An Alternative Growth Model

H. Gürak

www.hasmendi.net

hasmendi@gmail.com

2006

Abstract

It is the intention of this work to present an "alternative" long-run growth model based on a key concept named "qualifications of labor(-er)". We shall encounter this concept, qualifications of labor(-er), in every aspect and degree of the investigation of long-run growth analysis.

To put it more properly, given the gifts of nature, the "creative mental labor" appears to be the sole and everlasting genesis of all long-run economic growth. Technological advances, which are the indispensable ingredients of all long-run growth, are, in fact, the products of "creative mental labor". Efficient use of the technologies is also a rather essential factor.

Contents

Introduction **1**

Labor(-er), technological progress and growth **3**

The genesis of growth: qualifications of labor(-er) **5**

Is it likely to measure the qualifications of labor(-er)? 8

Productive factors and production factors (inputs) 10

Output, exchange and distribution in a "stationary" economy **12**

Barter-exchange and growth: 1-a **14**

Growth function 16

Barter-exchange and growth: 1-b **16**

Limits of growth 17

Barter-exchange and growth -2 .... **18**

Assuming access to "new markets" for the "new product" 18

Growth process in actual economies **20**

1- Growth without technological change: "given" technology 20

2- Growth with "technological progress": 22

Growth-reconsidered (both short- and long-run) 26

Conclusions **27**

References **28**

Introduction

The content of this paper is acquired from the book titled "Economic Growth and Global Economy", Chapter-5. In that book, the analysis of economic growth commences with the critical analysis of Classical period economists like A. Smith, Ricardo and Marx, continues with evaluation of works of some 20. Century well-known economists like Marshall, Keynes, Schumpeter, Harrod-Domar, and ends with critical presentation of works of Neoclassical heritage, including the so-called endogenous growth theories. An attempt shall be made, in this work, to construct an alternative theory of growth in order to make a contribution to the economic growth analysis.

As commonly well-known, the relations between labor(-er) and value-production, on the top of agenda of priorities in economic research for economists of Classical period. At that time, technological progress used to play an important role in their dynamic analysis and was treated as an endogenous factor. But, in spite of its important role assigned to it in economic analysis, the Classical economists failed to construct satisfactory growth models displaying the inter-relation between technological progress and economic growth.

After 1870s, the dynamic economic growth analysis began to be replaced by "static equilibrium" analysis of Marginalist and Neoclassical doctrines. The new aim of the new doctrines was to find the ways and means to bring economies into equilibrium. Leaving aside the attempts of Schumpeter in 1930s and 1940s re-emphasizing the importance of technological advances in economic growth, the dominant economic growth models of Neoclassical heritage were completely ignorant of them, until the appearance of Solow's contributions in 1950s. In other words, the economists of Neoclassical heritage had no idea at all on the impact of technological changes and how they affected the course of economic progress, at least not in their models.

The advocates of Neoclassical doctrine "rediscovered" technological progress and their imminent role they played, thanks to Solow. In analogy, they were rather cheerful after finding the dog, which was lost by them. After his "striking" rediscovery, Solow was awarded the Nobel Prize. However, Solow had some problems with the origin of technological progress and could not explain how it emerged within the system. But, he found an ingenious solution to this problem by declaring technological progresses as "exogenous" to the system.

They were being produced outside by non-economic factors and being introduced into the economic system "manna from heaven", thus making the amazing impacts on economic growth.

In spite of all the shortages of new theory, the interest on dynamic growth and technological progress increased sharply among economists, thanks to Solow's "re-discovery". Later, economists "re-discovered" the crucial role played by the qualities of labor(-er), e.g., human capital, as well. In 1980s, new equilibrium models called "endogenous" economic growth models began to emerge, which regarded technological progress as deliberate and conscious consequence of economic decisions. However, they all had many serious shortcomings in fully explaining the actual economic growth process, as indicated in the book titled "Economic Growth and Global Economy", by Gürak (2006). There seems to be no single economic growth model on which the economists have consensus, yet. There seems to be still a need and scope for further development of long-run economic growth analysis and that is why this work is being written. The shortcomings of the prevailing theories are the main cause for its emergence.

It is the intention of this work to present an "alternative" long-run growth model based on a key concept named "qualifications of labor(-er)". We shall encounter this concept, qualifications of labor(-er), in every aspect and degree of the investigation of long-run growth analysis. To put it more properly, given the gifts of nature, the "creative mental labor" appears to be the sole and everlasting genesis of all long-run economic growth. Technological advances, which are the indispensable ingredients of all long-run growth, are, in fact, the products of "creative mental labor". Efficient use of the technologies is also a rather essential factor, but, its efficiency is also related to "mental labor". The qualities of labor(-er) can be divided into two general groups:

1- Technology-producing labor(-er);
2- Technology-using labor(-er).

The technology-producing "creative mental labor(-er)" precedes the latter in importance in conjunction with long-run economic growth.

The probability of acknowledgement of an alternative growth analysis as presented in this work is not high, especially by the proponents of Neoclassical doctrine with equilibrium analysis. And some economists may consider that: Why should we bother with an alternative of unknown economist while there are plenty of works of well-known economists? They might have a point. But, if the economists decide to be open-minded and leave aside their subjective values of their committed doctrines for a short while and this alternative work with some degree, say not more than 10 percent, of objectivity and tolerance granted to

Solow's well-known articles, which study only the short-run growth analysis and embody many serious shortcomings, they may encounter some "logical, consistent as well as explanatory" things.

Labor(-er), technological progress and growth

Evaluating in retrospect, one observes that the economic growth analysis of Classical period economists were quantitatively as well as qualitatively less sophisticated. But, nevertheless, they seem to be more useful to grasp the actual economic relations compared to the contemporary Neoclassical analysis. For instance, the crucial importance of technological progress "rediscovered" by the Neoclassical economists in 1950s, were already existent in the analysis of Classical period economists as an "endogenous" factor. The same applies for the concept and role of human capital, or rather the "qualifications[1] of labor(-er)", which also was rediscovered in 1950s by Neoclassicals. Yet, for about 225 years ago, Adam Smith had written about the importance of education of labor force for the output and advocated that the children of poor families should have access to free education. At that time, there was no talk of a social state at all. Although technological progress was regarded as an "endogenous" process, being driven by internal forces, the Classical period economists had, unfortunately, failed to construct a coherent theory on long-run sustainable economic growth based on creative mental labor(-er) and technological progresses.

After 1870s, a ideological process of transforming what then was called "political economy" was initiated in order to pave the pay for a "pure scientific" economic analysis, as in the natural sciences like astronomy, free of any humanitarian subjective values, which increased progressively in mathematical sophistication in time. But this process also caused many serious deviations from the actual economics as it was taking place, in favor of some utopian facts and economic relations. All the historical developments, institutions and the cultural-political relations, personal values had suddenly lost all their importance. Instead, the new emphasis was on how to "static equilibrium", which actually never took place and never seem to take place in future, in reality.

