



Course: Economics I (macroeconomics)

## Study text

5th Chapter

Economic Growth

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## 5 Economic growth

In this chapter, our task is to analyze the long-term productivity possibilities of the economy, or we will explore economic growth opportunities (GDP growth). We will focus on resources (factors) of economic growth. Various models of economic growth will be introduced. Finally, we will discuss barriers to economic growth, the sustainable development and growth macroeconomic policy.

### 5.1 The concept of economic growth

Some economies grow faster and people have higher standard of living, some economies fail to start economic growth and the consequences of this phenomenon are reflected in the fact that these countries are over time poorer or completely poor. *Why does this happen and as a result of what? Is it possible to change this situation?*

When the economy grows, it means higher welfare for the society; therefore all states in the world are trying to achieve real economic growth. And they have many good reasons to do this. Here are some of them:

- fundamental goal of economic growth is to *imcrease the standard of living of the population* so people can consume more and in better quality. In the long term, production capacity growth is needed to ensure increasing living standard;
- improving living standards depends not only on the increasing production possibility in a country, but also on *how many peple distribute the product*. The standard of living is rising in the long run, if the potential product growth is faster than population growth in the country;
- sometimes it may seem that the economy is growing relatively slowly. However, *even relatively small change in potential GDP growth may generate significant improving in the macroeconomic performance and standard of living*. It was obvious on the consumption of countries that achieved long-term economic growth;
- if the economy is mananged to keep it on a trajectory of economic growth, it enables the creation of the *necessary maneuver space for this economy*. Because the newly produced resources enable to produce advanced capital goods in the future period and to provide structural changes ensuring growth dynamics for further development, otherwise the investment could have meant rising debt of the country.

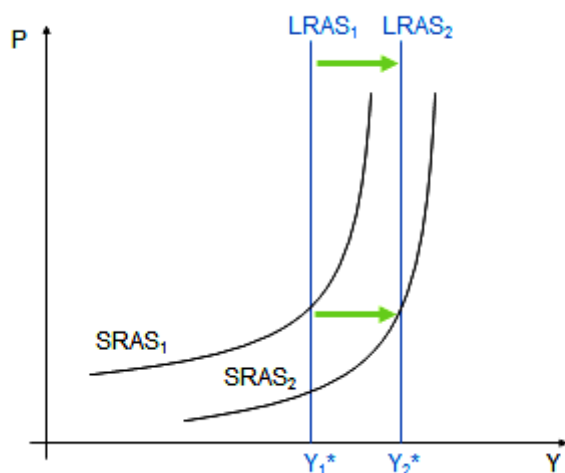
These are the main reasons why economists explore the possibilities of economic growth and are looking for real ways to provide it without devastated production resources.

**Economic growth** means the growth of **potential output** ( $Y^*$ ) and the theory of economic growth is concerned with the long-term development. The resources of growth are identified, because they cause long-term growth of potential output (not the short-term fluctuations in real output).

**In the narrow sense**, economic growth means **a long-term potential output growth per capita**.

Fig. 5.1 illustrates the economic growth in AS/AD model. Short- and long-term aggregate supply curves shift to the right in case of economic growth. If we wanted to deal with new macroeconomic equilibrium of the economy, we would have to take into account also the demand side of the economy.

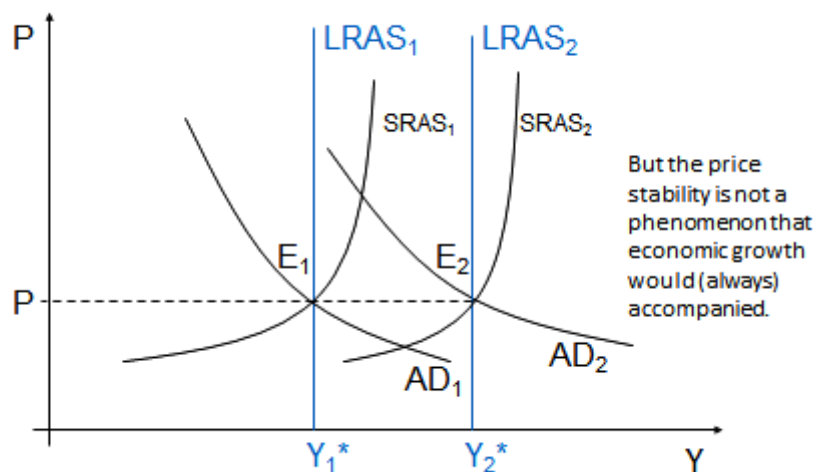
*Fig. 5.1 Economic growth in AS/AD model*



