On PRODUCTIVITY GROWTH

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Abstract

The relations between the riches of nations and the riches of **Productive Knowledge** (**Technology**) gains increasing acknowledgment among economists. Classical economists had assumed that the key to progress was the accumulation of homogenous capital goods. But, as P. Romer, among others, claims we cannot grow rich by accumulating more of the same capital goods. So the Classical growth theory falls short of expectations.

Capitalism's inherent feature is "**destructive creation**", said Marx. Decades later, in a similar fashion, Schumpeter stated that **"Capitalist system incessantly revolutionizes the economic structure FROM WITHIN**".

What are those dynamic forces causing the incessant changes in an economy ?

According to P. Drucker, A. Toffler, Baumol-McLennan and many others it is the productivity increases (growth) in general. P. Romer provides a more specific reply: technological change or the growth of new ideas. In this paper, H. Gürak goes deeper to the core and claims that all technological changes are produced by the **intellectual labor of human mind**. In other words, knowledge on production, i.e., technology or productive knowledge, gives occasion to a dynamic and uninterrupted growth process, but technology itself is **the product of mental labor**. In support of this assertion, a simple model of growth based on productive knowledge (creativity of mind) is introduced in the final section of full-text article titled "Creative Intelligence and Productive Knowledge".

Knowledge is the most powerful engine of production;
it enables us to subdue Nature and satisfy our wants.
Alfred Marshall

Introduction

How an economy grows has always been a fascinating subject for the economists. For decades and for centuries numerous attempts have been made to identify the determinant(s) of growth by many able minded scholars like A. Smith, Marx, Solow and many others to find universally applicable explanations to the subject. Smith's analysis on the division of labor and correlated productivity increase, Ricardo's remarks that the primitive hunter's capital good (the weapon) was a product of labor and Marx' comments that capitalism's internal forces enforces constant technological changes were all steps in this direction. But eventually, the determinants of growth were reduced to capital accumulation and population growth by the Neoclassical school for decades to follow.

Contemporary theories of growth seem to have focused on two central questions: **Why do economies grow**, in the first place? **And why do economies grow at different rates**? The former prerequisites the study of the nature of growth, e.g. the determinants of growth, while the latter puts emphasis on the comparative analysis of different growth rates and their determinants.

Which one is the right question to start with? The immediate and intuitive reply would be that both are important in the study of growth process, though the former seems to deserve more credit. But before trying to answer these questions we need to have proper knowledge about the initial causes and process of growth, i.e. **the genesis of growth**. In other words, we have to have knowledge about the very initial determinant(s) of growth generation before proceeding any further.

Do we have a logical and consistent theory of growth with appropriate explanatory power about its genesis, capable of accounting both the causes and the consequences of real world transactions? Unfortunately, the reply is negative.

Until a decade ago, textbooks on economic growth used to tell that the factors effecting growth can be analyzed in two groups;

1- endogenous factor (investments), and

2- exogenous factors (population growth and technological change).

The endogenous factor was expected to bring the economy to a stationary equilibrium eventually, as the Neoclassical growth models predicted. Once in equilibrium, the only factors causing growth would be the exogenous ones. The model was quite logical and consistent but unfortunately quite unrealistic as well for, among others, it failed to embody the technological change as an endogenous factor of growth.

Decades ago J. Schumpeter, in a similar fashion to many Classical economists, especially to Marx, had claimed that: "**Capitalism ... is by nature a form or method of economic change and not only never is but never can be stationary." (1970,p.82)** To Schumpeter, technological change **incessantly revolutionized** the economic structure **from within**. The result is a system of continues disequilibria as change succeeds change in an uninterrupted fashion. But the economic theorists had failed to incorporate this important factor into the growth theories.

However, the picture began to change with the contributions of scholars like Abramowitz, Solow, Schultz, Becker and others who placed more emphasis on human capital and the technological change. Yet, technology was still being treated as an exogenous factor of growth, coming as manna from heaven. This unrealistic approach to the role of technology was, at last, abandoned by another prominent scholar of the Neoclassical heritage, Paul Romer, who regarded the technological change as "the engine of growth". Though the new theory was within the general logical framework of Neoclassical parable, it was labeled “endogenous growth theory”. The new approach embodying technological change as the engine of growth was, in spite of its shortcomings, a step in the right direction.

