

ELEMENTS IN THE ANALYSIS OF GROWTH IN THE COMPETITIVE ECONOMIES

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Key words: economic growth, capital accumulation, investments supply, technological progress, employment.

Abstract: The economic growth is a current problem, even if the germs of the theoretic debate on this theme are not very current, because of a paradox phenomenon referring to the fact that the wealth of the world (expressed under different forms) grows spectacularly and some significant parts of the population live under the poverty threshold. We would like to present in this paper the main determiners of the economic growth or development, and to shortly analyze the representative theories, to outline the reference points from the reference theory and practice as well as the basic calculation coordinates and the empirical estimation of the economic growth. All these may form an analysis model for the growth from a competitive market economy.

The economic growth represents the growth of the gross domestic product (GDP) or of the national domestic product (NDP) per total and per capita in real terms. The economic growth may be considered from two angles that are: the absolute economic growth as a difference between two terms of a statistical series which characterize the GDP and NDP, and the relative economic growth (as a relation expresses under the form of the coefficient or percentage) and between the two terms of the respective theory. The terms of the series represent the GDP or NDP levels at different moments or periods of time.

1. The main determiners of the economic growth

The economic growth is usually considered to be as the expansion of the production or of the potential GDP of a country. So, an economic growth takes place only when the curve of the production probabilities of a nation moves to the exterior. The nations consider the economic growth as an essential economic and political objective. A resembling concept is the rhythm of growth of the production per capita, because it determines the rhythm of growth of the living standard.

The economic growth is not the same everywhere but all the countries which have registered a fast development present some common characteristics. The process of growth or economic development lies on the same essential factors, as it follows:

a) Human resources. The economists consider that the most important element of the economic growth is the quality of the entrances from the labor factor: the aptitudes, the knowledge and the discipline of the labor force. In the international economy, any other element which is involved in the production process (investments goods, raw materials, technology) may be purchased or borrowed. The modern investment goods which are bought may be used and efficiently maintained only by qualified and well prepared workers. The improvement in education, health and discipline and the possibility to use computers contribute to a great extent to the growth of the labor productivity;

b) *Natural resources.* These resources and especially the land represent the second traditional productive factor. In this category there is also the arable land, petrol fields and gases, forests, water and mineral resources. It is obvious the fact that lately the countries rich in petrol have obtained very high incomes only because of the respective reserves. The petrol productive countries are an exception; having natural resources does not necessarily mean or determine the success or failure of a country in the global economy; many countries which do not have natural resources have developed and focused on the sectors which involve more labor and capital;

c) *Capital formation* The workers from the rich countries manipulate a higher capital volume and as a consequence they are more productive. The capital accumulation presupposes the sacrifice of the current consumption for many years. The countries which are rapidly developed tend to invest very much in new investment goods (a percentage of 10-20% from the income enters in the process of capital formation). Capital does not only mean fabrics and computers. Many investments are made only by the state; these form the frame for the development of a strong private sector; they are general social capital investments, and they constitute very important projects which have to be accomplished so that the economic and commercial activity could take place (roads, irrigation systems, and railways, health care). Such investments tend to be invisible or global and to have higher rates. But these projects generate sometimes economies or external effects which the private companies cannot control; the task to carry out such investments goes to the government;

d) *Technical progress and innovation.* Technology is very important for the economic growth. The economic growth is not just a repetitive process of adding productive factors which resemble with the already existing ones; one can rather say that the substantial improvement of the production capacities of the prosperous nations is the result of an unending stage of investments or technical laps. The technical progress reflects the changes from the production process or the introduction of new products so that one could obtain a production which is superior from a qualitative and quantitative point of view to the consumption of the same entrance. The technologies register progresses which are mostly unnoticed; the small improvements which appear in the production process contribute to the improvement of the quality or to the growth of the volume of production. The economists have been very preoccupied with the way in which the technical progress may be encouraged. The technological changes are not just a simple mechanical procedure of finding new products or better processes. The fast innovation implies the promotion of the entrepreneurial spirit. [Samuelson Paul, Nordhaus William, 2000].

2. Theories regarding the economic growth

The world is practically in favor of the economic growth. There are some differences related to the proper way of accomplishing this objective. Some economists and economic decisive factors focus on the capital investments; other rely on the stimulation of the research and development activity and that of the technical progress; a third category sustains the role of the well prepared labor force.

