

EC201 MACROECONOMICS

CLASSICAL THEORY – THE ECONOMY IN THE LONG RUN

Main reference:

N. Gregory Mankiw, *Macroeconomics* 5/e, Worth Publishers,

Chapter 3, *National Income: Where It Comes From and Where It Goes*

OBJECTIVES

This chapter presents the classical model of the real side of the economy. The model of the chapter provides a complete description of how the real side of the economy works in terms of its production, distribution and allocation elements. The model is a long run model in the sense that it assumes prices to be flexible and that markets clear. The three main aims of this lecture are:

1. *To introduce students to some of the basic terms and concepts that are used in macroeconomic analysis, such as production function, consumption function and investment function.*
2. *To provide long-run answers to four questions:*
 - (a) *What determines the level of real GDP?*
 - (b) *What determines how GDP is distributed to labour and the owners of capital?*
 - (c) *What determines how GDP is allocated to consumption, investment and government purchases?*
 - (d) *What ensures equilibrium of the flows in the circular flow diagram?*
3. *To develop a model that is both a basis for further analysis and a benchmark for comparison with further macroeconomic development (open economy model) and approaches (Solow growth model, IS/LM analysis).*

Lecture 1 **The Classical Model of National Income Determination**

We are interested in the macro economy – macroeconomics. As such we are interested in the relationship between variables that are defined across the economy as a whole; output, consumption, investment, interest rates, money supply, money demand, balance of payments.

As macro economists we are interested in how the economy as a whole functions and we shall learn about this through what is known as the Classical Model of Income Determination.

The most important economic variable is the gross domestic product (GDP), output. Figure 3-1 describes the overall schematic of Classical model – the circular flow of income through the economy.

3-1 **What Determines the Total Production of Goods and Services in the Economy?**

An economy's output depends on (1) its quantity of inputs, called the factors of production, and (2) its ability to turn inputs into output, as represented by the production function.

The Factors of Production

$$(K = \bar{K}, L = \bar{L})$$

The Production Function

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

This says simply that the amount of GDP an economy can produce depends upon its capital stock K and its labour L . More K and L allows more output to be produced.

For example, given a production function of the form $Y = (KL)^{1/2}$ where $K=40$ and $L=10$, $Y = (400)^{1/2} = 20$.

Some production functions have a property called **constant returns to scale (CRS)**. This means that if the inputs increase by a certain percentage z , then output would increase by the same percentage.

The production function $Y = (KL)^{1/2}$ is a CRS pf. If the factors increase by 25% each then it can be shown that Y will also increase by 25%. If K and L double then Y will also double.

The Supply of Goods and Services

We can now see that the factors of production and the production function together determine the quantity of goods produced/supplied. In this simple start an economy with K , L and technology (the transforming function) **fixed**, we would have a fixed level of Y : $Y = F(\bar{K}, \bar{L}) = \bar{Y}$.

Okay, so now we have a model so far of how the output is produced in the economy but how is the output distributed to the people in the economy?

