift under the assumed conditions. What is worse people get poorer.

ocess through which paradox of thrift works to reduce savings is the process of reverse because increased saving is virtually a ***withdrawal*** from the circular flow of income. This at savings are not invested either because there is full employment or people do not want ue to high rate of risk. This leads to inverse multiplier. If people decide to increase their cutting down their consumption expenditure, demand for consumer goods and services will fall. The fall in demand results in build up of inventories (unsold stock of goods and services) of the business firm. Therefore, they cut down their production. This leads to decline in incomes. Since saving is the function of income, fall in income causes decline in savings. This process works until the economy reaches a new equilibrium point where saving equals investment.

It must however be borne in mind that if autonomous investment increases with the autonomous increase in planned savings, the paradox of thrift will not work. The reason is that additional savings will find way to the circular flow of income and investment. This will generate income depending on the multiplier. Increase in income will generate more savings and investment.

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QUESTIONS FOR REVIEW

1. Do you agree with the statement that Keynes derived his aggregate supply function by using classical production function. If yes, explain the derivation of the Keynesian aggregate supply function using appropriate diagrams.
2. Explain the concept of aggregate demand. How is the Keynesian aggregate demand function different from the classical demand function based on the Say's law?
3. (a) What is the meaning of the consumption function? Assume a hypothetical consumption function with $MPC = 0.75$ and present is graphically.

   (b) What is the difference between Keynes' own consumption function and one derived by the Keynesians?
4. Which of the following statements is correct?
   (a) Keynes assumed a constant MPC,
   (b) $\Delta C/\Delta Y$ varies with increase in income in Keynes's original consumption function,
   (c) The condition that $0 < MPC < 1$ holds always.
5. Suppose a consumption function is given as $C = a + bY$. Derive a saving function from this consumption function.
6. Assuming a consumption function, prove the following.
   (a) $S = (1 - b) Y - a$; and
   (b) $\Delta C/\Delta Y + \Delta S/\Delta Y = 1$
7. Suppose a consumption function is given as $C = 100 + 0.8Y$ and stock of capital is fixed at Rs 200. Based on this information, draw an aggregate demand function.

Chapter 7

Income Determination in a Closed Economy Model: A Model with Government Sector

INTRODUCTION

In Chapter 6, we have explained income and output determination in a simple economy model. In this chapter, we explain income and output determination in a closed economy model—a more realistic model. The closed economy model includes three sectors, viz., household, business and the government sectors. The **closed economy** model is also known as the **three-sector** model. The income and output determination in a four-sector model, i.e., the model with foreign sector will be explained in the next chapter.

7.1 INCOME DETERMINATION WITH THE GOVERNMENT SECTOR

A three-sector or a closed economy model is constructed by adding government sector to the two-sector or simple economy model. The government influences the level of economic activities in a variety of ways through its economic activities, fiscal policy (government expenditure and taxation policies), monetary and credit policy, growth policy, industrial policy, labour policy, price policy, wage policy, employment policy, control and regulation of monopolies, export and import policies, environment policy, etc. However, the closed economy model of the Keynesian income determination theory confines to the effects government expenditure (including transfer payments) and taxation. Thus, inclusion of the government sector into the simple economy model introduces three new variables to the model, viz., taxes (T), government expenditure (G), and transfer payments (G_T). The inclusion of the government complicates the analysis by bringing in the complex system of taxation, expenditure and transfer payments. However, we assume a simple system of government taxation, expenditure and transfer payments. In our simplified system, the government makes only the following fiscal operations.

(i) It imposes only direct taxes on the households;
(ii) It spends money on buying factor services from the household sector and goods and services from the private business sector; and
(iii) It makes transfer payments in the form of pensions and subsidies.

Capturing the effects of all the three variable—taxes, expenditure and transfer payments—on the equilibrium of the national income in a simple model is a difficult proposition at this stage of our analysis. Therefore, for convenience sake, the effects of these variables on the equilibrium level of income will be discussed in a *sequence* of four models— Model I, Model II, Model III and Model IV—each being the extension of the previous model. While Model I analyses the effect of *lump-sum* tax and government expenditure on the equilibrium level of income, Model II analyses the effect of transfer payments. Model III extends the analysis to the effect of proportional tax system. Model IV combines the three models and presents a comprehensive analysis.

7.1.1 Income Determination with Government Spending and Tax: Model I

Model I is an extension of the two-sector model presented in Chapter 6. It includes two additional variables—the government spending on purchases (G), and income tax (T). Model I is based on the following assumptions.

(i) There is no transfer payment;
(ii) There is only one form of tax, i.e., a lump sum income tax, determined exogenously; and
(iii) The government spending is too exogenously determined.

Let us also assume, for the sake of simplicity, that the government follows a balanced budget policy, i.e., the government keeps its expenditure (G) equal to its tax revenue (T). Given these conditions, Model I has been elaborated under (i) *AD-AS* approach, and *S-I* approach.

(i) AD-AS Approach

Under *AD-AS* approach, the variables of the aggregate demand (AD) and aggregate supply (AS) of the three-sector model can be specified as

$$AD = C + I + G \tag{7.1}$$

and

$$AS = C + S + T \tag{7.2}$$

The Keynesian condition for the equilibrium of the national income may now be written as

$$C + I + G = Y = C + S + T \tag{7.3}$$

Thus, at equilibrium,

$$Y = C + I + G \tag{7.4}$$

In three-sector model, variable C in Eq. (7.4) needs to be redefined. With tax imposition, consumption function (C) is redefined as

$$C = a + bY_d$$

where $Y_d = Y - T$, (disposable income)

where T = Tax (lump sum)

By substituting $Y - T$ for Y_d, consumption function in a three-sector model can be written as

$$C = a + b(Y - T) \tag{7.5}$$

By substituting Eq. (7.5) for C in Eq. (7.4), the equilibrium level of national income can be written as

$$Y = a + b(Y - T) + I + G \tag{7.6}$$

By rearranging the variables in Eq. (7.6), we get the equilibrium level of income (Y) as

$$Y = a + bY - bT + I + G$$

$$Y(1 - b) = a - bT + I + G$$

$$Y = \frac{1}{1-b}(a - bT + I + G) \tag{7.7}$$

Equation (7.7) gives a formal model for the equilibrium level of national income. If consumption function and the values of constants (I, G and T) are known, the equilibrium level of the national income can be easily worked out. A numerical example is given below.