We think that it is useful the analysis of the theories of economic growth which offer clues regarding the metrical forces of this process.

a) *The classical dynamics of A. Smith and Th. Malthus.* The two pioneers from economics have pointed out the essential role of the land in the process of economic growth. Smith presented the basic elements for the economic growth in “The Wealth of Nations” (1776).

He started from a hypothetical idyllic epoch when the land was free for everybody and where the capital accumulation did not matter (that primary state of the things which precedes both the function of land and the capital accumulation). In such an epoch, people take into their possession very large surfaces of land as the population is growing; the natural production is doubled as the population doubles because there is no capital.

The wages seize the whole national income because the ground rent must not be paid for land and the interest for capital. The real wage per worker remains the same in time because the production grows in the same rhythm with the population. [Smith Adam, 1962].

But this epoch could not last forever. The land is being occupied as the population grows. After the disappearance of the free grounds the balanced growth of the land, work and production is not possible any more.

The land becomes not enough any more; so the ground rent appear and rationalizes its use. The population continues to grow and such the national production. The production growth is inferior to the population growth because each worker uses a smaller ground surface; the law of diminishing returns comes into force.

The growth of the labor-land report leads to the diminishment of the marginal labor product and as a consequence to the decrease of the real salary; a conflict of interests appears between the classes – by the growth of the ground rent, landowners earn after the labor force owners.

Malthus thought that the pressure exerted by population will lead the economy to a point where the workers reach the maximum level for subsistence; when the salary goes below the resistance level the population decreases because of the morbidity growth. The population is doomed to a brutal, ugly and short life standard [Malthus Thomas]. This gloomy picture led to the appreciation that economics is a depressing science.

b) *the economic growth through the capital accumulation: the neoclassical model* Malthus's prediction proved to be unreal because it did not take into account the fact that the technological innovation and the capital investments can make the law of the diminishing returns invalid. The predominant factor of the economic development became the capital accumulation and the new technologies – the land did not become the factor which is able to limit the production [Solow Robert, 1956].

The neoclassical model serves as a basic instrument for misunderstanding the process of economic growth in the developed states. The neoclassical theory focused on the determining factors of the technical progress is also called the endogenous economic growth. The solution proposed by this theory, both for the solution of the theoretical problems but also for the solution of the practical problems, is the modification of the production function so that it could afford an economic growth which is self-supporting: endogenous.

The pattern leaves from the premises that the production is homogenous, being the result of two types of entrances: capital and labor. The labor force is influenced by the non-economical variables. One presupposes that the economy is competitive and that it operates under maximum employment circumstances.

The most important new elements of the neoclassical pattern are the capital and the technical progress. For the simplification one has to consider a single type of capital goods (K). The aggregate capital can be measured with the help of the total quantity of capital goods.

If we say that the number of workers is L , then the report K/L represents the quantity of capital per worker (k) that is the capital-labor report. The economists point out the need for the intensive capital growth that is the process by which the capital volume per worker grows.

For a certain technological stage, a fast rhythm of the investments leads to the diminishment of the capital return. Moreover the salary tariffs tend to grow because the marginal product of each worker grows.

In the absence of the technological progress the instensieve capital growth determines the growth of the production per worker, of the marginal labor product and of the salaries, but also the diminishment of the capital return and implicitly the decrease of its return rate. In order to analyze the effects of the accumulation, the graphic from figure 1 is used.

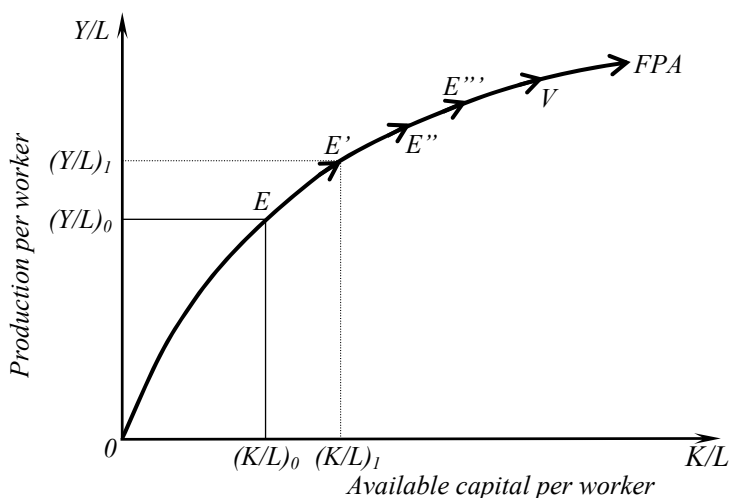


Fig. 1: The effects of the accumulation on the economic growth (the economic growth seen through the intensive capital growth)

The curve from the figure represents the function of the aggregate production (FPA) - and shows the production of each worker according to the available capital. The land, the natural resources and the available technology do not appear in the figure because they are considered constant for the moment.