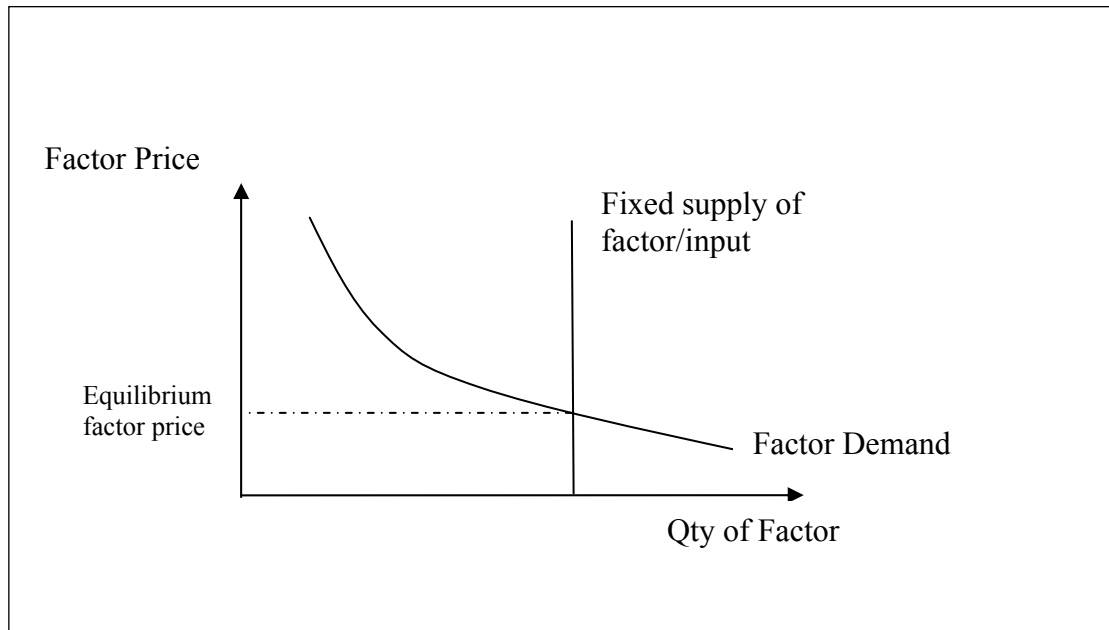
3-2 How is National Income Distributed in the Economy?

The answer to this question in the Classical model is provided by the **Marginal Productivity Theory of Distribution**, also known as the *Neoclassical Theory of Distribution*. In this model/theory only people who own the factors of production that takes part in the process of production gets any part of the output. So, the short answer is that the output is distributed to the factors of production.

In this theory the national income is distributed through **factor prices**.

There is a market for each of the factors of production, e.g. the labour market, and demand and supply in that market will determine the prices paid to the factor – the wage.

Let us see how a typical firm determines how much of these factors to employ and how much the factors will be paid.



Let us suppose that the firm is a small competitive firm, so it is a price taker in the market and not able to influence the factor prices – it can only really decide on how much of the factor to employ, in this case.

Firms sell at P , hire workers at W and rents capital at R . The firm seeks to maximise profits.

Profits = $R - C$,

$R = P \cdot Y$ $C = \text{labour costs } (W \cdot L) + \text{capital costs } (R \cdot K)$

Profits = $P \cdot Y - WL - RK = P \cdot F(K, L) - WL - RK$

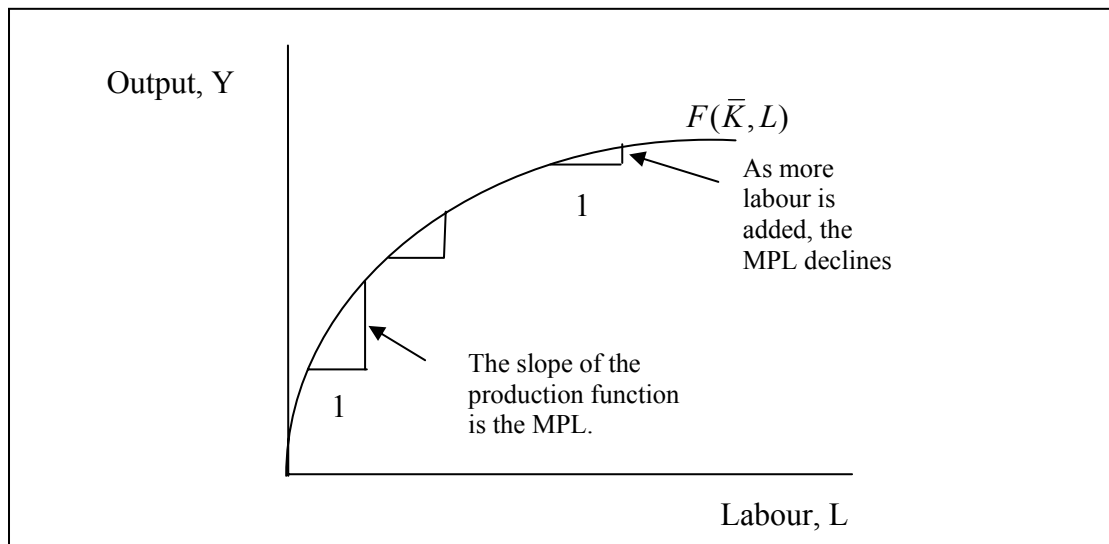
The competitive firm takes the product price P and the factor prices W and R as given and chooses the level of K and L that will maximise profit. *How do they chose the K and L ?*

The short answer is that they hire the L associated with $MPL = W/P$ and the $MPK = R/P$.