As a result, the Neoclassical ideology gained increasing attention and respect in time, and acquired global, not universal as the theory claims, recognition. Meanwhile, an economist named Keynes succeeded in shaking the foundation stones of Neoclassical theory after 1938, regarding the basic issues such as full-employment and automatic equilibrium if everything was left to market

1The concept "**qualification**" of labor refers to the education/training, talents, skills and experience possessed by laborer. Synonymously, it is "**human capital**" in a wider sense of meaning.

forces. But the fundamental concept of long-run equilibrium was unchallenged. In fact, Keynes was attempting to show the path to long-run static equilibrium. Since the main focus was on acquiring equilibrium, the Keynesian theory had nothing at all to say about the long-run growth. If it contained anything about growth, it was only until the point of equilibrium. But what then? Does such a short-run equilibrium theory, which have nothing to say about human capital and technological progress, deserve to be called globally applicable?

Actually, it seems to be more appropriate to regard the Keynes' analysis as a "different version" of the Neoclassical static equilibrium theory. Keynes had never objected to the concept of static equilibrium and had nothing to say about long-run developments. He had mentioned labor, but never made any reference to qualifications of labor(-er), that is human capital. And he saw no correlations between labor and technological progress, either. His theoretical criticism of the Neoclassical doctrine was not unjustified regarding employment and disequilibrium in his analysis. But Keynes had nothing new to say regarding the political measures to intervene in the market to reduce unemployment. At the time of publication of his book, the states in Europe and USA were already implementing some policy measures to tackle with the widespread unemployment problem. In other words, the so called "Keynesian policies" to increase employment and output were already being practiced in several parts of the world, long before Keynes mentioned them in his book. Some economists claim that the Golden Age for application of Keynesian policies was in the post Second World War era until the oil crises that is between 1945 and 1973. But this is not correct either, for that period was not characterized by unemployment, but, on the contrary, by shortages of laborers, which led to mass "import" of laborers in Europe, Australia and New Zealand.

In fact, in order to be fare to Keynes, it would be proper to make a distinction between the theoretical thoughts of Keynes and those called Keynesians. Because, there are, sometimes, considerable differences between them. As mentioned above, at the time Keynes' book was published, some countries were already applying so called "Keynesian policies", implying government intervention to eliminate unemployment. Keynes' book meant an important theoretical contribution to Neoclassical equilibrium analysis; but its practical contribution in actual economy is not that certain. In short, the contributions of Keynes and the so called Keynesian, including New-, Neo-, Post- and others, ought to be analyzed and evaluated on their own merits separately.

As to the prevailing Neoclassical ideology; in spite of the fact that it basically preserves the same origin and do not seem to have diverged from the original main path based on equilibrium, it seems to have been hit hardest by the proponents of ideology like Solow and many others, with their approaches based on issues like technological progress and qualifications of labor(-er). Until the study of the causes of growth by Solow in the 1950s, the focus of economic analysis was on the business cycles and restoring equilibrium, which, in fact, never came to existence. From 1870s on until 1950s, for about 80 years, the level of output was assumed to be determined by the level of employment of two factors of production, labor and capital. Rediscovery of the technological progresses on the growth of had caused the production function to change, followed by another rediscovery, the human capital. In other words, the original production function of Neoclassical doctrine, P=f(K,L), first became P=f(K,L,A), and then P=f(K,L,A,H). But, the ignorance or overlooking of the facts that L and H are, in principle, the same thing, two sides of the same medallion, and that A originates from "creative mental L" and is embodied knowledge in physical form in the means of production, and the organic relations between L,H,A and K, inevitably led to many analytical misconceptions, misperceptions and miscalculation. Since 1980s, many attempt have taken place to indigenize the technological progresses and human capital in the so called "endogenous growth models". A lot of progress has been made, but there still seems to be a wide scope and need for the further development of growth theory.

The genesis of growth: qualifications of labor(-er)

The purpose of this work is to make a contribution to the theory of growth by presenting a "simple" growth model based on "creative mental labor" and "technological developments". The gifts of the nature, e.g., raw-materials, and their market-values are assumed given. By hypothesis, the genesis of all value-added to the prevailing market-values of raw-materials, thus the source of incessant growth of output and riches of nations, is labor, or rather, the qualifications of labor(-er). With the application of technologies in production process, which are the products of mental labor(-er), the gifts of nature (raw-materials) are transformed into useful products either as tools of or intermediary inputs or consumption goods. To put it differently, the technologies produced by labor(-er) are used to produce output either for production or final consumption. When new technologies are embodied in the tools of production, they may either help to increase the per unit time productivity of employees, or introduce new products. Thus, the concept of marginal productivity of capital (-goods) is nothing but a fallacy.

In the following part, the concept of labor(-er) shall be categorized under four headings, in order to get a clearer insight into its contribution to growth process:

1- Physical labor(-er) (L^b).

2- "Creative" mental labor(-er) (L^y).

3- Technology using labor(-er) of various qualities (L^k).

4- Labor(-er)'s qualifications consisting of L^b, L^y and $L^{k'}$, (L^n or simply L).

Physical labor refers to all kinds of basic physical activities such as walking, drinking, holding, etc. Such activities are quite similar to those made by other living beings in order to survive in nature. Such activities can be initiated by the basic instincts. But, nevertheless, the control center of all kinds' activities is the brain, and in the absence of mental instructions, the living beings could not survive. Even the most basic activities are initiated by the instructions from brain. Therefore, there is always some degree of mental contribution involved at every stage of existence. The concept physical labor, in our case, implies simply carrying out of instructions, or basic co-ordination of physical organs.

"Creative" or "productive" labor is the source of all value-adding creative activities and changes, involving activities beyond the basic instructions from brain. In modern societies, the creative labor(-er) is, in general, employed in the R&D departments in search of new ideas. Research funds are normally employed to finance in the creation and development of either new products or new production methods to produce the available goods/services at lower cost. Naturally, not only highly educated, but also some labor(-er) with lower formal education can contribute to the creation of new ideas. One way or another, the new ideas or knowledge required to raise the productivity per unit time employed and the standards of living is always created by the creative mind of human beings. Accordingly, all technological developments required to increase both individual and total productivity also initiate from the creative mind.

Technology using labor(-er) of various qualities: Those who produce new technologies and those who employ these technologies in production are, in general, not the same labor(-ers). There is always a need for qualified labor(-er) to efficiently employ the existing technologies. In other words, the degree of utility of a technology depends on the qualities of existing labor-force. For instance, if the labor force is not properly equipped with the necessary knowledge for efficient production, it would be impossible to produce, say, airplanes or automobiles. Therefore, the qualities of the labor force are rather important for the efficient production and total wealth of the society, along with the labor(-ers) with creative mind.