As the capital per worker grows (accumulation), the economy moves to the superior part of the FPA curve. When the capital-labor report is moving from $(K/L)_0$ to $(K/L)_1$, the production per worker grows from $(Y/L)_0$ to $(Y/L)_1$.

When the capital grows intensively the return are decreasing and for this reason the return rate of the capital and the real interest rate are decreasing; the marginal productivity of the workers grows and the real salary tariff. If for various reasons, the capital volume per worker decreases, the effects are reverse.

On a long term, in the absence of the technological progress, the economy will enter a stability state where the capital is no longer growing, the real salaries are also not growing and the capital return and the real rates of the interest remain the same. The incomes and the salaries come to a stop – but the situation is much better then Malthus had imagined.

The neoclassical pattern shows that if the economic decrease is based only on the capital accumulation, the living standard will stop growing. The real salaries have stopped to grow in the last century, which shows the essential role of the technical progress which makes that the function of the aggregate production to move upwards (figure 2).

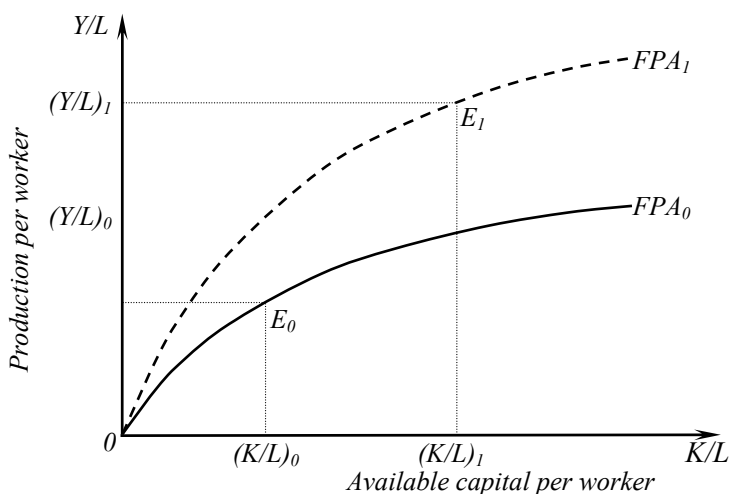


Fig. 2: The effect of the technical progress on the economic growth

So, it is necessary that besides the intensive capital growth, the technical progress should be taken into consideration. The economy is not stable but registers a process of growth of the production per worker, of the salaries and of the living standard. The impact of the technology change is very important on the profit rate and the real rate of the interests. Due to the technical progress, the real rate of the interests is not decreasing. The investments increase the productivity of the capital and counteract on the tendency of diminishment of the profit rate. [Samuelson Paul, Nordhaus William, Startz Richard, 2007].

3. The endogenous economic growth

The stationary state intervenes in the intersection point between the curves of saving and the need for investment (figure 3).

While the savings line is above the necessary of investments, the economy is growing because there is a capital accumulation. Starting from point A, the economy is moving in time to the right. The production function and the parallel curve of savings will grow because of the descending marginal product of the capital. The intersection of the investments line is also guaranteed with the savings curve due to the fact that the required investment line has a positive constant line.

In figure 4 there is a change in the presupposed production function in order to outline a constant marginal product of the capital. The production function, as the parallel savings function is a straight line. When the savings function does not become flat, the savings are higher than the necessary of investment.