Let us consider the case of labour.

$MPL = P \cdot \Delta Y = MRPL = P \cdot F(K, L+1) - P \cdot F(K, L)$

$P \cdot \Delta Y$ is the change in revenue from employing one additional unit of labour.



Most production functions have the property of **diminishing marginal returns** – as more of a factor is employed the change in the output will decrease as additional factors are employed.

$P \cdot \Delta Y = P \cdot MPL = W$ (nominal wage). This can be rewritten as,
 $MPL = W/P$ This says that the firm will hire workers until *the marginal product of labour is equal to the real wage*.

The same considerations underlie the decision about K.
 $MPK = P \cdot \Delta Y = MRPK = P \cdot F(K+1, L) - P \cdot F(K, L)$
Firms will rent K up to where $P \cdot MPK = R$ (nominal interest rate) and this can be written, $MPK = R/P$. This says that the firm will hire workers until *the marginal product of capital is equal to the real rental price of capital*.

Having now examined the mechanisms that determine how much each factor of production is demanded and paid, we can now explain how the total product is distributed in the economy.

The Division of National Income

Since each factor of production is paid an amount equal to its marginal contribution to output, total real payments to labour ($W/P \cdot L$) must be equal to its total real contribution to output **and** total real payments to capital ($R/P \cdot K$) must be equal to its total real contribution to output. Since only labour and capital contribute to output and they get what they contribute then the sum of the payments must be equal to total output.

$$(W/P \cdot L) + (R/P \cdot K) = (MPL \cdot L) + (MPK \cdot K) = Y$$

If each of the factors of production is paid its marginal product and the sum of the payments is equal to total output then where does profits come from? The response to this is that really what we call profits is really part of the payments to capital. People own L and K but firms also own K. So while we see the payment to L as wages and the payment to people who own K as interest, we account for the payment to firms who own K as profits. There is a big debate about this and indeed as to what capital is ... It is enough for us to understand that in this *Neoclassical Theory of Distribution*,

output is distributed throughout the economy on the basis of the contribution of the factors of production to the production process.

So, we have production taking place and now households have income based on the marginal productivity theory of distribution. How are these incomes used? – well, the group of people who receive the income use them to demand goods and services. Let us now see how this is explained in the Classical Model.

3-3 What Determines the Demand for Goods and Services

So, we have seen that $F(K,L) = Y = \text{GDP}$ and this is distributed to the factors of production, now we will see how that income is used. Total income is essentially used to demand the goods and services produced and four types of purchases are generally identified: consumption, investment, government and net exports.

Consumption

Households (labour and capital owning households) receive income Y .