Qualifications of labor(-er) (L^n): As mentioned before, in no part of the world, there is a labor-force without some degree of qualifications (without any form of education, training, skills) consisting only of purely physical labor(-ers). In real life, every individual's labor possesses some degree qualifications that is human capital. Therefore, it would be a serious error to categorize the laborers in accordance with an artificial division as qualified and unqualified. This error will not be repeated in this work, unless in exceptional cases. The letter $\mathbf{L^n}$ or simply **L**, shall refer to the physical as well as mental capabilities.

There are four basic factors determining the degree of qualifications of labor(-er)[2] and its productivity[3]:

1- Individual's "natural" capabilities/talents.

2- General level of knowledge of society.

3- Formal-informal education.

4- Experience or learning-by-doing.

Any degree of increase in any one of the factors mentioned above would raise the qualifications of labor(-er), as well. Every capable individual enjoys certain capabilities. In other words, every individual possesses certain degrees of the four factors stated above. At least, there would be some capabilities acquired through informal education from the family and environment in a modern society. The acquisition of some faculties in advanced societies would be more visible as almost every individual attends the school for at least 12 years. Therefore, the claim that every individual possesses some degree of qualifications (human capital) is not easy to challenge. Due to this fact, it would be more appropriate to talk about the different qualities of labor(-ers) rather than drawing a distinct line as qualified and unqualified labor-force.

There is a rather close relation between the level of labor(-er)'s qualifications and the level of standard in a country. The higher the level of qualifications of labor(-er), the higher would be the expected individual or total level of wealth. On the other side, regardless of the level of individual capabilities, if the nation's general development level is below the global contemporary level, productivity per unit time employed would be expected to be lower than the global standard. To put it differently, the level of qualities and productivity of a nation is closely related to the general level of knowledge accumulated and qualities of labor(-er). As mentioned before, the creative mental labor is the genesis of all value-added and wealth, but the level of productivity (efficient

2 General level of knowledge, skills, talent and experience (human capital) of labor(-er).

3 The institutional and cultural infrastructure play an important role in the development of labor(-er)'s quality, which shall be assumed to be at a level required for contemporary production relations.

application of technologies in production, depends on the level of qualities of labor(-er).

The impact of experience, importance of which seems to be underestimated, is also significant to the development of mental capabilities and thus to value generation. For experience, which is acquired in time through practice at work, plays an important role in the accumulation of skills and knowledge as well as in productivity growth. It is not infrequently observed in practice that productivity growth due to experience exceeds productivity growth due to formal education.

Experience is, in fact, the same thing as learning-by-doing according to common terminology. In his third model, for instance, Lucas (1988) the necessary capabilities for production are acquired through the learning-by-doing process. It increases as the hours spent at work increases. Assume that the workers accumulate sufficient technical skills in 6 months to maximize the output with a given technology. Workers are so specialized at practicing the job, the cost of production is minimized and output maximized. Per unit time productivity increases with increasing experience, along with ability to develop new technologies, given the technology.

Experience is at least as important in the service sector as in the goods producing sectors. For instance, the thoughts of an experienced worker in service sector in deciding on a strategically important issue can be extremely vital. More experienced individuals are more likely to make wise and right decisions, which may have great impact on the present and future production relations. In similar fashion, a more experienced medical doctor, or a teacher or a security officer is more likely to be more productive at work.

Is it likely to measure the qualifications of labor(-er)?

Is it possible to measure the mental labor or the qualifications of labor(-er), which are of crucial importance regarding the output as well as output growth? If so, what should be the proper method of measurement? Would the outcome reflect the facts properly?

The issue of measurement bears great importance for many economists. In fact, according to many economists, if something is not measurable, it cannot be scientific. The intention to measure is rather logical; but the expectation to achieve some definite results is rather illogical in all social sciences. Four factors were put forward above as the factors affecting the qualifications of labor(-er), among which the mental labor was indicated as the incessant source of long-run growth. None of these factors can be measured properly and acquire accurate results.

Let us recall the four factors mentioned above one by one: Regarding the first, individuals are endowed with different kinds and degrees of **natural talents**. Some individuals possess talents for sports while some are talented in arts. And there is no way, at present or in future, to measure such varieties and degrees of talents in a proper manner to achieve accurate results.

The "general" level of knowledge varies from country to country. It would not be a surprising finding that there is a great gap in the amount of accumulated knowledge between Sweden and Ghana or Pakistan. Sweden has been closely following the scientific and technological developments in the past 200 hundred years, while at the same time attempting to establish the appropriate infra-structure. Nowadays, Sweden has many globally competitive firms employing the most advanced technologies, while Ghana and Pakistan seem to be a late-comer in the field. Due to the prevailing conditions in their countries, the individuals who grow up in those countries encounter rather different environments and development levels. Swedish citizens enjoy a wide range of facilities to learn about and to benefit from the contemporary advanced technologies, while individuals in others are not even aware of most of these developments. There is no method to measure such divergences and their influence to make accurate comparisons.

Formal-informal education/training: To measure the amount of human capital, the qualifications of labor(-er), some economists use the number of school-years attended. Certainly, this can be a method of measurement; but definitely not an accurate one. There can be and are considerable divergences in the qualities of education/training between countries say, for 9 years' formal education. It is also a well-known fact that the quality of formal education/training may vary considerably among the schools in a country, especially in the developing world. Therefore, the measurement of the human capital, qualifications of labor(-er), based on formal school-years attended criterion can never be accurate.

Regarding the informal education/training, the solution is not less cumbersome. There are no "school years" to count, nor any probability at sight to achieve better results than the former.

Experience: The measurement problem is not any better than in the previous cases. There is no method available to measure the experiences of individuals accurately. Each individual possesses varies degrees of knowledge and skills, which influences the accumulation of experience differently.

Let us recall the initial question in light of all these facts: Is it likely at all to be able to measure the qualifications of labor(-er) accurately, which is the incessant source of long-run economic growth? In order to give a positive answer to this question, one has to be either naïve or rather optimistic. The best likely outcome would be measuring some "probabilities" or "tendencies".

Productive factors and production factors (inputs)

There used to be two factors of production in the orthodox economic theories; labor, **L**, and capital, **K**. Due to developments in economic theories since 1950s, two factors are now added to original ones; technological change, **A**, and human capital, **H**. In this section of this work, the reader shall encounter with a different approach than the prevailing one. There are only "**two productive factors**" of production, but "**many production factors**".