Numerical Example For a numerical example, let us recall our earlier consumption function and constant investment given as

$$\text{(a) } C = 100 + 0.75Y_d \tag{7.8}$$

and

$$\text{(b) } I = 200 \tag{7.9}$$

Let us also assume that the government has a balanced budget with

$$G = T = 100 \tag{7.10}$$

By substituting the values in Eq. (7.7), we get the equilibrium level of the national income (Y) as follows.

$$Y = \frac{1}{1-0.75}[100 - (0.75 \times 100) + 200 + 100] \tag{7.11}$$

$$= \frac{1}{0.25}(100 - 75 + 200 + 100)$$

$$= 4(325)$$

$$Y = 1300$$

Graphical Analysis The determination of equilibrium level of the national income in a three-sector model is presented graphically in Fig. 7.1. The aggregate demand without the government sector, is designated as $C_1 + I$. As Fig. 7.1 shows, the aggregate demand schedule $(C_1 + I)$ intersects the aggregate supply schedule (AS) at point E_1 where national income is in equilibrium at Rs 1200. This part of analysis is the same as given in the two-sector model.

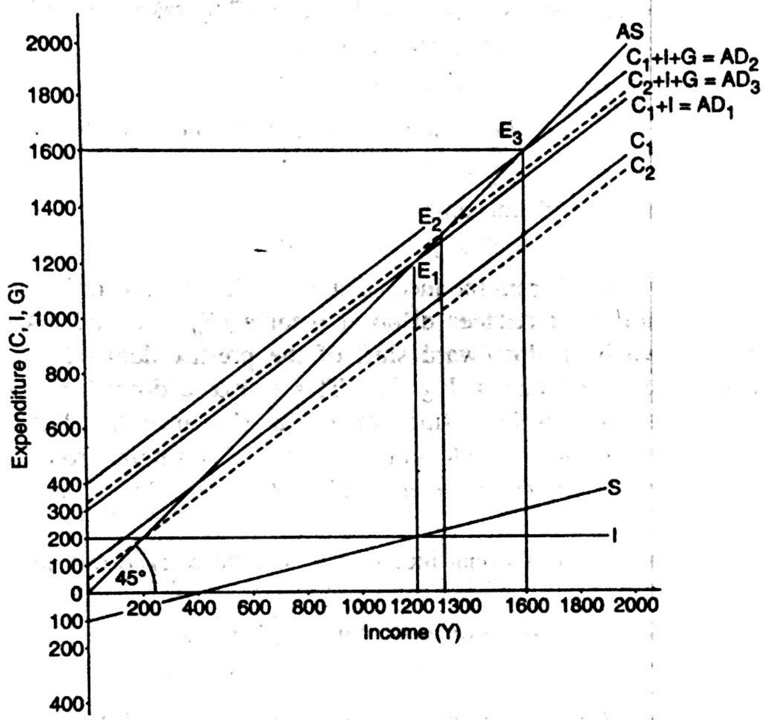


Fig. 7.1 Income Determination in Three-Sector Model

Let us now introduce the government sector to the model. For graphical presentation of the model, let us begin with a simple case. Let us assume that the government makes an expenditure of Rs 100, that is, $G = 100$, which it finances through currency creation, not by taxation, i.e., $T = 0$. With the addition of G under this condition, the aggregate demand function changes from $C_1 + I = AD_1$ to $C_1 + I + G = AD_2$ and the AD schedule shifts upward as shown in Fig. 7.1. As a result, the equilibrium point shifts from point E_1 to E_3 which determines the national income equilibrium at Rs. 1600.

The equilibrium level of the national income with the effects of government expenditure can also be worked out mathematically. Given the assumptions (7.8) through (7.10), the equilibrium level of the national income in three-sector model is given as:

$$Y = 100 + 0.75Y + 200 + 100 \ (= G) \tag{7.12}$$

$$Y - 0.75Y = 100 + 200 + 100$$

$$Y(1 - 0.75) = 400$$

$$Y = 1600$$

Equation (7.12) shows the *effect of the government spending* (*G*) on the level of the national income when there is **no tax.**

Let us now introduce a lump sum tax and see its effect on the national income. Suppose total lump sum tax (*T*) equals Rs 100, i.e.,

$$T = 100 \tag{7.13}$$

After the introduction of tax, the consumption function (7.8) takes the following form.

$$C = 100 + 0.75Y_d \tag{7.14}$$

where, $Y_d = Y - T$

By substituting $Y - T$ for Y_d, the consumption function can be rewritten as:

$$C = 100 + 0.75(Y - T)$$

Since $T = 100$, the final form of consumption function is given as

$$C = 100 + 0.75(Y - 100) \tag{7.15}$$

Recall that a tax is a withdrawal from the income stream. The tax has therefore an adverse effect on the consumption function as it reduces disposal income (Y_d). The adverse effect of tax on consumer demand is shown by a downward shift of the pre-tax demand schedule, C_1, to the position of C_2 shown by a dotted line in Fig. 7.1. This causes a downward shift in the pre-tax aggregate demand schedule, AD_2, to the position of AD_3 as shown by the dotted line. The downward shift in the aggregate demand schedule shifts the equilibrium point from E_3 to E_2 where the equilibrium level of the national income is determined at Rs 1300. Thus, a tax causes a fall in the national income.

The post-tax equilibrium level of national income can also be worked out numerically as shown below.

Recall the post-tax consumption function given in Eq. (7.15) as

$$C = 100 + 0.75(Y - 100)$$

By substituting this consumption function into the equilibrium Eq. (7.12), the equilibrium level of national income can be obtained as follows.

$$Y = 100 + 0.75(Y - 100) + 200 + 100 \tag{7.16}$$

$$Y = 100 + 0.75Y - 0.75 \times 100 + 200 + 100$$

$$Y = \frac{1}{1 - 0.75}(325)$$

$$Y = 1300$$

Note that this equilibrium level of the national income (with $G = T$) is the same as given in Eq. (7.11). Using Eq. (7.16), one can analyse the effect of a tax cut on the equilibrium level of the national income.