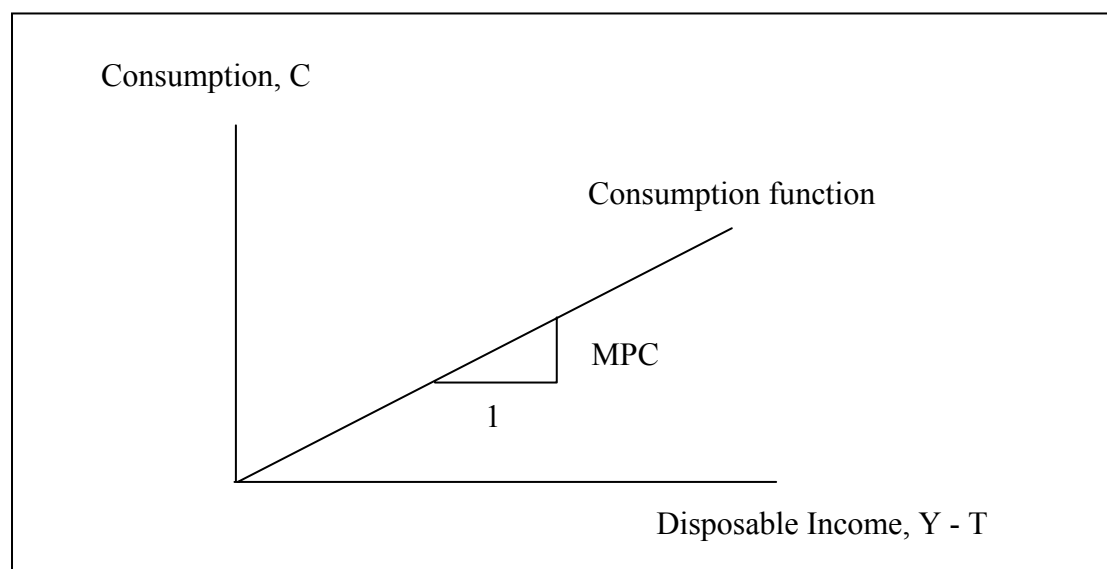
Households pay taxes T that provides the government with its revenue/income.

Household disposable income is then $(Y-T)$

Households divide their income between consumption C and savings S .

Consumption is modelled as determined by $C = C(Y - T)$, a consumption function.

The MPC tells us the proportion of income that is spent from a unit of disposable income (pound).



The proportion by which consumption changes when disposable income increases by one pound is called the MPC.

So consumption is determined through a consumption function.

Investment

Both firms and households demand investment goods. Firms both replace and add to their capital stock, and households buy new homes.

The quantity of investment goods and services demanded depends on the interest rate. This is so whether or not firms have to borrow the funds – give example.

We have to distinguish between nominal and real interest rates. This distinction is important and especially so when price are changing. Nominal interest rate R is the one usually report, 8%. Real interest rate r is nominal interest rate minus the rate of inflation, $r = R - \text{inf} = 8\% - 3\% = 5\%$, for example. The real interest rate measures the true cost of borrowing and thus determines the quantity of investment. We can write a function for investment as $I = I(r)$.

Government Purchases

Central government purchases missiles, computers, services,...

Local government purchase library books, road cleaning services, ..

Government make **transfer payments** such as welfare and social security payments. These are not made in exchange for any good or service. Transfer payments are the opposite of taxes – they increase household disposable income in the same way taxes reduce disposable income. Thus an increase in transfer payments financed by increased taxes leave household income unchanged. We define T as taxes minus transfer payments: $T_{\text{taxes}} = T - T_{\text{tp}}$.

If government purchase $G = T$ then the government has a balanced budget.

If $G > T$ then the government has a budget deficit.

If $G < T$ then the government has a budget surplus.

For simplicity we model G and T as exogenous variables: $(G = \bar{G}, T = \bar{T})$.

- *We have looked firstly at how total income/output $Y = F(K, L)$ is produced/supplied.*
- *We looked at how the total income is distributed to households and firms.*
- *We just looked at how demand for total output is determined.*
- *Now we need to develop an explanatory of how the Supply and Demand are brought into equilibrium in the economy.*

3-4 What Brings the Supply and Demand for Goods and Services into Equilibrium?

In other words, what ensures that the sum of consumption, investment and government purchases $(C + I + G)$ equals the amount of output produced Y . We will see that in this Classical Model, the interest rate has the crucial role of equilibrating supply and demand.