Productive factors:

1- **Labor(-er) L**) (physical as well as mental).
2- **Nature** (entire ecological system

Production factors (inputs) of production:

The concept production factor, as used in this work, differs from the concept used in orthodox equilibrium theories; all required inputs of production are the factors of production. For instance, along with labor(-er) and capital (-goods), all raw-materials, energy used, buildings, tools, in short, every item necessary for aimed output are factors (inputs) of production. In contrast to the orthodox equilibrium theories, capital (-goods) are not assumed to be productive; but on the contrary, they are employed to increase the productivity of labor(-er) employed in production. The factors (inputs) of production are:

- Labor(-er).
- Raw-materials.
- Intermediaries (semi-finished goods).
- Energy inputs, water, etc..
- Capital goods (machinery, tools).
- Consultancy services.
- Post-production marketing and sale efforts.
- Transport-insurance.
- Administrative costs.
- And all other inputs required for output.

Factors (inputs) of production can be subdivided into two broad groups:

- Labor(-er) (**L**).
- Other inputs ($\mathbf{X}_i$).

"Productive" factors and value-creation:

There are only two productive factors; nature and labor(-er). Nature is productive in the sense that it is capable of supplying products with use-vales without any external intervention. These products range from directly consumable products such as vegetables, fruits to basic inputs of production transformed by labor. Productivity of the nature is closely associated with environmental conditions and the nature, generally, does not supply products, which are directly consumable, in modern societies. In order to be consumable contemporary products, they have to be "**transformed**" into "useful" products by labor(-er).

Only, and just only after being processed by labor(-er), the supplies of nature are transformed into products with "exchange-values".

The labor-time spent could range, from simple labor-time, say transporting the apples from garden to market place, to more complex labor-time with higher qualifications transforming apples into semi-finished or semi-finished products. For instance, the raw form of a chair is the tree, and it is transformed by labor into a useful product with "exchange-value". It is a common knowledge of physics that nothing in nature disappears completely and nothing is created without using available inputs; natural supplies only change forms by labor(-er). In other words, the nature supplies the basic inputs of all output and labor converts them into other shapes demanded for consumption. Assuming the supplies of nature as given, the source of all use-value and exchange-value is the labor(-er).

Following the same logic, an attempt will be made below to construct a simple growth model based on labor(-er). It will not be the aim of this simple model to give an exact account of the actual complex economic relations. But, rather, it shall function as a pioneer model to pave the way for following more realistic models. Therefore, the simple model shall serve the purpose. Because, the main purpose of the simple model is to show that the original source of all value created and of technological innovations is the labor(-er), or, rather, to be more specific, the mental labor. Therefore, the reader is asked to keep in mind that aspect of the model all the time.

Some basic assumptions:

1- The determinant factor of the long-run growth is technological progresses, which are a product of the creative mental labor, ($\mathbf{L^Y}$).

2- The nature, one of the "two productive factors", supplies the necessary inputs for production, while labor(-er) transforms them into useful products.

3- $\mathbf{L^n}$ or simply **L,** denotes the average labor(-er) endowed with certain degree of qualifications (human capital).

4- The level of general knowledge and development in a country determines the general level of labor-force qualifications, $\mathbf{L^n}$, which, in its turn, determines the level of labor(-er) productivity. $\mathbf{L^n}$ includes, in addition to physical labor $\mathbf{L^b}$, the mental labor $\mathbf{L^y}$, which creates new technologies and qualified labor(-er), $\mathbf{L^k}$, using the technology in production.

5- Let us denote the qualifications of average laborer in Turkey by $\mathbf{L^n_{TR}}$, and in EU by $\mathbf{L^n_{EU}}$. The present situation due to differences in qualifications can be shown as $\mathbf{L^n_{EU} > L^n_{TR}}$. Or, simply, as $\mathbf{L_{EU} > L_{TR}}$.

6- There are two countries or producers with equal quantity of labor-force (**TR,EU**). Further assume that the quantity of physical labor-time spent a day is equal in both countries ($\mathbf{L^b_{TR}=L^b_{EU}}$). Under these circumstances, the wage rate in both cases should be equal ($\mathbf{w_{TR}=w_{EU}}$).

However, the situation described above will change as soon as we take into account the differences in qualifications of labor-force. Assume that the average qualifications of labor-force in EU are better than in TR ($\mathbf{L^n_{EU} > L^n_{TR}}$). Naturally, the labor-force in EU would be more productive than the labor-force in TR and enjoy a higher wage rate ($\mathbf{w_{EU} > w_{TR}}$). The difference between the qualifications of labor-forces is due to relatively higher degree of accumulated knowledge in EU, better educated labor-force, and technological as well as institutional development level.

Output, exchange and distribution in a "stationary" economy

First of all, we shall consider a stationary economy in which "**only physical labor(-er)**" is employed and no growth takes place. The purpose is to analyze barter-exchange relations, along with individual and total consumption level, using the physical labor-time employed approach.

The qualified labor(-er) will be included in the following sections and its impact on growth will be analyzed. The structure of the model facilitates the study of income distribution together with growth.

Assumptions:

1- There are only two producers and two consumers, Leyla, **L** and Maria, **M**.
2- Only two products are produced and consumed; X_1 and X_2.
3- Tastes are the same.
4- No accumulation. All output is consumed at the same day of production.
5- No money. Barter-exchange takes place.
6- Only "physical labor" is used in production, L^b.

Since the creative mental labor, L^y, has not been introduced, yet, there are neither new technology, (**A**), developed nor any means-of-production (capital-goods), **K**, produced. Thus, there is no need for qualified labor, L^k, for the efficient employment of technologies.

Production function:

$$Q = f\,(L^b{}_L, L^b{}_M)$$

$L^b{}_L$, denotes Leyla's, and $L^b{}_M$ Maria's physical labor. Initially, both Leyla and Maria enjoy "the same qualifications" of physical nature ($L^b{}_L = L^b{}_M$). Each work 10 hours a day and produce two different products (X_1 and X_2). Leyla's daily output is 4 units of X_1 that of Maria's 2 units of X_2, and both have identical tastes and preferences. At the end of each day, they exchange products worth of 5 hours labor-time ($2\,X_1 = 1\,X_2$). The outcome is:

Leyla's output	$4\,X_1$	10 hours / day	
Maria's output	$2\,X_2$	10 hours / day	
Total output	$Q^T = q^L + q^M = 4\,X_1 + 2\,X_2 = 20$ hours / day		(1)
Leyla's consumption	$C^L = 2\,X_1 + 1\,X_2$		(2)
Maria's consumption	$C^M = 2\,X_1 + 1\,X_2$		(3)
Total consumption	$C_t^{L,M} = 4\,X_1 + 2\,X_2$		(4)

Both, Leyla and Maria, spend equal quantities of labor-time and, as a result, consume equal quantities. The exchange is "fair" in terms of labor-time employed and both enjoy equal quantity of utility.