(ii) Saving-Investment Approach with G with T

The same result can be arrived at by using the saving-investment approach income determination with government expenditure (*G*) and tax (*T*). By saving-investment approach, the national income equilibrium in a three-sector model can be specified as

$$S + T = I + G \tag{7.17}$$

By substituting values for I, G and T from Eqs. (7.9) and (7.10), equilibrium condition given in Eq. (7.17) can be written as

$$S + 100 = 200 + 100 \tag{7.18}$$

What we need now is to derive the saving schedule (S) based on Eq. (7.18). The saving schedule for three-sector model can be derived as follows. In a three-sector model,

$$S = (Y - T) - C$$

By substituting consumption function for C in this equation, we get

$$S = (Y - T) - [a + b\,(Y - T)] \tag{7.19}$$

By substituting, numerical values for constants a, b and T, saving function can be written as

$$\begin{aligned} S &= Y - 100 - [100 + 0.75\,(Y - 100)] \\ &= Y - 100 - 100 - 0.75\,Y + 75 \\ &= 0.25Y - 125 \end{aligned} \tag{7.20}$$

By substituting saving function given in Eq. (7.20) for S in Eq. (7.18), we get national equilibrium equation as

$$\begin{aligned} 0.25Y - 125 + 100 &= 200 + 100 \\ 0.25Y &= 325 \\ Y &= 1300 \end{aligned} \tag{7.21}$$

Alternatively, following the procedure given in Chapter 6 saving function can be written as follows.

$$\begin{aligned} S &= -100 + (1-0.75)(Y-100) \\ &= 0.25Y - 125 \end{aligned} \tag{7.22}$$

By substituting Eq. (7.22) for S in Eq. (7.17), the equilibrium condition can be rewritten as follows.

$$\begin{aligned} 0.25Y - 125 + 100 &= 200 + 100 \\ 0.25\,Y &= 325 \\ Y &= 1300 \end{aligned} \tag{7.23}$$

Note that saving-investment approach also yields the same equilibrium level of income. Income determination in three-sector model by saving-investment approach is illustrated in Fig. 7.2. As the figure shows, in the simple economy case, S and I schedules intersect at point E_1 determining the equilibrium level of income at Rs 1200. With inclusion of tax (T), saving schedule shifts to $S + T$. And, with addition of G, investment schedule (I) shifts upward to $I + G$. Schedules $I + G$ and $S + T$ intersect at point E_2 determining the equilibrium level of income at Rs 1300. Note that with inclusion of $T = G = 100$, national income increases exactly by the amount of G, i.e., by the amount of injection. Why? This question will be answered later in this Chapter.

7.1.2 Income Determination with Transfer Payments: Model II

Model II is an extension of *Model* I with addition of transfer payments to the Model. A transfer payment is a *non quid pro quo* payment made by the government to different sections of the society for social welfare purposes, for example, old-age pensions, retirement benefits, unemployment compensations, social security payments, poverty relief grants, social welfare payments, and so on.

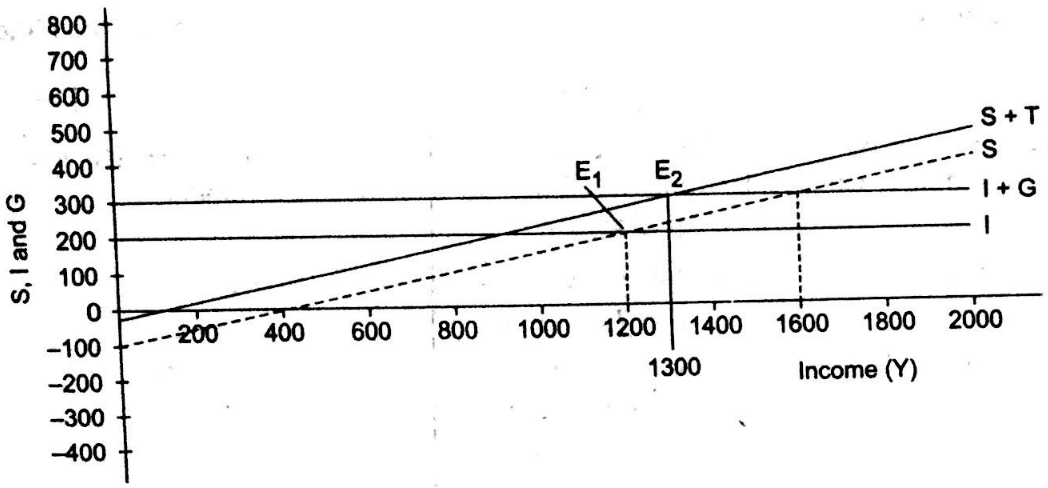


Fig. 7.2 Income Determination by Saving-Investment Approach

A transfer payment is opposite of tax and it can be treated as negative tax. Transfer payments enhance spending capacity of the households and hence have a positive effect on the equilibrium level of the national income.

Transfer payments may be autonomous or may be financed through a lump sum tax. The two different ways of financing transfer payments affect national income equilibrium in two different ways. The analysis of the transfer payments financed through additional lump sum tax is similar to that of government spending and taxation. It is so because transfer payments become a part of the government expenditure and additional tax becomes a part of the total lump sum tax. We will analyse here only the effect of *autonomous transfer payments* on the national income.

The model for the analysis of the transfer payments remains essentially the same as one used for analysing the effects of the government spending and lump sum tax with the same equilibrium condition, that is, $Y = C + I + G$. However, the introduction of transfer payments in the model, all other things remaining the same, alters the consumption function from

$$C = a + b(Y - T)$$

to one given below.

$$C = a + b(Y - T + G_T) \tag{7.24}$$

(where G_T is autonomous transfer payment).

Recall now the equilibrium Eq. (7.7). It is reproduced here.

$$Y = \frac{1}{1-b}(a - bT + I + G) \tag{7.25}$$

By incorporating transfer payment (G_T) in Eq. (7.25), the equilibrium equation involving transfer payments can be expressed as

$$Y = \frac{1}{1-b}[a - b(T - G_T) + I + G]$$

$$= \frac{1}{1-b}[a - bT + bG_T + I + G] \tag{7.26}$$

In Eq. (7.26), the term bG_T is the increase in consumption caused by G_T. When the value of G_T is known, the equilibrium level of the national income can be known.

Numerical Example To illustrate the effect of transfer payments, let us assume that the economy is in equilibrium at point E_2 in Fig. 7.1. The equilibrium level of income at point E_2 is given by Eq. (7.16), reproduced below.

$$Y = 100 + 0.75(Y - 100\ ) + 200 + 100 \tag{7.27}$$
$$= 1300$$

Let us assume that $G_T = 50$ and that an increase in consumption caused by G_T equals 0.75 (50).