On the Supply side we saw that,

$$Y = F(K, L) \quad \sim \quad Y = F(\bar{K}, \bar{L}) = \bar{Y}$$

and on the Demand side,

$$Y = C + I + G \quad \sim \quad \bar{Y} = C + I(r) + \bar{G}$$

$$C = C(Y - T) \quad \sim \quad C = C(\bar{Y} - \bar{T})$$

$$I = I(r) \quad \sim \quad I = I(r)$$

$$G = \bar{G} \quad \sim \quad G = \bar{G}$$

$$T = \bar{T} \quad \sim \quad T = \bar{T}$$

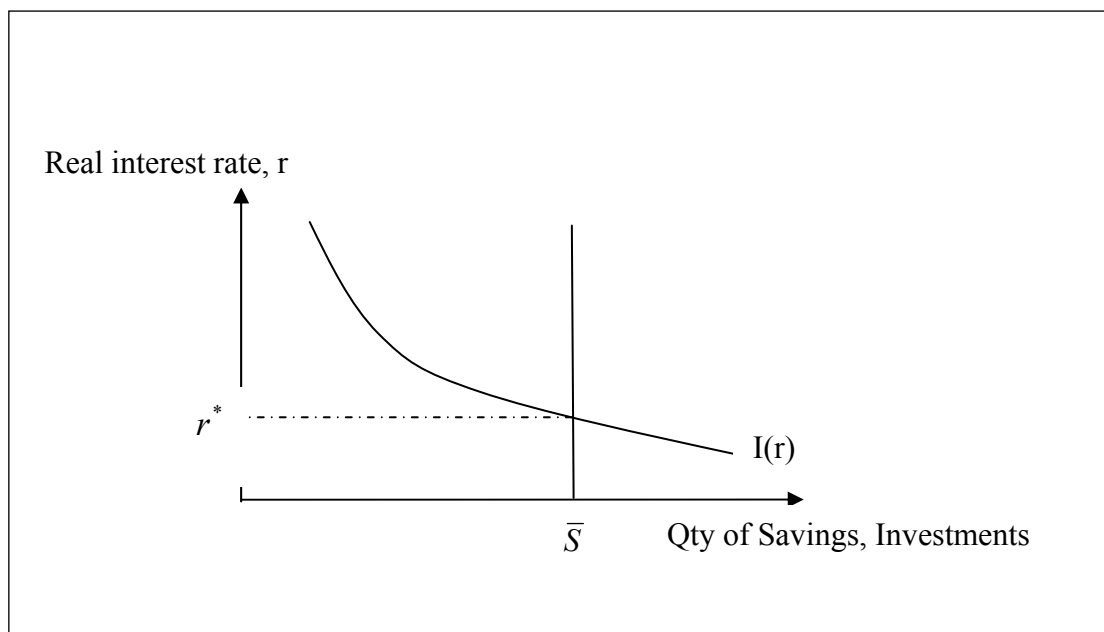
National savings is $Y - C - G = S$ and this is equal to investment I .

$$Y - C - G = I \quad \sim \quad \bar{Y} - \bar{C} - \bar{G} = I$$

$$S = I(r) \quad \sim \quad \bar{S} = I(r)$$

For fixed values of Y , G and T , national saving S will also be fixed.

In the model now r adjusts to ensure equilibrium between S and I and this brings about a general equilibrium in the economy.



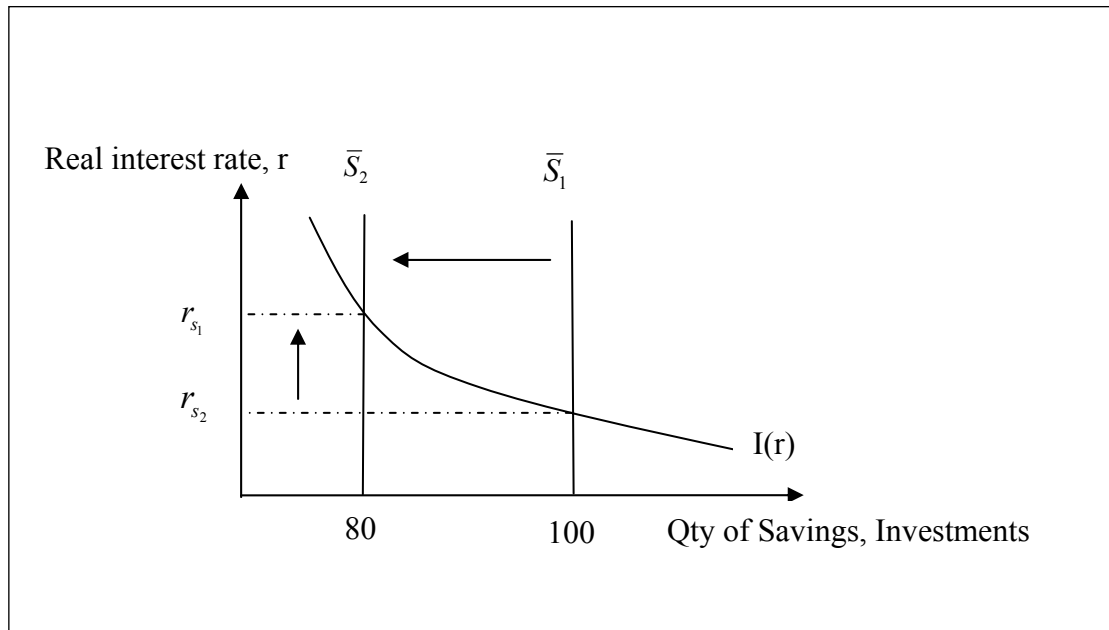
At the equilibrium interest rate, households desire to save balances firms' desire to invest, and the quantity of loanable funds supplied equals the quantity demanded – this is the classical ***Loanable Funds Theory of Interest Rate Determination***.