In the absence of mental labor's contribution, which implies the absence of technological innovations, no growth would take place, for the production capacity and tastes are given. The existing system is capable of only maintaining the status quo of production and exchange relations. Equilibrium exists but there is no growth.

For growth to take place, both the output and consumption have to increase. For output to increase, there is need for the creative capabilities of mental labor, or, to put it differently, new technologies have to be introduced. There has to be either innovation introducing **a new production method for a "given" product**, or **entirely new products with new production methods**. In the following models, we shall assume that, given the product, **a new production method** increases the produced output.

Barter-exchange and growth: 1-a

Technological-productivity[4] growth:

Given product / new production method

Additional assumptions:

- By utilizing her "mental" capabilities, Leyla increases the productivity of her labor-time employed in production. The reason for mental capabilities could be the education/training obtained, or natural talents, or experience. Leyla's labor is no longer pure $\mathbf{L^b}$, **but** $\mathbf{L^n}$. By the assistance of her "creative mental labor", $\mathbf{L^Y}$, Leyla introduces a new technology, which increases the productivity of her labor-time employed.[5]

- With the introduction of new technology, the need for new skills of labor(-er) arises. In other words, for the efficient employment of new technology, the skills of **L** have to improve.

- Both, economic efficiency (**EE**) and technical efficiency (**TE**) are assumed to be at optimum level.

- Supply and demand is in balance. Every additional item of output is consumed, but the exchange-relations will have to change.

Leyla increases her daily output from 4 $\mathbf{X_1}$ to 8 $\mathbf{X_1}$ with the employment of new technology developed by her mental capabilities. Initially, the labor of Leyla had no qualifications; that is $\mathbf{L^n_{L,t}}$ =0. But now;

$$L^n_{L,t+1} > L^n_{L,t}$$

And

$$q^L_{t+1} > q^L_t$$

---

4 For the concept "technological productivity", see Gürak, 2006, Chapter-2.

5 The mankind has been producing new technologies, thereby increasing their productivity, for tens or even hundreds of centuries even in the absence of formal or informal education/training.

For Maria, the initial conditions are still valid.

$$L^{b}_{M,t+1} = L^{b}_{M,t}$$

And

$$q^{M}_{t+1} = q^{M}_{t}$$

The new total production function is:

$$Q = f\,(L^{n}_{L};\, L^{b}_{M}) \qquad (5)$$

The new technology (**A**) developed by Leyla's "creative mental labor" (**L**^{Y}) is embodied in material form in the means-of-production and help to increase her productivity. [6]

Since tastes and working-hours have not changed and there is no third party to enter into exchange-relations with, for the entire output to be consumed, the production and exchange relations have to change:

Leyla's output	8 X_1	10 hours/day
Maria's output	2 X_2	10 hours/day

$$\text{Total output } \mathbf{Q_{t+1} = q^{L}_{t+1} + q^{M}_{t+1} = 8\ X_1 + 2\ X_2} = 20 \text{ hours/day} \qquad (6)$$

The "fair" exchange ratios in accordance to labor-time spent approach would be as follow:

Leyla's consumption	$C^{L}_{t+1} = 4\ X_1 + 1\ X_2$	(7)
Maria's consumption	$C^{M}_{t+1} = 4\ X_1 + 1\ X_2$	(8)
Total consumption	$C^{L,M}_{t+1} = 8\ X_1 + 2\ X_2$	(9)

Both producers continue to work 10 hours a day, as in the initial case. But, due to "new technology" developed by Leyla's creative mental labor, total output is increased:

$$\mathbf{Q_{t+1} > Q_{t}} \qquad (10)$$

Along with personal consumption:

$$C^{L}_{t+1} > C^{L}_{t} \qquad \text{and} \qquad C^{M}_{t+1} > C^{M}_{t}$$

---

6 Technologies, or productive knowledge, embodied in the means and tools of production, are produced with the purpose to assist labor in the process of production and contribute to increased productivity per unit time employed.

However, this kind of "fair" exchange embodies an "unfair" feature. Although the increase in total consumption is entirely due to Leyla's contribution, the other consumer, Maria, who made no new contribution at all, benefits from the new situation as much as Leyla does. This kind of exchange relations in accordance with labor-time employed criterion does not seem quite "fair", at all.

Growth function

In order to produce the capital-goods which embody the new technology introduced by Leyla's creative mental labor, the "given" supplies of nature have to be transformed into physical products. By assumption, there were only two inputs of production; natural inputs and labor-time employed and the supply of means-of-production is a function of creative mental labor. Thus, growth process (**g**) depends on the qualifications of Leyla's labor, $\mathbf{L^n}$, or to be more specific, on the "creative" mental labor, $\mathbf{L^y}$.

$$g = f\ (L^n) \qquad \text{or} \qquad g = f\ (L) \qquad (11)$$

Since, by assumption, there is no supply-demand imbalance, every output is consumed, but exchange-ratios vary.

The described "fair" exchange relations in accordance with Marxist approach have a serious deficiency. Maria, who makes no contribution to total output growth, benefits just as much as Leyla from the new situation. There is a serious error in this kind of growth process; Leyla's productivity is, in a sense, being penalized, while the "stationary" position of Maria is rewarded.

Barter-exchange and growth: 1-b

Assuming the presence of a new market for additional output

In the model presented above, exchange relations were based on the assumption that the community consisted of two individuals, only. Now, we assume that additional items are sold to a new buyer in another market, while the exchange rations between Leyla and Maria remain the same, as in the initial case.

Assume that Leyla exchanges the additional 4 units of $\mathbf{X_1}$ with a third person and receives 3 units of $\mathbf{X_3}$ in return. Under the new circumstances, the total output of the community consisting of Leyla and Maria will increase, along with Leyla's output and consumption, while the position of Maria remains unchanged as before.

By assumption, there was no deficiency in "effective demand" for the additional output and both, **EE** and **TE** was at optimum level:

Leyla's output $8\ \mathbf{X}_1$

Maria's output $2\ \mathbf{X}_2$

Total output $\mathbf{Q}_{t+1} = \mathbf{q}^{L}_{t+1} + \mathbf{q}^{M}_{t+1} = 8\ \mathbf{X}_1 + 2\ \mathbf{X}_2 = 20$ hours/day (12)

Maria's consumption $\mathbf{C}^{M}_{t+1} = 2\ \mathbf{X}_1 + 1\ \mathbf{X}_2$ (13)

After trade with third individual:

Leyla's consumption $\mathbf{C}^{L}_{t+1} = 2\ \mathbf{X}_1 + 1\ \mathbf{X}_2 + 3\ \mathbf{X}_3$ (14)

Total consumption $\mathbf{C}^{L,M}_{t+1} = 4\ \mathbf{X}_1 + 2\ \mathbf{X}_2 + 3\ \mathbf{X}_3$ (15)

In other words;

$Q_{t+1} > Q_t$

$C^{L}_{t+1} > C^{L}_{t}$

But;

$C^{M}_{t+1} = C^{M}_{t}$

Under the new circumstances as described above, Leyla's consumption along with total consumption of the community increases as a result of Leyla's contribution, while consumption of Maria, who made no contribution at all to total output, remains "unchanged".