The effect of the transfer payment on the equilibrium level of the national income can be obtained by inserting $G_T = 50$ in Eq. (7.27) which can now be rewritten as

$$Y = 100 + 0.75(Y - 100 + 50\ ) + 200 + 100 \tag{7.28}$$
$$Y(1- 0.75) = 100 - 75 + 37.50 + 200 + 100 = 362.50$$
$$Y = (1/0.25)\ (362.50)$$
$$= 1450$$

Thus, given the equilibrium at point E_2, a transfer payment of Rs 50 adds an income of Rs 150 = 1450 – 1300 to the national income. Given the $\Delta Y = 150$, the multiplier of the transfer payments (with tax) equals $\Delta Y/G_T = 150/50 = 3$ and the government expenditure multiplier (without tax) equals 4. Thus, the transfer payment multiplier is 1 less than the government expenditure multiplier. The difference between the government expenditure multiplier ($\Delta Y/\Delta G$) and transfer payment multiplier ($\Delta Y/\Delta G_T$) can be shown as follows. Suppose $\Delta G = \Delta G_T$ and recall that

$$\Delta Y/\Delta G = 1/(1 - b)$$

and

$$\Delta Y/\Delta G_T = b/(1 - b)$$

By subtracting, we get

$$\Delta Y/\Delta G - \Delta Y/\Delta G_T = 1/(1 - b) - b/(1 - b) = 1$$

The reason for this difference is the fact that any ΔG adds directly to the aggregate demand, whereas only a part of increase in G_T, that is, ΔbG_T , adds to the demand for consumption. The reason is two-fold: (i) a transfer payment does not add to the aggregate demand till it is spent on consumer goods, and (ii) only a part of G_T, not the entire of it, is spent on consumption—a part of it taxed: it is so because of definition of disposable income. On the contrary, the government expenditure on purchase of goods and services directly adds to the aggregate demand. It is also important to note that transfer payment multiplier is equal to the tax-cut multiplier.

7.1.3 Income Determination with Tax as a Function of Income: Model III

In analysing the effect of tax on the equilibrium of the national income, we have so far assumed a lump sum tax—a constant factor determined exogenously. A lamp-sum tax is unrealistic—assumed only for theoretical purpose. In this section, we move one step forward to a realistic system of taxation. In *Model* III, we assume a tax function rather than a lump sum tax. For the purpose, we assume an autonomous constant tax ($\bar{T}$) and a proportional income tax rate, expressed as tY. A proportional income tax is, by implication, a function of income.

The tax function used for model III can be expressed as

$$T = \overline{T} + tY \tag{7.29}$$

where, T = total tax, $\overline{T}$ = autonomous tax, and t = income tax rate.

Given the tax function (7.29), consumption function can now be written as

$$C = a + b\,(Y - \overline{T} - tY) \tag{7.30}$$

or

$$C = a - b\overline{T} + b(1 - t)Y$$

By substituting the consumption function (7.30) into the equilibrium equation given as $Y = C + I + G$, the equilibrium level of national income can be expressed as

$$Y = a + b(Y - \overline{T} - t\,Y) + I + G$$

$$= a + bY - b\overline{T} - btY + I + G$$

$$Y - bY + btY = a - b\overline{T} + I + G$$

$$Y\,(1 - b + bt) = a - b\overline{T} + I + G$$

$$Y = \frac{1}{1 - b + bt}(a - b\overline{T} + I + G)$$

or

$$Y = \frac{1}{1 - b(1 - t)}(a - b\overline{T} + I + G) \tag{7.31}$$

The term

$$\frac{1}{1 - b(1 - t)}$$

in Eq. (7.31) is the **tax multiplier** in case of $T = f(Y)$.

Numerical Example Suppose structural equations are given as follows:

$$C = 100 + 0.80\,(Y - T)$$

$$I = 200$$

$$T = 25 + 0.1Y$$

$$G = 100$$

Given these parameters, equilibrium Eq. (7.31) can be written as follows.

$$Y = 100 + 0.80(Y - 25 - 0.10Y) + 200 + 100$$

$$= \frac{1}{1 - 0.80 + 0.08}(380)$$

$$= 1356.60$$

7.1.4 Income Determination with Tax Function, Government Expenditure and Transfer Payments: Model IV

In model III, we have shown income determination with two fiscal operations of the government, including government spending on purchases (G), and a tax function (T). Model III is an extension of model I. Now we extend model III to include transfer payments (G_T) and analyse its effect on the equilibrium level income. This makes our Model IV. Recall that the effect of transfer payment on the equilibrium level of income has already been analysed in model II. In model IV, we include it again just to present a complete three-sector model of income determination.

We assume that all the parameters of Model IV are the same as in Model III and that transfer payments (G_T) = 50. With the inclusion of transfer payments (G_T), consumption function given in Eq. (7.31) can be written as follows.

$$C = a + b(Y - \overline{T} - tY + G_T) \tag{7.32}$$

By substituting Eq. (7.32) in equilibrium Eq. (7.31) can be expressed as

$$Y = a + b(Y - \overline{T} - tY + G_T) + I + G$$

$$= a + bY - b\,\overline{T} - btY + bG_T + I + G$$

$$= \frac{1}{1-b(1-t)}(a - b\,\overline{T} + bG_T + I + G) \tag{7.33}$$

By substituting parametric values in Eq. (7.33), we get the equilibrium level of national income as follows.

$$Y = \frac{1}{1-0.8(1-0.1)}[100 - 0.8(25) + 0.8(50) + 200 + 100]$$

$$= \frac{1}{0.28}[100 - 20 + 40 + 200 + 100]$$

$$= \frac{1}{0.28}[420]$$

$$= 1500$$

7.2 THE FISCAL MULTIPLIERS

In this section, we discuss briefly the multipliers associated with government's fiscal operations, called *fiscal multipliers*. Given our limited purpose here, we consider only the main fiscal operations of the government, viz.,

(i) government expenditure (including transfer payments), and
(ii) taxation of incomes.

Government's fiscal operations affect the equilibrium level of national income depending on the **multiplier effects** of fiscal operations. Government expenditure (with no taxation) increases the equilibrium level of national income. The overall effect of the government expenditure on the national income depends on the value of *government expenditure multiplier*. On the other hand, taxation (with no government expenditure) causes a reduction in the national income. The overall effect of taxation depends on the *tax multiplier*. In practice, however, both the fiscal operations (government spending and taxation) go side by side. If the government adopts a balanced budget policy, it spends only as much it taxes. In that case, the overall effect of government's fiscal operations on the national income depends on the combined effect of expenditure and tax multipliers. In this section, we describe the method of working out the *expenditure multiplier, tax multiplier* and the *balanced budget multiplier*. Let us discuss first the government expenditure multiplier.

7.2.1 The Government Expenditure Multiplier: The G-Multiplier

To explain and derive the government expenditure multiplier, let us assume (i) that the government spends its money on the goods and services only, i.e., there is no transfer expenditure, (ii) that I, G and T are constant, and (iii) consumption function is given.