In the case of economic growth and aggregate demand curve shifts also to the right. The new point of macroeconomic equilibrium (E) will be formed at higher real output (Y). The average price level (P) depends on proportionality of aggregate supply and aggregate demand curve shift.

Fig. 5.2 shows the economic growth in terms of price stability. There are proportional shifts of SRAS and AD curve. The new point of macroeconomic equilibrium determines the higher long-term performance. This case can be considered as ideal for the economy, because of stable price level. However, real economies rather meet up with inflation. Usually moderate inflation is accepted when the growth rate of real output exceeds the growth rate of the aggregate price level.

*Fig. 5.2 Economic growth in terms of price stability*



Aggregate demand can (and usually does) grow faster than aggregate supply, this will put pressure on prices and new equilibrium will determine higher price level. This situation is presented in Fig. 5.3. The economy reaches the new output  $Y_a$  at higher price level  $P_2$ . Actual product  $Y_a$  is lower than potential output  $Y_2^*$  in this case.

*Fig. 5.3 Economic growth in terms of lagging aggregate supply*

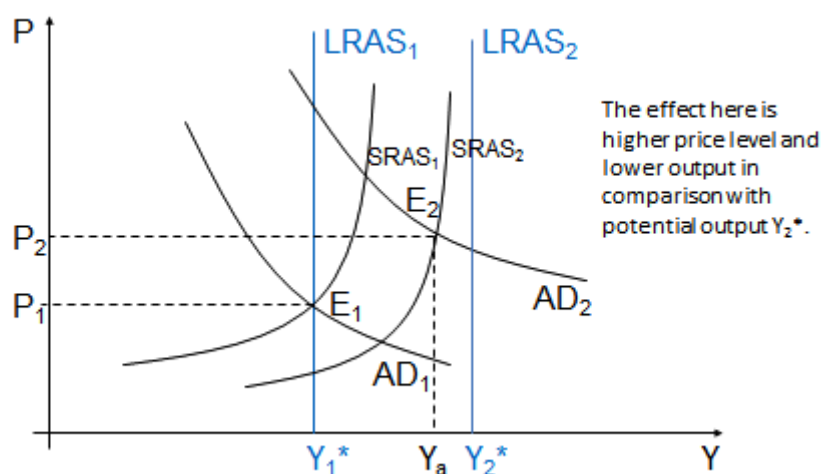
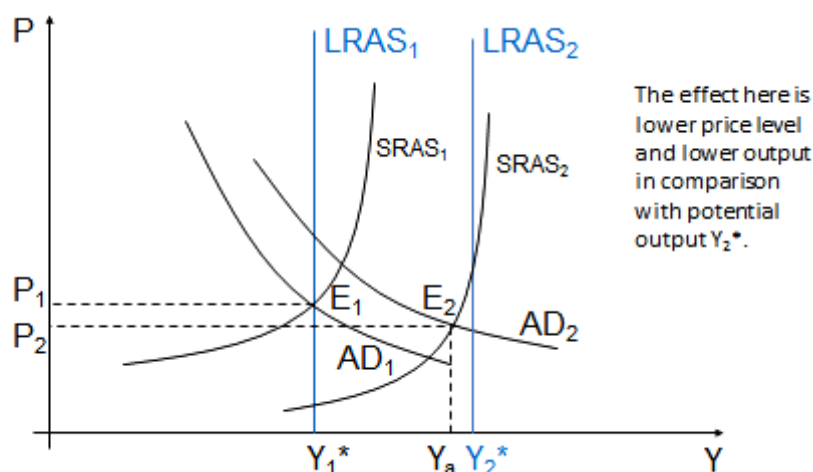