The "fair" exchange relations in Marxist terminology are not valid anymore. The new exchange relations seem to be more rational and fair, promoting the further contributions. This outcome has, actually, much closer resemblance to actual relations.

Limits of growth

By assumption, there was no deficiency in effective demand for additional products. But, in fact, there is always a limit of demand for the "available" products in markets and the markets are bound to saturate sooner or later, implying the end of growth process. Population growth may support the growth process to some extent, but not sufficiently, in the long-run. There is always a limit for growth with "given" products. In other words, for the growth process to be incessant, introduction of "**new products and production methods**" is imperative.

Barter-exchange and growth -2

Technological productivity growth-2:

New product/new production method

In the simple model presented above, we studied how productivity growth affected the exchange relations, with "given" product. Now, we shall assume that Leyla, by utilizing her "creative" mental labor, develops an "**entirely new product produced by a new production method",** denoted as X_4, in addition to the previous increase of product X_1. Let us analyze the production and exchange relations between Leyla and Maria, first.

As in the foregone models, we assume no deficiency in "effective demand", along with **EE** and **TE** are at optimum levels. The new production function is:

$$Q = f\,(L^{n}_{L};\, L^{b}_{M}) \qquad (16)$$

10 units of the new product (X_4) are produced, and entire output is consumed in domestic market consisting of Leyla and Maria. Since, by assumption, markets are cleared, as a result of new technology the total output would increase, but as in the case of 1:a above, Maria will be the major beneficiary of output growth as a result of barter exchange, though she made no contribution, at all.

Leyla's output	$4\,X_1 + 10\,X_4$	
Maria's output	$2\,X_2$	
Total output	$Q^{T}_{t+1} = 4\,X_1 + 10\,X_4 + 2\,X_2$	(17)

The outcome of the "fair" barter-exchange based on labor-time employed approach would be as follows:

Leyla's consumption	$C^{L}_{t+1} = 2\,X_1 + 5\,X_4 + 1\,X_2$	(18)
Maria's consumption	$C^{M}_{t+1} = 2\,X_1 + 5\,X_4 + 1\,X_2$	(19)
Total consumption	$C^{L,M}_{t+1} = 4\,X_1 + 10\,X_4 + 2\,X_2$	(20)

Assuming access to "new markets" for the "new product"

Assuming the case where new product is sold to a third party, along with growth in productivity the consumption level of Leyla will be improved, while that of Maria remains the same, as in the Model-1:b.

Let us explain with an example: Assume that Leyla's "new" product, X_4, is used in trade with a third party and 5 units of X_4 is exchanged in return of 6 units of X_5. The new production and consumption relations will be as follows:

Leyla's output	$4\,X_1 + 10\,X_4$	
Maria's output	$2\,X_2$	
Total output	$Q_{t+1} = 4\,X_1 + 10\,X_4 + 2\,X_2$	(21)

The outcome of barter-exchange:

Leyla's consumption	$C^{L}_{t+1} = 2\,X_1 + 1\,X_2 + 5X_4 + 6\,X_5$	(22)
Maria's consumption	$C^{M}_{t+1} = 2\,X_1 + 1\,X_2$	(23)
Total consumption	$C^{L,M}_{t+1} = 4\,X_1 + 2\,X_2 + 5X_4 + 6\,X_5$	(24)

To summarize;

$$Q_{t+1} > Q_t \tag{25}$$

$$C^{L,M}_{t+1} > C^{L,M}_{t} \tag{26}$$

$$C^{L}_{t+1} > C^{L}_{t} \tag{27}$$

but;

$$C^{M}_{t+1} = C^{M}_{t} \tag{28}$$

The interpretation of the above data is as follows: The reason for incessant economic growth in the long-run is the uninterrupted introduction of **entirely new products and production methods** accompanied with unsaturated demands for higher consumption.

The models studied above clearly show that the cause of all productivity increase is the technological innovations, which are the products of creative mental labor. Along with the increase in "**productive knowledge**", that is new technologies, the individual and total wealth increases. Since there seems to be no upper limit to the creativity of mental capabilities, there also seems to be no barriers, for now, for the long-run growth of economies.

Negative developments in the environmental issues may reduce the quantity or exhaust completely the necessary inputs of production, which, in its turn, could bring an end to the growth process. But, it would not be irrational and illogical to expect the introduction of necessary precautions in time to prevent such a disaster. The decline in the global reserves of oil and coal should not emerge as a serious problem in energy sector, because the creative mental labor is capable of producing alternative sources of energy. For instance, borax and hydrogen seem to be the sources of future energy.

To summarize, one can easily claim that, assuming the supplies of nature as given, the source of all value-added in the past, present and future is the labor of man, which develops and uses technologies in production.

Growth process in actual economies

In the models so far, we studied production and distribution relations under barter-exchange conditions where no money is used in transactions, as traditionally used to be in economic analysis since the time of Classical economists. Barter-exchange is no longer practiced in contemporary economies, but, nevertheless, used in the models above in order to explain the growth process. The analysis is believed to serve the purpose.

In this part of the study, an attempt will be made to reflect the actual output and growth relations in a more realistic way, as they occur. There shall certainly be some generalized and abstract assumptions as well as virtual economic relations. But the intention is to make analysis reflecting the actual relations, as realistic as possible.

The growth process can be studied under two sub-categories, as described in Gürak, 2006, Chapter-2:

Short-run Growth: (given technology).
1-a) **EE** and/or **TE** improvement.
1-b) Production for new markets.

Long-run Growth: (New technologies).
2-a) Given product, but new production method.
2-b) New product / new production method.

In the following sub-sections, the growth process will be studied with "given" and "new" technologies, respectively. An exchange model with money will be introduced later.

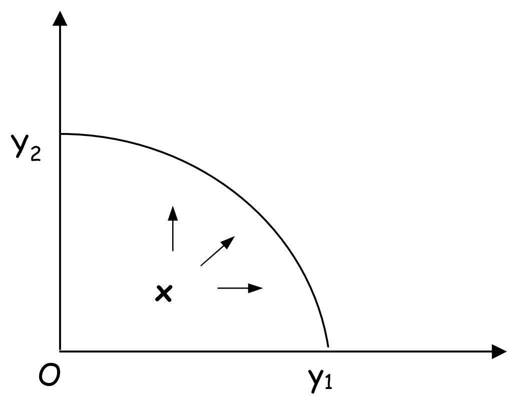
1- Growth without technological change: "given" technology

1-a) EE and/or TE growth

The crucial assumption regarding the short-run is production with "given" technology, which implies absence of technological innovations. Under such circumstances, if there is a lack in economic efficiency (**EE**) or technical efficiency (**TE**), in other words, if **EE** and/or **TE** are not at optimum level, the output can be increased until optimum level. But, once optimum level is reached, the growth ends and the economy is equilibrium.