To work out the government expenditure multiplier, i.e., G-multiplier, and its effect on the national income, let us recall the three-sector equilibrium Eq. (7.7) reproduced below.

$$Y = \frac{1}{1-b}(a - bT + I + G) \tag{7.34}$$

Let us now suppose that the government expenditure increases by ΔG, all other factors given. This (ΔG) causes an increase in the aggregate demand and, therefore, a rise in the equilibrium level of income by, say, ΔY. The equilibrium level of the national income with ΔG can be expressed by modifying Eq. (7.34).

$$Y + \Delta Y = \frac{1}{1-b}(a - bT + I + G + \Delta G) \tag{7.35}$$

By subtracting Eq. (7.34) from Eq. (7.35), we get ΔY resulting from ΔG.

$$\Delta Y = \frac{1}{1-b}(\Delta G) \tag{7.36}$$

The government expenditure multiplier (G_m) can then be obtained as

$$G_m = \frac{\Delta Y}{\Delta G} = \frac{1}{1-b} \tag{7.37}$$

7.2.2 The Tax Multiplier: The T-Multiplier

A tax is withdrawal from the circular flow of the income. Therefore, a tax has a negative effect on the equilibrium level of national income. Tax multiplier refers to the negative multiple effect of a change in tax on the national income. To analyse the effect of change in tax and to work out tax multiplier, we will confine to only two kinds of taxation systems:

(a) lump sum income tax, and
(b) proportional income tax.

A change in lump sum income tax or a change in proportional income tax affects the equilibrium level of national income differently. Therefore, tax multiplier in the two methods of taxation is different. The effect of a lump sum tax and that of the proportional income tax have already been discussed (see Models III and IV). For the sake of completeness, we show here the computation of the tax multipliers of a rise in the *lump sum tax*.

Increase in Lump Sum Tax and Tax Multiplier In order to find the impact of a change in the lump sum tax, let us introduce ΔT into the equilibrium equation. Let us recall again the national income equilibrium Eq. (7.7) with a given lump-sum tax (T). The equation reads as

$$Y = \frac{1}{1-b}[a - bT + I + G] \tag{7.38}$$

Let us now introduce a change in tax by ΔT. A change in tax, ΔT, changes the national income by ΔY. When ΔT and ΔY are incorporated into the national income equilibrium Eq. (7.38), it takes the following form.

$$Y + \Delta Y = \frac{1}{1-b} [a - b(T + \Delta T) + I + G] \tag{7.39}$$

$$= \frac{1}{1-b} [a - bT - b\Delta T + I + G]$$

The effect of ΔT on the equilibrium level of national income, i.e., ΔY, can now be obtained by subtracting Eq. (7.38) from Eq. (7.39). Thus, we get,

$$\Delta Y = \frac{1}{1-b} [- b\Delta T]$$

$$\Delta Y = \frac{-b\Delta T}{1-b} \tag{7.40}$$

Now, tax multiplier (T_m) can be obtained by dividing both sides of Eq. (7.40) by ΔT.

$$T_m = \frac{\Delta Y}{\Delta T} = \frac{-b}{1-b} \tag{7.41}$$

Note that ΔT, that is, a rise in tax, has a **negative effect** on the equilibrium level of the national income. Increasing tax by ΔT, decreases equilibrium level of national income by a multiple of ΔT. And, as a corollary of it, a tax cut $(-\Delta T)$ results in a rise in the equilibrium level of national income.

7.2.3 The Balanced Budget Multiplier

Now we turn to examine the effect of *balanced budget policy* of the government on the national income. When a government adopts a balanced budget policy it spends only as much as it collects through taxation. That is, in the balanced budget policy, $T = G$ and $\Delta G = \Delta T$. The effect of the balanced budget policy on the national income is measured through the ***balanced budget theorem*** or *balanced budget multiplier*. The balanced budget theorem states that the *balanced budget multiplier is always equal to one*. Therefore, the balanced budget theorem is also called *unit multiplier theorem*. The proof of the balanced budget theorem with a lump sum is given below.

The effect of a lump sum tax has already been discussed above (see Eq. 7.34). We reproduce Eq. (7.34) here with a minor modification, i.e., replacing T with $\bar{T}$. That is,

$$Y = \frac{1}{1-b} (a - b\bar{T} + I + G) \tag{7.42}$$

In order to find the balanced budget multiplier let us incorporate ΔG and ΔT (while $\Delta G = \Delta T$) into Eq. (7.42). When we do so, Eq. (7.42) takes the following form.

$$Y + \Delta Y = \frac{1}{1-b} [a - b(\bar{T} + \Delta T) + I + G + \Delta G] \tag{7.43}$$

By subtracting Eq. (7.42) from Eq. (7.43), we get

$$\Delta Y = \frac{1}{1-b} (- b\Delta T + \Delta G) \tag{7.44}$$

Since $\Delta T = \Delta G$ in the balanced budget, by substituting ΔG for ΔT in Eq. (7.44), we get

$$\Delta Y = \frac{1}{1-b}(-b\Delta G + \Delta G) \tag{7.45}$$

By rearranging the terms, in Eq. (7.45) we get:

$$\Delta Y(1-b) = -b\Delta G + \Delta G \tag{7.46}$$

$$\Delta Y(1-b) = \Delta G(1-b)$$

$$\Delta Y = \Delta G$$

The balance budget multiplier (BB_m) can be obtained by dividing both sides of Eq. (7.46) by ΔG. Thus,

$$BB_m = \frac{\Delta Y}{\Delta G} = \frac{\Delta G}{\Delta G} = 1 \tag{7.47}$$

Alternatively, the balanced budget multiplier can also be obtained by adding up G_m and T_m. We know from Eqs. (7.37) and (7.41) that $G_m = 1/(1-b)$ and $T_m = -b/(1-b)$, respectively. Thus,

$$BB_m = G_m + T_m \tag{7.48}$$

$$= \frac{1}{1-b} + \frac{-b}{1-b}$$

$$= \frac{1-b}{1-b} = 1$$

It is thus proved that when $\Delta G = \Delta T$, the balanced budget multiplier (BB_m) is always equal to unity. It implies that with $\Delta G = \Delta T$, national income increases exactly by the amount of increase in the government expenditure (ΔG). This can be proved as follows.

Under the condition of balanced budget,

$$\Delta Y = G_m(\Delta G) + T_m(\Delta T)$$

$$= \frac{1}{1-b}\Delta G + \frac{-b}{1-b}\Delta T$$

Since in a balanced budget, $\Delta G = \Delta T$, by substitution,

$$\Delta Y = \frac{1}{1-b}\Delta G + \frac{-b}{1-b}\Delta G$$

$$= \left(\frac{1}{1-b} - \frac{b}{1-b}\right)\Delta G$$

$$= \frac{1-b}{1-b}\Delta G$$

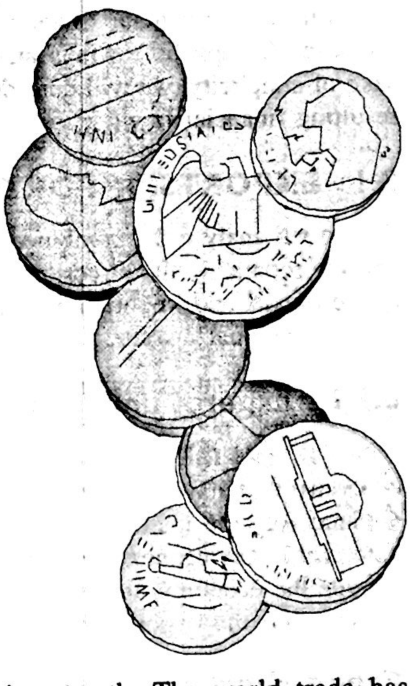
$$= 1(\Delta G)$$

$$\Delta Y = \Delta G$$

This discussion brings us to the end of our three-sector model. The four-sector model will be discussed in the next chapter.