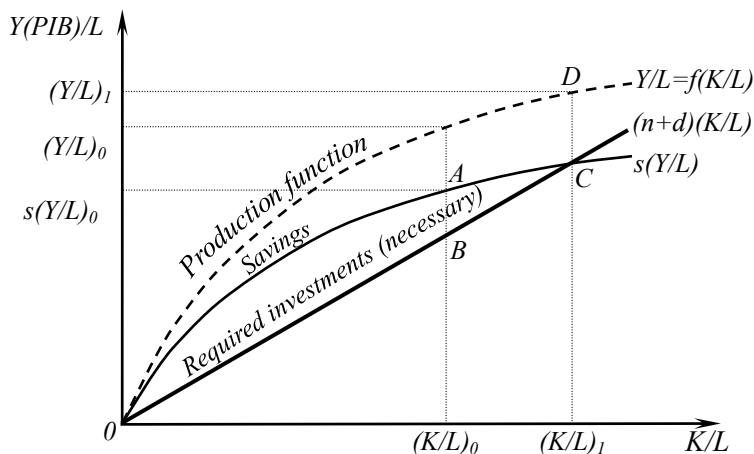


Fig. 3: The stationary state of the economy (the neoclassical Solow model)

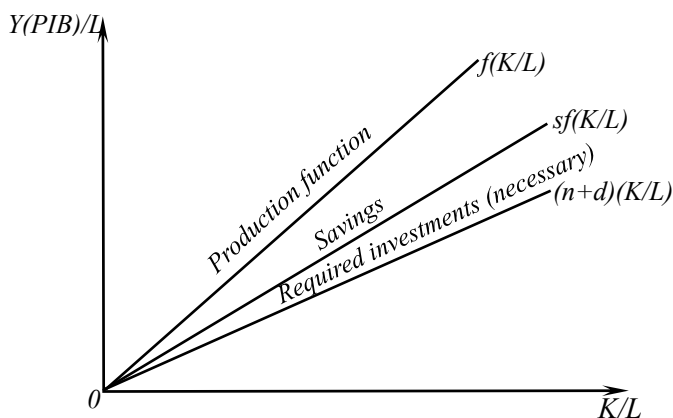


Fig. 4: Graphic of the endogenous economic growth

The disparity between the savings and the required investments is as higher and the economic growth rate is faster as the savings rate is higher.

The open economy from this figure can be shown with the help of a simple algebra model, which leads to the endogenous economic growth. One considers a production function with a constant marginal product of the capital and with the capital as being the single productive factor: $Y=a \times K$. This means that the output is proportional with the basic capital. The marginal product of the capital is just the constant a . It is thought that the savings rate is constant and equal with s , and that the population does not grow and the capital does not depreciate; the saving contributes to the growth of the fix capital. As a consequence $\Delta K=sY=saK$, where: $\Delta K/K=sa$. The capital growth rate is proportional with the savings rate. The output in its turn is proportional with the capital: $\Delta Y/Y=sa$. The higher the savings rate is, the higher the production rate is.

So, it was thought for a certain period of time (30 years) that the simple modification of the form of the production function may offer a satisfying solution, a very simplified one of the problems discussed in the neoclassical theory regarding the economic growth. This is due to the fact that the elimination of the marginal descending returns is against the macroeconomic principles.

The modified presumption implies constant scale returns of the capital. If increasing the capital means the proportional growth of the production, then supporting all the productive factors means higher and more consistent growth of the production. If there are constant scales returns only obtained from the capital, then there will be ascending scale return resulted from all the productive factors.

This means that as the firms develop, they become more and more efficient, so that one firm may dominate the entire economy. Because this does not have to happen, one has to ignore the possibility of some constant scale return s, in the case of all the factors involved and the possibility of ac constant scale return for a single factor, at elast at the level of an single firm.

No company that is alone manages to take hold of all the advantages given by the capital; all these companies will benefit from some advantages even if they are not increasing their capital. If the private benefit offers constant return for all the factors, there will be no monopoly tendencies.

The approach partially separates the private capital benefits from the social benefits. The endogenous growth theory is focused on the fact that there are external benefits (advantages) of the capital. The presumption may be reasonable if one takes into consideration only the technical capital (the companies also use human capital which produces ideas for a relatively lower cost than the cost of the technical capital).

A developed model of economic endogenous growth includes both the capital and the labor. The key presumption is that a better technology can be obtained as a sub-product of the capital investment. It is thought that the technology is proportional with the capital per worker: $A = \alpha(K/L) = \alpha k$, and that this technology generate the labor growth, so that the production function may be written under the form: $Y = f(K, AL)$ –the marginal capital product per worker (α) and regulates the way in which the capital is combined with labor in order to produce technology (A). The technological growth depends on the capital growth per worker $\Delta A/A = \Delta K/K - \Delta L/L = \Delta k/k$.

The algebraic approach involves two stages. In the first stage it is considered that the production and the capital are growing in equal rates, from where it results that the capital return (v/k) is a constant. In the second stage, this hypothesis is used in order to retroactively settle the economic growth rates.