At the optimum capacity utilization and efficiency level where no unemployment prevails, output should be somewhere on Y_1 Y_2 curve, as indicated in Figure-1. At point **X**, either **EE** or **TE** or but hare not at maximum capacity. Output can be increased until it reaches $\mathbf{Y_1}$**-**$\mathbf{Y_2}$ curve. But, then growth comes to an end.

Figure-1 Short-run growth with "given" technology



Specific assumptions for this case:

- "Given" technology (**T**)
- The labor force is qualified enough to use the "given" technology efficiently ($\mathbf{L^k}$).

Production function:

$$\mathbf{Q = f\ (L^k,\ X_i)} \qquad (29)$$

$\mathbf{X_i}$ denotes all inputs of production such as energy, raw-materials, marketing, means of production, etc., excluding the labor(-er).

Short-run growth [7] is primarily a function of **EE** and/or **TE**.

$$\mathbf{g = f\ (EE,\ TE)} \qquad (30)$$

1-b) Extended production for new markets

Figure-1 can also be used to explain the case of finding new markets for the "given" product. The equations (29) and (31) showing the output and growth functions, respectively, are also valid. In order to increase the output (to grow), an increase in the inputs of production and of labor employment would be sufficient, with given technology.

7 Economic growth implies an increase in VA (profit + wage).

If **EE** and **TE** are at optimum levels, then growth would be a function of **new investments**.

$$g = f(I) \quad (31)$$

This equation reflects the well-known orthodox economic approach, which dominated economic thinking until Solow's "**re-discovery**" of the vital role played by technology in 1950s. With "given" technology, investments take place and output increases; but only until the markets saturate. Then the growth process ends.

Investments are a function of the labor-qualifications (**L^n**) and expected rate of profit (**r^E**).

$$I = f(L^n, r^E) \quad (32)$$

2- Growth with "technological progress":

In some models above, the technology (**T**) employed in production and the qualification degree of labor(-er) was assumed "given". From now on, we shall focus a case where the "creative" labor (**L^Y**) enters into picture and paves the way for long-run growth by introducing "new" technologies. In other words, the long-run growth takes place due to technological innovations and improvements in the qualifications of individuals.

Assumptions:

- "Creative" mental labor **(L^Y)** introduces new technologies **(A)**.
- Education/training increases the qualifications of laborers **(L^n).**
- Fair competition.
- **EE** and **TE** at optimum level.
- No imbalance in supply-demand (**S=D**).

Now, let us study the impacts of technological innovations of different nature.

2-a) "Given" product, "new" production method.

Some "new" technologies are designed to produce a "given" product at a lower unit cost. For instance, assume that a "given" product is produced at the unit cost of 10 TL by all producers. In a competitive environment, the producers would make every effort to produce the unit costs, in order to gain a cost advantage against competitors. The producers who ignore this fact are bound to wither away from the market.

Assume that one of the competitors succeeds in reducing unit costs by employing a new production method. The reduction in unit cost may be due to one of the factors mentioned below:

1- "Given" inputs, but output increases.

2- Output increases faster than the increase in inputs.

3- Output increases while inputs decrease.

4- Inputs decrease while output remains the same.

The producer who gets the cost advantage by new technology would have three options.

1- To reduce the sale-price.

2- To increase the profits by maintaining the same price level.

3- To follow a price-policy combining both options mentioned above.

However, there is always an upper limit to growth with "given" products though the producer may enjoy competitive advantage due to new technology, which reduces unit costs. Sooner or later, the markets are bound to saturate, the profit rate to fall and growth rate to diminish and eventually stop.

The production function:

$$\mathbf{A = f\,(L^{y}, L^{k}, L^{b}, X_{i}, A)} \qquad (33)$$

Or simply:

$$\mathbf{Y = f\,(L^{n}, X_{i}, A)} \qquad (34)$$

$\mathbf{L^n}$, denotes the labor-force with sufficient degree of qualifications to employ the new technology efficiently. As we know, technological innovations are introduced by $\mathbf{L^y}$ in order to increase the productivity of labor(-er) and are embodied in the physical products. Therefore, there is only one "productive" factor in the production function; $\mathbf{L^n}$ or just **L.**

Technological innovations (**A**), are internalized (embodied) in the physical products employed in production process ($\mathbf{X_i}$) and they are a function of "creative" mental labor ($\mathbf{L^y}$), technological development level (**T**) and R&D investments ($\mathbf{I^{R\text{-}D}}$):

$$\mathbf{A = f\,(L^{y}, T, I^{R\text{-}D})} \qquad (35)$$

Under the assumption of no depreciation of the means of production, the growth function would be:

$$\mathbf{g = f\ (I^A)} \quad (36)$$

$$\mathbf{I^A = f\ (L^n,\ r^E)} \quad (37)$$

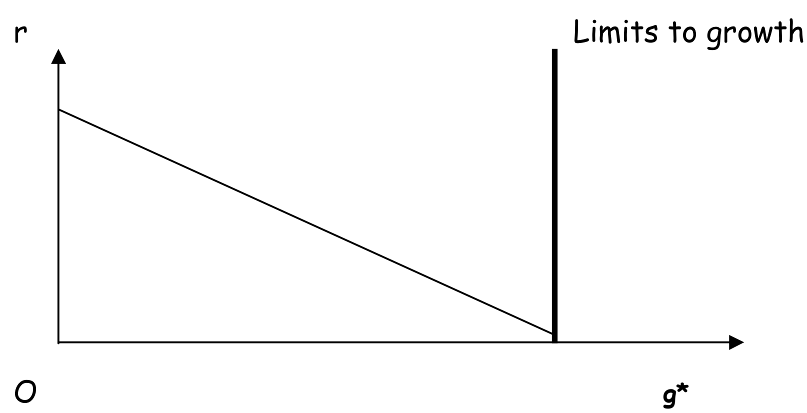
$\mathbf{I^A}$ denotes "new" investment due to technological innovation, $\mathbf{L^n}$ the laborers required for the use of new technology, $\mathbf{r^E}$ the expected profit rate. The labor(-er) requires new qualifications for efficient employment of new technologies. Therefore, for the growth process to be complete, the qualifications of the labor(-r) have to be increased in addition to new investment.