Chapter 8

Income Determination in Open Economy Model: A Model with the Foreign Sector



INTRODUCTION

We have so far analysed national income determination in a closed economy model. In this Chapter, we move on to discuss income determination in an 'open economy' model. An open economy is conceptually one which has economic transactions with the rest of the world. Open economy model, is, in fact, a realistic model. It is difficult to name an economy of the modern world which has no economic transactions with any other country. It is another thing that only a few countries account for the major proportion of the world trade and in its growth. The world trade has increased at a tremendous pace during the post-Second World War period. Between 1950 and 2005, the world trade (exports + imports) increased from $60 billion to $21046 billion, although only 8 countries accounted for nearly half of it—the US (12.5 percent), West Germany (8.3 percent), China (6.8 percent), Japan (5.3 percent), France (4.6 percent), UK (4.2 percent), Netherlands (3.6 percent) and Italy (3.5 percent)[1]. In 2005, there were 30 countries whose foreign trade (exports + imports) accounted for over one-quarter of their *GDP*, including 3 countries, whose foreign trade ran over 100 percent of their *GDP*, *viz.* Singapore (197 percent), Hong Kong (164 percent), and Malaysia (109 percent). In 2005, India had a share of only 0.9 percent in the world exports and

1. Based on data published in World Development Report-2007, Table 5.

1.2 percent of the world imports. In 2005-06, India's foreign trade (exports + imports) accounted for only 16.2 percent of her *GDP*.[2] Currently, India's exports account for about 13% and imports about 19% of her *GDP*.

Foreign trade and transactions of a country affect its macro variables, and thereby the equilibrium level of its national income, especially when foreign transactions account for a significant proportion of its *GNP*. For example, US being the largest trade partner of India, the US recession is affecting the Indian economy. Rupee appreciation against dollar has affected leather and textile industries of India. More than 20 lakh workers have lost their jobs. Subprime crisis of US has seriously affected the financial sector of the country. IT industry of India is reported to be adversely affected by the US recession.

In this chapter, we will analyse the effects of foreign transactions on the equilibrium level of the national income, using a four-sector model. It should be noted at the outset that foreign transactions involve two kinds of flows: (i) commodity flows, and (ii) financial flows. Financial flows are of two kinds: (i) financial flows resulting from the commodity flows, and (ii) autonomous flows including foreign borrowings and investment, like FDI and FII, and financial assistance. For the sake of simplicity, we will consider only foreign trade—merchandise exports and imports—and the resulting financial flows.

8.1 EXPORTS, IMPORTS AND THE AGGREGATE DEMAND

Before we analyse the combined effect of exports and imports on the national income, let us first analyse separately the effect of export and import on the national income. Let us begin by looking at the export and import functions, their determinants and how they affect the aggregate demand and the national income.

8.1.1 Export Function and Export Multiplier

Like C, I and G, exports of goods and services constitute a part of the aggregate demand in an economy and its effect on the economy is also the same. There is however a difference. The demand for consumer goods (C), investment goods (I) and the government purchases (G) originate within the econcmy, and is called *domestic demand*. But, the demand for exports originates outside the economy. It is therefore called the *external demand*. Let us look at the determinants of exports and the export function.

Export Function Exports of a country are a function of a number of external and internal factors. Some of the ***important external determinants of exports*** of a country are: (i) domestic prices of exports in relation to those in importing countries, (ii) income of the importing countries, (iii) importers' income-elasticity for imports, (iv) their tariffs and trade policy, and (v) their exchange rate policy and foreign exchange restrictions. Some of the ***important internal determinants of exports*** of a country include: (i) export policy of the exporting country, (ii) export duties and subsidies, (iii) availability of exportable surplus, (iv) trade and tariffs agreements with other countries, and (v) international competitiveness of domestics goods.

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2. *Economic Survey* 2007–2008, MOF, GOI, Table 6.3, p.112.

In practice, however, exports of a country are determined mostly by the external or exogenous factors. It is neither practically feasible nor useful from policy point of view to incorporate all the determinants of exports in a simple open economy model used for income determination. For the purpose of theoretical determination of the national income in four-sector model, therefore, exports are treated to be autonomous, determined exogenously, and export (X) is assumed to be given as $\bar{X}$.

Exports and Aggregate Demand As noted above, in an open economy, exports constitute a part of the aggregate demand. Exports result in inflows of incomes from abroad. A part of this income is consumed and a part saved. The increase in consumption due to increase in exports affects the economy in the same manner as the increase in consumption due to increase in income. Since exports constitute a part of the aggregate demand, AD for an open economy is given as

$$AD = C + I + G + X \tag{8.1}$$

Assuming there are no imports, the equilibrium level of the national income with exports can be written as:

$$Y = C + I + G + X \tag{8.2}$$

where,

$$C = a + b(Y - T) \tag{8.3}$$

The equilibrium level of income in an economy with no imports can be obtained by substituting Eq. (8.3) into Eq. (8.2). Thus,

$$Y = a + b(Y - T) + I + G + X$$

or

$$Y = \frac{1}{1-b}(a - bT + I + G + X) \tag{8.4}$$

Export Multiplier Given the Eq. (8.4), the export multiplier (X-multiplier) can be easily worked out. Assuming an increase in exports, ΔX, national income equilibrium equation (8.4) can be rewritten as:

$$Y + \Delta Y = \frac{1}{1-b}(a - bT + I + G + X + \Delta X) \tag{8.5}$$

Subtracting Eq. (8.4) from Eq. (8.5), we get

$$\Delta Y = \frac{1}{1-b}(\Delta X) \tag{8.6}$$

$$\frac{\Delta Y}{\Delta X} = \frac{1}{1-b} = X\text{-multiplier}$$

Equation (8.6) implies that an increase in exports results in income at the rate of export multiplier. Note that X-multiplier equals the investment multiplier, that is, $1/(1-b)$ where $b = MPC$.