According to the neoclassical theory, the growth rate of the production (GDP on the whole) is: $\Delta y/y = \theta \Delta k/k + (1 - \theta) \cdot \Delta A/A$, where θ = the production rate owed to the capital. The technological growth formula is substituted in order to show that the production and the capital per worker (y , k) are growing with the same rate: $\Delta y/y = \theta \Delta k/k + (1 - \theta) \cdot \Delta k/k \Rightarrow \Delta y/y = \Delta k/k$.

The y/k report is constant because the numerator and the denominator grow in equal rates. The production function is divided to K and it results: $y/k = f(K, AL)/K = f(K/K, AL/K) = f(1, \alpha) \equiv \alpha$. Knowing the equation for the capital accumulation may be also written under the form: $\Delta k/k = sy/k - (n+d)$, is substituted by y/k and it results: $\Delta y/y = \Delta k/k = g = sy/k - (n+d) = sa - (n+d)$. The GDP growth rate per capita is $sa - (n+d)$.

A high savings rate generates a high rate of economic growth. The high growth rate of the population and of the capital depreciation leads to a low rate of economic growth. The problem of the determining factors of the technical progress is highly important for the weak developed states [Dornbusch Rudiger, Fisher Stanley, Startz Richard, 2007].

4. The Economic Growth Policy

One of the oldest theories from the economic sciences is that according to which the population growth acts against the accomplishment of some high incomes [Malthus Thomas].

The Solow model regarding the economic growth leads to the prediction that a high population growth (n) means lower income under the stationary circumstances, because each worker has a smaller capital. If one takes into consideration a wide range of incomes, the population growth depends on the income.

In the modern era, the poor countries have high birth rates and also high morbidity rates which leads to a higher demographic growth. As the incomes grow, the morbidity rate diminishes (especially the diminishment of the infantile morbidity), and the growth of the population is smaller. When the incomes are very high, the birth rate decreases – many wealthy countries register a birth rate which is close to zero.

If one draws a graphic of the population growth rate in relation with the income, according to the simple Solow model, with an endogenous increase of the population, this will go up and down, so that in the end it comes near to zero. The line corresponding to the required investments depends on the population growth but when the population growth is not constant any more, the line of the required investments becomes a curve.

The line of the required investments is modified in order to represent the modification of population growth. The line of the required investments, including a variable population growth $[n(y)+d/k]$, goes up slowly then abruptly and then it becomes flat. The line of the required investments is crossing with the savings curve in three points. The first point (the lowest) is the poverty threshold characterized by a high population growth and low incomes. The balance from the last point (the third) is characterized by the low population growth and high incomes. The two extreme points (the first and the third) are called stable balance points, because the economy is moving towards these. The second point is as an unstable balance point because the economy is moving away from this.

In order to overcome the low balance stage there are two possibilities. If the economy can accomplish a fast acceleration which should bring the income above the unstable balance point, than it will continue its road until it reaches a higher balance level. As an alternative a nation can leave out for good the low threshold by moving the savings curve upwards or by moving the required investments downwards, so that they are not able to cross each other in the low level balance point and in the unstable balance point. One can reach to an ascending line of the savings by growing the productivity or the savings rate.

The control policies for the population growth lead to the diminishment of the required investments. There are some governments which start to recognize the necessity of reducing the demographic growth – by using birth control methods or even forced sterilization methods.

The economic success of the so-called “Asian tigers” (Hong Kong, Singapore, South Korea and Taiwan) is due not only to the growth of the total productivity (the output growth on the input unity), but also to the savings and investments, and drawing as many workers as possible (especially women), improving the education in order to increase the human capital. The fact that this thing can be accomplished also through some ways which are thought to be old-fashioned (savings, sustained labor and competition) generate hopes.

One can think that it is a problem if the high incomes represent a positive fact. The interest for high investments is justified as these lead to a high consumption. The higher the savings rate is for the ones from the society, the higher the capital per worker (k) is, than the higher the required investments are in order to maintain the coefficient or the capital-labor report. As a consequence, a too higher savings rate may lead to a high income level but, at the same time a low consumption.