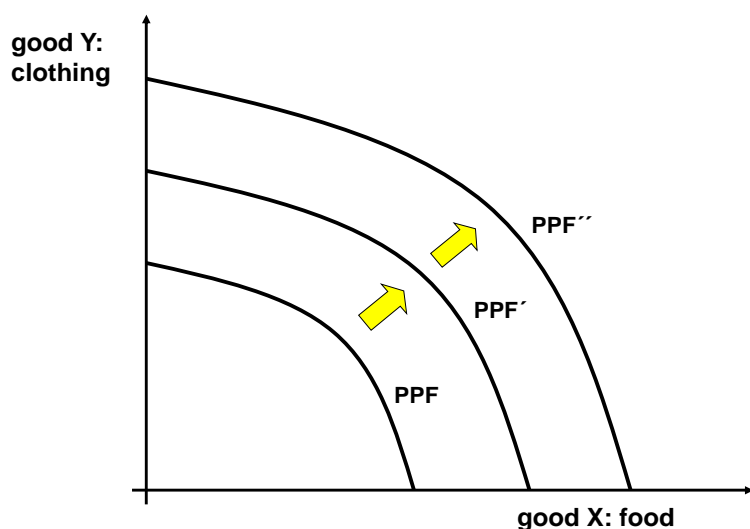
Fig. 4.5 demonstrates the situation when aggregate demand growth is lagging behind the growth of aggregate supply and it results in decreasing price level. The new output  $Y_a$  is less than potential product ( $Y_2^*$ ) in this case.

Fig. 5.4 Economic growth in terms of lagging aggregate demand



The positive development of potential GDP (the growth) can be drawn graphically as a outward shift of the production possibility frontier (PPF). It is a curve that expresses the various possible combinations of two types of good (i.e. good X - food, good Y - clothing). All points along the frontier (curve) means fully and efficiently utilized all available production resources. Economic growth using the PPF is demonstrated in Fig. 5.5. The economy has adopted the ability to produce higher long-term output.

Fig. 5.5 Economic growth in the form of a PPF shift



## 5.2 Measurement of size and product development

Economists not only observe the change and development of economic growth, but also seek ways how to measure this development and explain the figures calculated. So far, a characteristic of economic growth as a long-term development of potential

product can be considered as economic-theoretical approach. Some economists use the term economic growth as the development of the real product. Economic growth is expressed as a change of flow variables during a given time period. Such developments can be expressed as an absolute difference between the product in the period  $t$  and product in the previous period  $(t - 1)$ . This expression can be written as:

$$\Delta Y = Y_t - Y_{(t-1)}$$

Here is *the growth coefficient* used to monitor the development of economic growth. It can be written as follows:

$$g_{Yt} = \frac{Y_t}{Y_{(t-1)}} \cdot 100 (\%)$$

Very often us formula is *the rate of real output growth* ( $G_{Yt}$ ), written as follows:

$$G_{Yt} = \frac{Y_t - Y_{(t-1)}}{Y_{(t-1)}} \cdot 100 (\%)$$

We are able to express the growth rate of nominal output ( $G_{Ynt}$ ) as the sum of the growth rate of real output ( $G_{Yt}$ ) and growth rate of the price level inflation in a given period ( $\pi_t$ ). *Growth rate of nominal output* has the form:

$$G_{Ynt} = G_{Yt} + \pi_t$$

The most used term is *the output growth per capita*. This indicator can be written either as an absolute value or as the growth rate.

Suppose that the population is growing as fast as the amount of labor ( $L$ ), then we can identify the growth rate of the product per capita with the growth rate of the product per unit of labor.

**GDP per capita** represent **the standard of living of a country**. However, the explanatory power of this indicator is problematic in the way it does not reflect the way of distributing the product between the individual residents, just only an average variable.

The concept of economic growth differs from the concept of *economic development*. The concept of economic development is usually understood and used in a wider sense. In addition to the rise in the living standards of the population it includes other elements of the economy, such as the necessary structural changes in the economy and changes in technologies used in production. It is relevant to note that just long-term economic growth is a precondition for economic development.