8.1.2 Import Function[3]

Let us now look at the determinants of imports and their effect on the aggregate demand and on the national income. We begin by specifying the import function.

[3] Under the assumption that $X = \bar{X}$, import multiplier, given the import function, is the same as foreign trade multiplier, as shown in the subsequent section.

Imports are purchases of goods and services from abroad. Payments for imports are a *leakage* from the income stream because payments made for imports make the domestic incomes flow out of the economy. The level of imports determines the level of outflow of domestic income.

Like exports, imports are determined by a number of both internal and external factors. In case of imports, however, internal factors play a predominant role. The major determinants of the imports of a country are: (i) prices of the foreign goods in relation to the domestic prices, (ii) income level of the domestic economy, (iii) income-elasticity of imports, (iv) tariff rates and import policy of the government, (v) exchange rate policy and foreign exchange restrictions, and (vi) taste and preference for foreign goods.

In income determination model, however, most of these variables are assumed to remain constant in the short run. There are two major variables which appear in the short-run import function, viz., (i) the level of income, and (ii) autonomous imports, independent of the level of the income, for example, import of food grains and capital goods. Given these conditions, import function can be expressed as:

$$M = \overline{M} + mY \tag{8.7}$$

where, $\overline{M}$ is constant, autonomous import and m is marginal propensity to import.

Imports and Aggregate Demand The aggregate demand, as given in Eq. (8.1), is reduced by the amount of payments for imports. This negative effect of imports on the aggregate demand is accounted for by including imports (M) as a ***negative value*** in the aggregate demand equation. Following the national income accounting convention, only exports net of imports (i.e., $X - M$) appear in the aggregate demand equation. Thus, the aggregate demand equation for an open economy is expressed as:

$$Y = C + I + G + (X - M) \tag{8.8}$$

Equation (8.8) means that if $M > X$, the aggregate demand decreases, and if $X > M$, the aggregate demand increases.

8.2 NATIONAL INCOME EQUILIBRIUM IN A FOUR-SECTOR MODEL

Having explained the export and import functions, we turn now to explain the determination of national income in a four-sector model incorporating both X and M. At equilibrium, the level of national income equals the aggregate demand as given in Eq. (8.8). The entire four-sector model of income determination can be written as follows.

$$Y = C + I + G + (X - M) \tag{8.9}$$

where

$$C = a + b(Y - T) \tag{8.10}$$

$$M = \overline{M} + mY \tag{8.11}$$

and I and G are constants.

The equilibrium level of the national income can now be obtained by substituting Eq. (8.10) and Eq. (8.11) in Eq. (8.9). Thus, at equilibrium,

$$Y = a + b(Y - T) + I + G + (X - \overline{M} - mY) \tag{8.12}$$

By simplifying Eq. (8.12), we get the final form of the equilibrium equation as given below.

$$Y = \frac{1}{1-b+m}(a - bT + I + G + X - \overline{M}) \tag{8.13}$$

In Eq. (8.13), the term $1/(1 - b + m)$ is ***foreign trade multiplier*** when consumption and imports are both a linear function of income. Incidentally, $1/(1 - b + m)$ gives also the import multiplier. A proof of foreign trade multiplier is provided in the following section. Let us first present the four-sector model graphically.

Graphical Presentation The simple four-sector model of income determination is illustrated graphically in Fig. 8.1 under certain simplifying assumptions: (i) there is no transfer expenditure (G_T), and (ii) X is autonomous. As Fig. 8.1 shows, the economy would be in equilibrium at point E_2 without foreign trade. With the inclusion of foreign trade in the model (assuming $M > X$) the AD_3 schedule shifts downward to $AD_2 = C + I + G + X - M$ and equilibrium point shifts to E_1. It means that inclusion of foreign trade (with $M > X$) causes a reduction in the equilibrium level of national income. In case $X > M$, the $C + I + G + (X - M)$ schedule will shift upward above the $AD_3 = C + I + G$ schedule and equilibrium point will shift beyond point E_2.

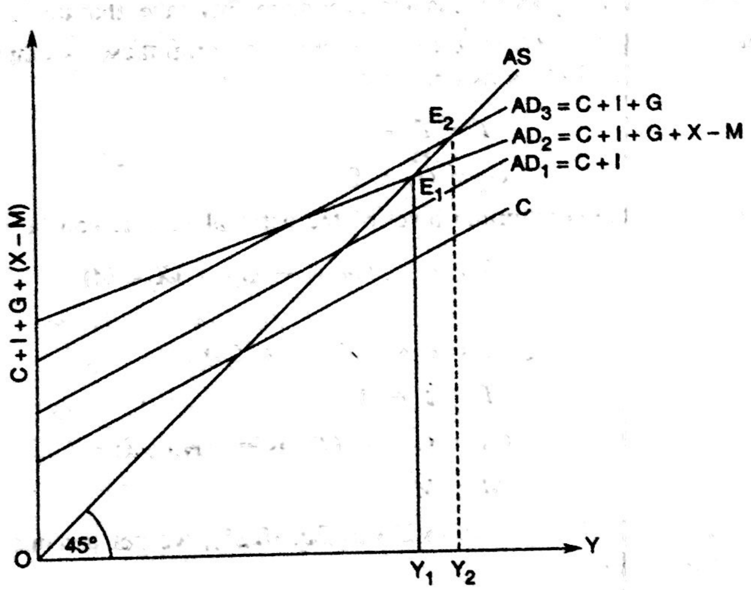

Fig. 8.1 Income Determination in a Four-Sector Model

Foreign Trade Multiplier Given the equilibrium Eq. (8.13), let exports increase by ΔX, *all* other variables remaining constant. The equilibrium of the national income can then be written as:

$$Y + \Delta Y = \frac{1}{1-b+m}(a - bT + I + G + X - M + \Delta X) \tag{8.14}$$

Equation (8.14) can also be written as:

$$Y + \Delta Y = \frac{1}{1-b+m}(a - bT + I + G + X - M) + \frac{1}{1-b+m}\Delta X \tag{8.15}$$

Subtracting Eq. (8.13) for Y from Eq. (8.15), we get

$$\Delta Y = \frac{1}{1-b+m}\Delta X \tag{8.16}$$

By rearranging Eq. (8.16), we get ***foreign trade multiplier*** as

$$\frac{\Delta Y}{\Delta X} = \frac{1}{1-b+m} \tag{8.17}$$

Equation (8.17) can be alternatively written as:

$$\frac{\Delta Y}{\Delta X} = \frac{1}{1-(b-m)} \tag{8.18}$$

Equation (8.18) yields an *important* conclusion, that is, if $b = m$, foreign trade multiplier is equal to unity, and if $b > m$, foreign trade multiplier is greater than unity and *vice versa*.