National Savings S can be broken down into Private Savings S_p and public/government savings S_g , $S = S_p + S_g$ so that

$$Y - C - G = (Y - T - C) + (T - G) = I(r) \quad \sim \quad (\bar{Y} - \bar{T} - \bar{C}) + (\bar{T} - \bar{G}) = \bar{S} = I(r)$$

100 + 0	=	100 = r^*
100 + 10	=	110 = r^* ↓
100 - 20	=	80 = r^* ↑

Discuss the impact of government surplus/deficit on the equilibrium real interest rate and its impact on output in the economy.



Summary

1. The factors of production and the production technology determine the economy's output of goods and services. An increase in one of the factors of production or a technological advance raises output.
2. Competitive, profit-maximising firms hire labour until the marginal product of labour equals the real wage. Similarly, these firms rent capital until the marginal product of capital equals the real rental price. Therefore, each factor of production is paid its marginal product. If the production function has constant returns to scale, all output is used to compensate the inputs.
3. The economy's output is used for consumption, investment and government purchases. Consumption depends positively on disposable income. Investment depends negatively on the real interest rate. Government purchases and taxes are exogenous variables of fiscal policy.
4. The real interest rate adjusts to equilibrate the supply and demand of the economy's output – or equivalently, to equilibrate the supply of loanable fund (savings) and the demand for loanable funds (investment). A decrease in national saving, perhaps because of an increase in government purchases or a decrease in taxes, reduces the equilibrium amount of investment and raises the interest rate. An increase in investment demand, perhaps because of a technological innovation or a tax incentive for investment, also raises the interest rates. An increase in investment demand increases the quantity of investment only if higher interest rates stimulate additional savings.

QUESTIONS

Review Questions

1. What determines the amount of output an economy produces?
2. Explain how a competitive, profit-maximising firm decides how much of each factor of production to demand.
3. What is the role of constant returns to scale the model of how income is distributed?
4. What determines consumption and investment?
5. Explain the difference between government purchases and transfer payments. Give two examples of each.
6. What makes the demand for the economy's output of goods and services equal the supply?
7. Explain what happens to consumption, investment and the interest rate when the government increases taxes.

Main Questions

1. Use the classical model approach to answer the following questions.
 - (a) What determines the level of real GDP?
 - (b) What determines how GDP is distributed to labour and the owners of capital?
 - (c) What determines how GDP is allocated to consumption, investment and government purchases?
 - (d) What ensures equilibrium of the flows in the circular flow of income/output in the economy?
2. Consider an economy described by the following equations:
$$Y = C + I + G$$
$$Y = 5,000$$
$$G = 1,000$$
$$T = 1000$$
$$C = 250 + 0.75(Y - T)$$
$$I = 1,000 - 50r$$
 - (a) In this economy, compute private saving, public saving, and national saving.
 - (b) Find the equilibrium interest rate.
 - (c) Now suppose that G rises to 1,250. Compute private saving, public saving and national saving.
 - (d) Find the new equilibrium interest rate.