### 5.3 Sources (factors) of economic growth

*Sources of economic growth* can be seen in several key elements:

a) **human source**, in the form of:

- *amount of labor*;
- *qualification* (education, skills and experience), referred to a “human capital” and its costs of obtaining, maintaining and increasing as the investment in this capital; motivation and the entrepreneurial spirit of people;

b) **natural resources**, soil quality and quantity, structure and availability of mineral resources and climatic conditions;

c) **capital resources**, in the form of capital goods that expand production. Examples include:

- machinery and equipment, real estate, buildings, land and buildings;
- technical level of these goods, their performance, accuracy, demands on energy consumption, ease of use, wide range of applications etc.

More generally, the sources of economic growth are divided into *two groups*:

- **quantitative (extensive) sources of economic growth** more and more factors of production - labor, capital and natural resources are involved in production processes; with the same qualitative characteristics. The growth is supported by increasing the number of participating units of inputs,
- **qualitative (intensive) sources of economic growth** increase the quality of the ingredients of economic growth. They include improving qualifying structure of employers or management, better quality of raw materials or prefabricated materials and natural resources, modern technology is used. The higher output can be produces using the same level of inputs.

Of course, a desirable way how to increase the performance of the economy lies in using *qualitative sources*. In a *broader sense*, we can stress the following:

- effective and efficient integration into the international division of labor;
- liberalization or practical and appropriate deregulation or regulation of markets by the government;
- access to information technology and work using data.

In reality, there is combination of both types of resources, quantitative and qualitative. However, it is matter what ratio is used. If the economy would involve more and more quantity of inputs with the same qualitative characteristic, it will encounter sooner or later their limitations (scarcity). Therefore, economists stress the qualitative sources

of economic growth. These are referred very often to positive technological change (technological progress).

Very important thing is how the inputs used. In this context we talk often about **the productivity of inputs**.

Another important variable is the amount of capital per unit of work. It is the figuring of the **capital-labor ratio**. The synonym is **the capital intensity**. This category can be written as the ratio of:

$$\frac{K}{L}$$

When increasing the amount of capital per one worker, we are talking about **capital deepening**. This phenomenon occurs when the supply of capital is growing faster than the number of economically active population. The capital deepening can occur even in terms of the absence of technological progress. The growth ratio of K/L influences positively the amount of product.

The growth rate of capital per unit of labor can be expressed roughly as the difference between the capital growth rate and the labor growth rate as follows:

$$g_{K/L} = g_K - g_L$$

As an example we can name capital deepening process of mechanization of agricultural production, using machinery, irrigation equipment, feeding machinery, expansion of transport infrastructure and logistics centers, the introduction of computer technology in the bank sector, etc.

If the capital stock grows at the same rate as the amount of labor or if the ratio K/L is constant, we talk about **capital expansion**.

## 5.4 Growth accounting

Now we will examine how the individual source of economic growth contributes to the total growth of the product. Therefore, detailed studies are based on “**growth accounting**”. This approach consists of detailed accounts of all ingredients that contribute their bit to growth changes.

The growth accounting is based on the neoclassical theory of income distribution. Therefore, marginal productivities of inputs are the main variables here. Part of the product is attributable to the marginal physical product of capital input ( $MPP_K$ ) and labor ( $MPP_L$ ), then where, if we assume a negligible share of natural resources, the product is a sum of:

$$Y = MPP_K \cdot K + MPP_L \cdot L$$

Total increase in product depends on increments of capital and labor:



$$\Delta Y = MPP_K \cdot \Delta K + MPP_L \cdot \Delta L$$

And expressions:

$$\Delta K/K ; \Delta L/L$$

represent the growth rate of capital and labor and the following products:

$$K \cdot MPP_K / Y$$

$$L \cdot MPP_L / Y$$

represent the shares of capital or labor amount of the generated income (Y).

Now, here is the growth accounting equation, when *not considering technological progress*:

$$\frac{\Delta Y}{Y} = \frac{\Delta K}{K} \cdot \frac{K \cdot MPP_K}{Y} + \frac{\Delta L}{L} \cdot \frac{L \cdot MPP_L}{Y}$$

Potential GDP growth rate  $\frac{\Delta Y}{Y}$  is equal to the sum of the growth rate of capital multiplied by the share of capital costs of the product and the growth rate of labor multiplied by the share of labor costs of the product.

When taking into account the technological progress ( $\kappa$ ), it usually represents a growth rate of multifactor productivity of both factors (labor and capital).