8.3 A COMPLETE FOUR-SECTOR MODEL OF INCOME DETERMINATION

The four-sector model given in Eq. (8.12) assumes, for simplicity sake, that tax is a constant factor, i.e., $T = \overline{T}$, and transfer payment, $G_T = 0$. In this section, we drop these assumptions and present a complete four-sector model. Let us assume that

$$T = \overline{T} + tY \tag{8.19}$$

and,

$$G_T = \overline{G}_T > 0. \tag{8.20}$$

With these assumptions, the equilibrium level of the national income can be expressed as:

$$Y = C + I + G + \overline{G}_T + (X - M) \tag{8.21}$$

where,

$$C = a + b(Y - T + G_T) \tag{8.22}$$

$$T = \overline{T} + tY \tag{8.23}$$

$$G_T = \overline{G}_T \quad \text{(Transfer payment)} \tag{8.24}$$

$$M = \overline{M} + mY \tag{8.25}$$

By substituting Eqs. (8.22) through Eq. (8.25) in Eq. (8.21), we get a reduced form of equilibrium equation as given below.

$$Y = \frac{1}{1-b+bt+m}(a - b\overline{T} + b\overline{G}_T + I + G + X - \overline{M}) \tag{8.26}$$

$$= \frac{1}{1-b(1-t)+m}(a - b\overline{T} + b\overline{G}_T + I + G + X - \overline{M})$$

8.3.1 The Foreign Trade Multiplier (F_m) with Tax Function

Given the equilibrium Eq. (8.26), the foreign trade multiplier can now be worked out as follows. Suppose country's exports increase by ΔX. With increase in the exports, the equilibrium equation can be written as:

$$Y + \Delta Y = \frac{1}{1-b(1-t)+m}(a - b\overline{T} + b\overline{G}_T + I + G + X - \overline{M} + \Delta X) \tag{8.27}$$

By subtracting Eq. (8.26) from Eq. (8.27), we get

$$\Delta Y = \frac{1}{1-b(1-t)+m}\Delta X$$

The *foreign trade multiplier* in a complete four-sector model can be expressed as

$$F_m = \frac{\Delta Y}{\Delta X} = \frac{1}{1-b(1-t)+m} \tag{8.28}$$

Equation (8.28) gives the *foreign trade multiplier* in a complete four-sector model. It may be noted from this equation that like taxation, imports have a negative effect on the multiplier.

Numerical Example In order to illustrate income determination numerically in a four-sector model, let us recall the equilibrium Eq. (8.21) reproduced here (for ready reference).

$$Y = C + I + G + \overline{G}_T + (X - M) \tag{8.29}$$

Recall also the expanded version of the variables in Eq. (8.29), given in Eq. (8.22) through Eq. (8.25), and make the following assumptions.

$$C = 100 + b\,(Y - \overline{T} - tY + \overline{G}_T)$$

$$I = 200 \qquad G = 100$$

$$\overline{T} = 100 \qquad \overline{G}_T = 50$$

$$X = 20 \qquad M = 10 + 0.1Y$$

$$b = 0.8 \qquad t = 0.25$$

By substituting these values in Eq. (8.29), we get the equilibrium equation as follows.

$$Y = 100 + 0.8(Y - 100 - 0.25Y + 50) + 200 + 100 + (20 - 10 - 0.1Y)$$

$$= 100 + 0.8Y - 80 - 0.2Y + 40 + 200 + 100 + 10 - 0.1Y$$

$$Y - 0.8Y + 0.2Y + 0.1Y = 100 - 80 + 40 + 200 + 100 + 10$$

$$Y\,(1 - 0.8 + 0.2 + 0.1) = 370$$

$$Y = \frac{1}{0.5}(370) = 740$$

Alternatively The parametric values can be substituted straightaway in the reduced form of the equilibrium equation, that is, Eq. (8.27) to obtain the equilibrium level of the national income. Since

$$Y = \frac{1}{1-b(1-t)+m}(a - b\overline{T} + b\overline{G}_T + I + G + X - \overline{M}),$$

$$Y = \frac{1}{1-0.8(1-0.25)+0.1}(100 - 0.8 \times 100 + 0.8 \times 50 + 200 + 100 + 10)Y$$

$$= \frac{1}{0\cdot5}(100 - 80 + 40 + 200 + 100 + 10) = \frac{1}{0\cdot5}(370)$$

$$Y = 2\,(370) = 740$$

Conclusion The foregoing analysis of the national income determination in the four-sector model takes us to the end our discussion on the Keynesian theory of national income determination. The important conclusion that emerges from the four-sector model, especially the foreign-trade multiplier formula as given in Eq. (8.28), is that given a country's marginal propensity to consume and tax rate, country's propensity to import plays the most important role in determining the overall *multiplier*: the higher the marginal propensity to import, the lower the multiplier.

SUGGESTED READINGS

Froyen, Richard, T., *Macroeconomics: Theories and Policies*, (Macmillan Publishing Co., New York, 3rd Edn., 1990), Appendix to Ch. 5.

Shapiro, E., *Macroeconomic Analysis*, (Harcourt Brace Jovanocich, Inc., New York, 4th Edn., 1994), Ch. 7.

QUESTIONS FOR REVIEW

1. What additional variables are included in the model when foreign trade is introduced in the national income determination model? How do they affect national income equilibrium?
2. *What is export multiplier? Find export multiplier from the following model.

$$AD = C + I + G + X$$

where $C = a + b(Y - T)$

$$I = \bar{I} \qquad G = \bar{G}$$

$$T = \bar{T} \qquad X = \bar{X}$$

$$M = 0$$

Compare export multiplier with investment multiplier.

3. *How is import function different from export function? Assuming the following model, find the foreign trade multiplier.

$$Y = C + I + G + (X - M),$$

where, $C = a + b(Y - T)$

$$I = \bar{I} \qquad G = \bar{G}$$

$$T = \bar{T} \qquad X = \bar{X}$$

$$M = \bar{M} + mY$$

4. *Suppose in Question 3, $T = \bar{T} + tY$ and $G_T = \bar{G}_T > 0$, where, $\bar{T}$ is constant tax, and G_T is constant government transfer payment. Find the foreign trade multiplier. (Guide: see Section 8.4)
5. *Suppose that the behavioural equations and identities for an economy are given as follows.

$$C = 100 + b(Y - 50 - tY)$$

$$I = 50 \qquad G = 50$$

$$X = 10 \qquad M = 5 + 0.1Y$$

$$b = 0.8\ (mpc) \qquad t = 0.25$$

(a) Specify the endogenous and exogenous variables,