When new investments to replace depreciation of the means of production ($\mathbf{I^d}$) is introduced, in addition to new investments due to technological changes ($\mathbf{I^A}$), growth function would look as below:.

$$\mathbf{g = f\ (I^A,\ I^d)} \quad (38)$$

As displayed on Figure: 2, demand would increase somewhat, assuming a price fall as a result of cost-reducing technological innovation. But, nevertheless, the growth process will eventually come to an end, when markets saturate

Figure: 2 Limits to growth and profit rate (given technology)



2-b) New product, new production method

Long-run growth is a dynamic process without a foreseeable limit, though it may, from time to time, experience interruptions. Because, there seems to be no upper limit to the creative capabilities of mental labor to create new products and/or production methods; nor there seems to be an upper limit of demand for new products. Under such circumstances, there would be no ground to expect the markets to saturate, nor for growth to end and the profit-rate would follow a trajectory with ups and downs, in accordance with technological innovations.

Now, we shall study how the introduction of new products influence growth process, assuming **EE** and **TE** are at optimum level. As before, **S=D** by assumption.

Production function:

$$\mathbf{Q = f\,(L^n\,,\, X_i,\, A)} \qquad (39)$$

Under the assumption of no depreciation of the means of production, the growth function would be:

$$\mathbf{g = f\,(I^A)} \qquad (40)$$

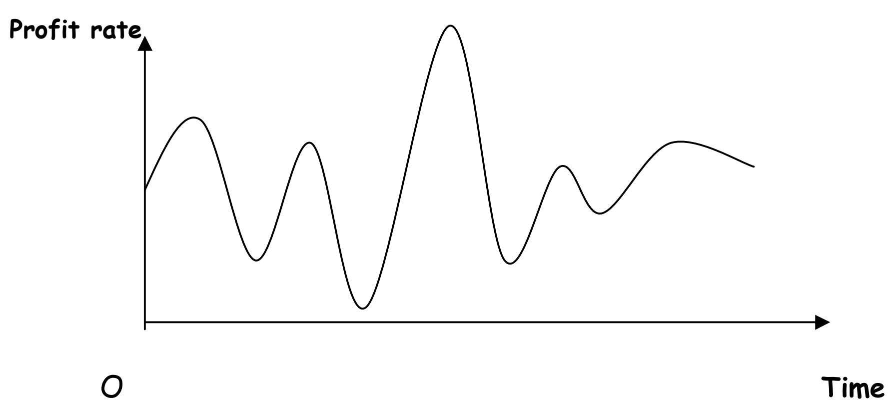
$$\mathbf{I^A = f\,(L^n,\, r^E)} \qquad (41)$$

As displayed in Figure: 3, the profit-rate would never fall to zero level given the incessant supply of technological innovations. However, it is expected to fluctuate. To put it differently, in the initial phase of new technology, the owner will enjoy "monopoly" privileges in the market and highly likely obtain higher profit-rate than the average for markets. In time, the competitors are assumed to introduce similar technologies and products, which would cause the monopoly profits to decline. But, new wave of new technologies would again facilitate monopoly profits, and the process would go on like this. Therefore, the profit-rate is never expected to decline to zero level, but to fluctuate.

When new investments to replace depreciation of the means of production ($\mathbf{I^d}$) is introduced, in addition to new investments due to technological changes ($\mathbf{I^A}$), growth function would be as in eq.38:.

$$\mathbf{g = f\,(I^A,\, I^d)} \qquad (38)$$

Figure: 3 Probable fluctuations in profit rate



To summarize; as long as demand for new products does not cease, new products will continue to be developed by mental labor, thereby increasing output and consumption, thus paving the way for an incessant growth process in the long-run, with fluctuations, of course.

Growth-reconsidered (both short- and long-run)

In the models above, we studied first short-run growth process in the absence of technological innovations, and then the long-run growth with technological innovations, separately. Naturally, in actual economies the individuals do not make decisions as in the models. Producers normally set in a production process with regard to long-run expectations, though they often face some unexpected incidences in the short-run and might have to make some critical decisions. In fact, the long-run consists of short-run processes. The question is; is it possible to a have a production and growth function covering both periods, short- and long-run.

Regardless of the time aspect, whether short- or long-run, the inputs of production, or, in line with orthodox terminology, the production factors, are always "the same".

$$\mathbf{Q = f\ (L^n\ ,\ X_i)} \qquad (42)$$

However, the case for growth function is somewhat different. Because, we now have to take into account the growth process in both periods, short- and long-run.

$$\mathbf{g = f\ (EE,\ TE,\ I)} \qquad (43)$$

$$\mathbf{I = f\ (I^A,\ I^d,\ L,\ r^E)} \qquad (44)$$

$\mathbf{I}$, denotes both, new investments due to technological progress, $\mathbf{I^A}$, and new investments to replace depreciated means of production, $\mathbf{I^d}$, while $\mathbf{L}$ denotes qualified labor-force required to realize production efficiently and $\mathbf{r^E}$ the expected profit rate.

The role played by demand in growth process

The assumption that supply declines as markets saturate, which causes demand to fall is rather crucial. For fluctuations in demand and supply are not necessarily proportional. Sometimes the quantity demanded precedes supply, and sometimes the vice versa. There are many factors influencing the demand schedule:

1- Price of product.

2- Purchasing-power of consumers (income level).

3- Tastes and preferences.

4- Prices of competing products.

5- Public expenditures.

The role played by demand in growth process is naturally rather significant. However, in the absence of technological innovations introducing "new products", demand for goods/services cannot alone secure long-run growth. Assume that "given product" is produced by a "given technology". In time, as the markets gradually saturate, demand will gradually decline and eventually there will be production for the replacement of depreciated goods, only. In other words, there will be "equilibrium" in markets. Assume that only cost-reducing technological innovations take place and are used in production. The consequence will be the same as in previous case, i.e., as markets saturate, the growth process will gradually decline until equilibrium, given purchasing power. Therefore, in both cases, in the absence of technological innovations introducing "new products", demand will not be a sufficient condition to sustain long-run growth.

In this work, the emphasis was on revealing the source of long-run growth. Therefore, a thorough analysis of the impact of demand on growth process shall be ignored, for the time being.

Conclusions

According to the findings of this section, the labor(-er) appears as the only production factor capable of adding value, assuming the supplies of nature (basic inputs of production) as given and stable. The nature supplies us the basic inputs and labor(-er) transforms them into useful products. All means-of-production are transformed natural inputs aimed at increasing labor-productivity. Thus, the labor, or rather the qualifications of labor of individuals is the source of all value-added and all new technologies required for growth to take place. As to the qualifications level labor; it is proportional to the technological development level of country in which they live and to the quality of education acquired. The increase in the number of technological innovations and in the general welfare level can only is achieved by the contribution of creative capabilities of mental labor.

References

Gürak, H.	2006	Ekonomik büyüme ve küresel ekonomi Ekin Kitabevi, Bursa.