If we expand the accounting equation by the technological progress, it will include also the aggregate (integral) factor productivity of labor and capital ( $\frac{\Delta \kappa}{\kappa}$ ):

$$\frac{\Delta Y}{Y} = \frac{\Delta \kappa}{\kappa} + \frac{\Delta K}{K} \cdot \frac{K \cdot MPP_K}{Y} + \frac{\Delta L}{L} \cdot \frac{L \cdot MPP_L}{Y}$$

Calculations in the growth accounting also focus on identifying product development per capita. The calculations show a significant conclusion that the output growth rate per capita (standard of living) depends on the capital intensity and technological progress.

The connection between product development and its growth factors is often expressed by **aggregate production functions**, generally in the form of:

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

where Y represents macroeconomic product, K, L, A represent inputs and T represents the level of technological progress.

Often *Cobb - Douglas* production function is used in its general form, when the land input is omitted (included in capital):

$$Y = T \cdot K^{\alpha} \cdot L^{\beta}$$

The coefficients  $\alpha$  and  $\beta$  represent the flexibility of the output to inputs, respectively their share of the product. If the sum of the coefficients  $\alpha$  and  $\beta$  is greater than 1, we can talk about growing returns to scale. If the sum is less than 1, there are decreasing returns to scale, and if the sum of  $\alpha$  and  $\beta$  equals to one, talking about constant returns

## 5.5 Models of economic growth

In economic theory the issue of economic growth is *a relatively complex problem*. There is no comprehensive and widely accepted theory that would comprehensively and systematically explain the causes of economic growth. Nor econometric approaches using the most advanced analytical techniques have been able to affect the development and dynamics of resources and growth factors. There are a number of models that are built on a series of assumptions that differ from reality more or less. Often a set of coefficients, symbols, aggregates prevail in these models that are hardly to define and determine accurately.

Economic growth models can be classified into certain areas. We can divide them according to their characteristics of their content in relation to the various existing schools of economic thought.

### ***Classical models of economic growth***

One of the basic models of economic growth is a model, whose author is *T. R. Malthus*, one of the representatives of *Classical political economy*. This model is based on the assumption of stagnant quantity and quality of agriculture, and abstracts from rising amount of capital and technological progress. Population growth in terms of quantity workforce is considered as a driving force of economic growth. This, however, means a gradual reduction of the marginal product of labor ( $MRP_L$ ). Growth rate of the product has been converging to the rate of population growth until it becomes lower. As a result, the product per capita is decreasing (and real wages) up to the level of subsistence necessary for survival. In this situation, the population growth significantly slowed down to with the product.

Product per capita and real wages can increase either due to a reduction in the population (mortality due to wars, epidemics, etc.), or by reducing the birth rate due to difficult life circumstances. The problem of this solution is the impossibility of its final (or at least long term) solution. Since the re-growth of real wages and increase the standard of living above subsistence level will lead to an increase in the population of reproductive opportunities (increasing the birth rate) and product distributed among a larger number of people will oscillate around subsistence.

Long-term fixation of real wages at the level of simple subsistence is presented in the form of *"iron law of wages"*. When experiencing this level of wages, the economy shows zero growth of the product.

Another representative of the *Classical political economy*, *David Ricardo*, introduced his theory that is based on altered social conditions including the technological progress. Also recognized the need for tillage fallow far less fertile soil and reaching the “stationary state”. This is a situation when workers receive “subsistence (minimum) wages” and the remaining income is in the form of rent paid to land owners. The main thought of D. Ricardo lies in the dynamism of the conditions and benefits of international including principle of comparative advantages application. He expanded theory of *A. Smith* – the author of principle of absolute advantage. The division of labor in international trade contributes to economic growth.

### ***Neoclassical model***

The main representative of the thought process of economic growth is a Nobel laureate in economics *Robert M. Solow*. His model is the most illustrative one. It is now one of the basic tools for understanding the process of growth in advanced economies and was applied together with the growth accounting in empirical research of economic growth.

Assuming only two types of inputs - capital and labor, the growth of labor input (L) is determined by forces lying outside the economy and is not influenced by other economic variables. R. M. Solow presumed a situation of modern technologically advanced economy whose growth is based not only on capital (deepening and expanding), but also on technological progress.