The consumption per capita corresponding to the stationary state (c^*) is equal with the income per capita (worker) corresponding to the stationary state [$y^*=f(k^*)$] minus the stationary state investment [$(n+d) \cdot k^*$], respectively: $c^*=f(k^*)-(n+d) \cdot k^*$ or $(C/L)^*=f(K/L)^*-(n+d) \cdot (K/L)^*$. The corresponding consumption for the stationary state is maximized in the point where a marginal growth of the capital produces additional output so that it could cover the necessary of investment: $MPK(k^{**})=(n+d)$.

The capital k^{**} the golden rule of the fixed capital corresponds to the highest level of consumption which it can sustain. One can deal with the consumption and the savings above the golden rule, both presently but also later in time. The future consumption may grow under the golden rule. [Dornbusch Rudiger, Fisher Stanley, Startz Richard, 2007].

5. Calculating the economic growth

The economic growth is due to growth of the volume and of the productivity of the used factors which is conditioned by the level of technology and the degree of qualification of the labor force.

The two sources of the economic growth may be studied with the help of the production factors – the production function is a quantitative connection between the entrances (factors, resources) and output (production, income). It is said that in order to make all the things simpler, the single important inputs are the work (L) and the capital (K). The relation $Y=A \cdot f(K,L)$ shows that the output (Y) depends on the inputs and on the technological level (A) – it is said that A represents the technological level, because at a given level of the entrances, Y is as higher as A is; A is sometimes called productivity, which is a more neutral term than technology.

Higher inputs mean higher outputs. The marginal labor product (MLP) and the marginal capital product (MCP) are positive. The presented equation correlates the level of the outputs with the levels of the inputs and the technological level. Currently it is easier to work with the growth rates, than with the growth levels. The production function from the respective equation may be transformed in a very special correlation between the growth of the inputs and the growth of the outputs.

This is synthesized through the calculation equation of the economic growth: $\Delta Y/Y = \theta \Delta K/K + (1-\theta) \cdot \Delta L/L + \Delta A/A$, where θ = the percentage of the income owed to the capital. This last equation shows the contribution to the growth of the output, that of the factors and the growth of the productivity (efficiency): labor and capital contribute in an equal part with the growth rate of the respective factor multiplied with its marginal productivity; the rate of the technological improvement (also called technical progress or the growth of the productivity of the factors (represents the third term of the equation).

The growth rate of the total productivity of the factors is the value which is supposed to grow Y as a result of improving the production methods, when all the other inputs remain unchanged. In other words, there is a growth of the total production of the factors, when more profit can be obtained from the same productive factors. The

analysis may be continued with the help of the production function Cobb-Douglas $AK^\theta L^{1-\theta}$. Economists prefer the Cobb-Douglas function because it describes exactly the economy and they can work very easy with the algebraic instruments.

It is thought that is much more correctly to calculate the economic growth in output terms (Y- production, income) per capita, rather than in total output terms. The GDP per capita is the report between the GDP and the number of inhabitants. The income per capita (v) is equal with the report between the total result (Y) and the number of inhabitants (P), that is: $y \equiv Y/P$, and the capital per inhabitant (K) is equal with the report between the total capital (K) and the number of inhabitants (P), respectively: $k \equiv K/P$. The GDP growth rate is equal with the GDP per capita growth rate of the population: $\Delta Y/Y = \Delta y/y + \Delta P/P$, and $\Delta K/K = \Delta k/k + \Delta P/P$.

In order to transpose the calculation equation of the economic growth per capita one has to subtract the population growth from both equation terms of calculation the economic growth and these terms are reorganized $\Delta Y/Y - \Delta P/P = \theta(\Delta K/K - \Delta P/P) + \Delta A/A$. If we refer to the inhabitants, this equation is as it follows: $\Delta y/y = \theta \Delta k/k + \Delta A/A$. The capital-work coefficient (k) is the key determinant for the value of the result per worker.

BIBLIOGRAPHICAL REFERENCES

1. Dornbusch Rudiger, Fisher Stanley, Startz Richard, (2007), *Macroeconomy*, Economică Publishing House, Bucharest;
2. Malthus Thomas, *An Essay on the Principle of Population; or A View of its Past and Present Effects on Human Happiness*, 6th edition (published for the first time in London in 1826, by John Murray, Albemarle Street);
3. Samuelson Paul, Nordhaus William, (2000), *Political economy*, TEORA Publishing House, Bucharest;
4. Smith Adam, (1962), *The Wealth of Nations*, vol. I, Academiei României Publishing House, Bucharest;
5. Solow Robert, (1956), *A Contribution to the Theory of Economic Growth*, Quaterly Journal of Economics.