### ***Keynesian models of economic growth***

Keynesian economics deals with the economy where unemployment is higher in comparison with the natural rate of unemployment. Therefore, Keynesian models examine the conditions of a “*steady growth*” as growth in terms of full employment and include also disorders that interfere with this growth. First Keynesian growth models were presented by economists *R. F. Harrod* and *E. D. Domar* (Neoknesian stream). Both authors emphasized the role of investment for economic growth.

Keynesian models use many **assumptions**. Usually there are the following:

- *increase the amount of labor* is determined by conditions lying outside the model - exogenously. The labor is influenced by technological progress;
- there is a *constant share of savings* (S) of income (Y):

$$S = mps \cdot Y$$

$$mps = aps$$

- *there are constant coefficients of labor intensity of production* ( $l = L/Y$ ) and *capital intensity of production* ( $k = K/Y$ ). To create a unit of production it is needed  $l$  units of labor and  $k$  capital units, and the assumptions are the mutual

lack of interchangeability of these two inputs and also constant returns to scale;

- *all savings are invested that  $S = I$  (i.e. necessary condition for making investments).*

**Postkeynesianism** (J. Robinson, N. Kaldor, P. Sraffa) as a economic stream emphasized the role of capital accumulation for economic growth. Its growth theory is closely connected with the theory of distribution. If the economy is to achieve long-term economic growth, the growth rate of real wages should not exceed the growth rate of labor productivity. Wages and profits are part of the national income and the profit is a prerequisite for its investment – i.e. capital accumulation.

### ***School of growth limits***

The school of growth limits represents specific approach to the issue of long-term product growth. Authors (*Mr and Mrs Meadows*) dealt with actual problems, such as problem of population growth, industrial production, food production, environmental problems and human impact on the production of drawing fossil fuels. Furthermore, this school concentrates on the development of various indicators of living standards, such as product per capita and life expectancy. In this context it can be said that the authors formulate two basic models of product growth:

- *the growth limits* are going to come in terms of dynamic population growth, decline in stocks of non-renewable natural resources, accompanied by growing environmental pollution. This term refers to the exhaustion of agricultural land, critical shortage of raw materials and fuels, and the inability of nature to absorb pollution. These conclusions are often compared with *Malthusian theory*, that is based on solving the discrepancy between increasing population and deficiency of resources;
- *a possible solution* lies in a conscious birth controlling to and limiting the production when mainly natural resources are being exhausted.

### ***Theory of endogenous growth***

The endogenous theory of growth attempts to explain the long-term difference between the economically developed and less developed countries. The technological progress is considered as a basis in the form of improving physical and human capital. And this technological progress is generated by forces **within the economy** – and has *endogenous character*. Of course, it is necessary to create internal conditions and therefore, the technological progress is conditioned by:

- *quantitative and qualitative levels of physical capital*. It means new ideas, discoveries and improvements that can be applied. At the same time technological progress is determined by the ability of workers to fund research and implement its conclusions in economic practice;

- *the existence of certain institutional conditions*, such as government support for research as a public good or educational support.

It is obvious that the involvement of endogenous factors of economic growth involves not only modern capital equipment (machinery, management and control systems, etc.), but also a qualified personnel.

Technological progress brings positive externalities (according to the authors), because the know-how results are not possible to protect in the long run and they become the property of others (new technologies are spreading worldwide). They are also associated with increasing returns to scale, allowing invest more in advanced technologies.

### ***Sustainable development and global challenges of growth***

This concept stresses the need of such development that enables *meeting the needs of society in these days without constraining the needs of future generations*. The term “sustainability” means such an economic growth, based on qualitative sources and it does not damage the wider natural and social conditions in the future.

Of course, a fundamental problem is in using available natural resources. Sustainable development is determined by the procedure when:

- in the case of renewable resources, such as forests, etc., *regenerative capacity of such resources and its further development* must be retained;
- in the case of non-renewable resources, *new technology must be implemented* to keep (substitute) the resources;
- *negative externalities* (pollution etc.) must not exceed the level when the nature is damaged.

And there are problems related to sustainable growth and global development of contemporary civilization:

- *decline in the quality and other environmental degradation;*
- *gradual exhaustion and lower availability of traditional natural resources;*
- *population explosion in regions with zero or negative growth;*
- *uneven economic development, consumption and production;*
- *uncontrolled migration of population for economic reasons.*

### **Barriers to economic growth and overcoming the underdevelopment**

The absolute amount of product produced during a certain period is used as an indicator of **the economic strength** of the country. More precise variable is product

per capita, because it matters how many people can distribute the product. Thus, we talk about **economic (living) standard** of the country.

To express the development of the country more precisely we introduce the HDI - ***Human Development Index***.

The Human Development Index is one of the attempts to express the quality of human life. This index has been published since 1990 in statistical publication "Human Development Report" published annually under the auspices of UNDP (United Nations Development Programme). HDI is calculated on the basis of three categories: human health, educational level and material standard of living. Human health is expressed as the average life expectancy. The education level is determined by a percentage of literate population of and a combined share of the population in the relevant age group attending schools of first to third grade. The material level is expressed as a share of GNP per capita expressed in value of the US dollar, whose value is converted to purchasing power parity.

Human development index takes values from 0 to 1. The highest value is referred to the most advanced economy. Based on the value of the HDI, states are divided into three groups:

- *states with high level of human development (HDI  $\geq 0.8$ );*
- *states with medium level of human development (HDI ranging from 0.5 to 0.799);*
- *states with low level of human development (HDI  $< 0.5$ ).*

The value of GDP expresses how much the state is rich, while the HDI value indicates the extent to which the state is "humanly developed".

### ***Barriers to economic growth***

Why so some states show economic growth and others do not? Why are there these differences? The reason lies in the existence of **barriers to economic growth**.

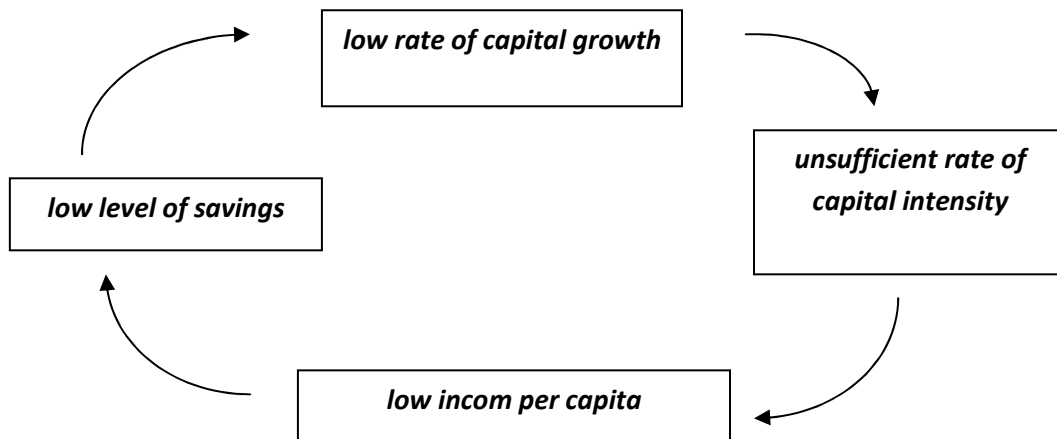
Although opinions are very diverse, they can be summarized as follows.

1. *Development of population.* Demographic developments differ among developed and developing countries. The dynamics of population growth generally does not correlate with the rate of production capacities, exacerbating poverty in developing countries.
2. *Insufficient supply of capital goods* is often regarded as the main barriers to economic growth. Savings formation is missing. Savings are not accumulated, because they often leak, usually are illegally moving abroad.

3. The basic aspects of ***vicious circle of underdevelopment*** were expressed by economist *G. Myrdal*.
4. Another barrier is *the lack of technological progress*. But we can appoint another, such as *inadequate workforce skills, natural effects of war*.

The vicious circle of underdevelopment is demonstrated in Fig. 5.6.

Fig. 5.6 Vicious circle of underdevelopment



Barriers to economic development are not only economic in nature, but there are *institutional barriers*. These include:

- *business legal framework* (stability, clarity and enforceability of laws), the state apparatus (abuses in the process of formation and company operation, corruption, favoritism and personal enrichment);
- *the persistence of religious, kinship and clan relationships* that may be a barrier for economic growth. Further, it may be traditions, customs and culture of work;
- *political and military stability* plays an important role, for example in attracting long-term foreign investments;

The above aspects can either promote economic growth, or vice versa hamper it in their various combinations.

### ***Overcoming the underdevelopment***

There are considerable differences of economic growth among countries. Global goal is help the least developed countries to adapt gradually the conditions of economic growth and to create a stable environment for economic development of society.

Such as procedures are looking for that would lead to overcoming underdevelopment of some countries and regions, and to brought them to achieving the desired economic growth characteristics.

The basic problem is *the start of economic growth*. The start is meant as the development of production in one or few specific sectors where at least basic starting conditions for start-up growth (skilled workforce, plenty of available resources or international context) have been implemented.

Pro-growth measures may also take the form of foreign technical assistance and foreign financial resources. All these alternatives are dependent on the specific situation of the country and on the specific condition of international economic and financial relations.

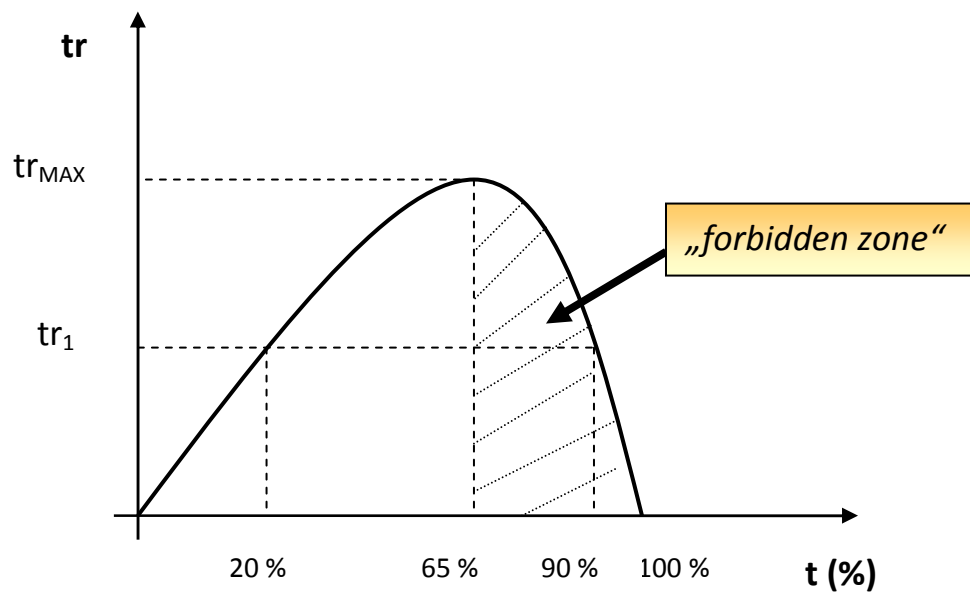
Pro-growth policy is a part of conservative economic thinking, **supply-side economics** (A. B. Laffer, G. Gilder). The principle consists in long-term maintenance of available production resources involved in production and in their systematic expansion. It also includes access to secure high employment.

Representatives of supply-side economics came up with the idea that fiscal (budget) aspect of innovation growth ability may be higher income taxation of all economic entities, since high taxation of labor income has been discouraging further increase in production. High taxes also discourage savings necessary to invest, both in terms of households and firms. Therefore it is necessary to pay attention to these problems as a whole. The basic tool for describing these relationships, it has become **Laffer curve**. It shows the empirically established truth that government revenue (tax revenues -  $tr$ ) and tax rate ( $t$ ) are not related proportionally.

Fig. 5.7 illustrates the relationship between tax revenues and tax rate. Laffer curve has the shape of inverted U. We can observe that the same tax revenue ( $tr_1$ ) may be achieved at two different rates of taxation (in this picture at 20 % and 90 %). If the economy is moving in “forbidden zone”, the tax rate dampens economic activity (possible effect is the increase in the underground economy). Further development of human society is only possible under conditions of a systematic and considerate economic growth.



Fig. 5.7 Laffer's curve



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