The purpose of the full-text article titled “Creative Intelligence and Productive Knowledge” is to present an alternative theory of growth to the dominant Neoclassical doctrine. In this abridged version, however, the purpose is to draw attention to the productivity changes as the engine of prosperity of nations (growth). The central assertion is that all economic change is based on technological change, and **the origin of**

all technological change is the "**productive knowledge**" or synonymously "**knowledge on production**" which is the "**product of human mind**", i.e**., "intellectual manpower**". Thus, technological change originating from human mind (brain-power) is the genesis of all economic growth and value generation and an indispensable factor both at micro (firm) and macro (country) level productivity increases (Gürak, forthcoming). In other words, **the genesis and the engine of all-new products and new production methods is the brain of human beings**, given, of course, the natural endowments.

What is Technology?

Technology (or productive knowledge), can be defined as the set of specific knowledge to produce commodities or to render services responding to practical needs and wants of the community as well as to increase our control over the environment we live in. A more concise definition would be: technology is **knowledge applied to resources through human labor**. As an UNCTAD study postulates: "**Technology is the key to the progress of mankind and that all peoples have the right to benefit from the advances and developments in science and technology**." (UNCTAD,1983,p.1) But, unfortunately, the transactions in technology markets display many disadvantages for the developing countries and their firms.(Gürak,1990)

Technology being the "**key to the progress of mankind**" is expected to pave the way to economic development and narrow the gap between the developed and developing countries. Not only in our present era, but also throughout the entire history of mankind the productive knowledge has been the key to growth process through productivity increases. It has always been the true source of improving the standards of living even in pre-commercial societies where barter trade was the common means of exchange or even in primitive hunting communities.

But there is something more important than the knowledge on production itself; the source of it; **the human beings** who not only produces the “productive knowledge” but also apply it to specific areas to increase the standards of living. Assume a grand pool of knowledge but no human resources to make use of it. Who would produce the all kind of

tangible as well as intangible output we consume? More importantly, who would add to this pool of knowledge any more? Without the human beings, there would be no economic activity at all. Therefore, the most important ingredient of economic life is the educated / trained human resources, i.e**., knowledgeable human resources**, or in the Neoclassical jargon, the "Human Capital".

By the way, why is it called Human Capital ? Why not **"Intellectual Labor"** or **"Mental Labor" ?**

What is Productivity ?

Productivity increase has always been the source of increased economic welfare though the word in the present context of meaning could not even be found in the lexicons until five six decades ago. **Productivity** simply indicates **the relation between the value-added (VA) or the quantity supplied and the inputs of production**.

Every incremental increase in productivity implies increased value-generation (value-added or) with regard to inputs. Due to the continued productivity increase with regard to inputs, the mankind has been able to consume ever more as well as better quality products ranging from manufactured goods to services and enjoy decreasing production costs per unit of output. In the absence of any productivity rise, the mankind would still be struggling for survival instead of enjoying the fruits of technological wonders provided by the inventiveness of human mind. Productivity growth implies greater amount of value-added, ever increasing income and rising consumption levels.

Productivity increase achieved by new technologies either introduces entirely new products for the consumers or methods of production for the producers or both at the same time. A new method of production, whether to produce a given product with less unit costs or an all- new product, normally always raises the **VA**, the rate of profit (**r**) and the labor wage productivity (**LWP = VA/Wage Bill**) cet. par. But not always the quantity supplied per unit of employee (**Q/L**) (see Table:1),

From the point of view of profit driven firms, the size or the rate of **VA** to costs is not as important as the rate (**r**) and size of profits (π). But for the nation as a whole **the aggregate value added** (**GDP**) has more significance than profit rate (**r**) for it consists of

wages, profits and interest. The higher the **GDP** the greater will be the income of the nation and thus the total as well as per capita purchasing power. The growth rate of **GDP** effects the profit rate of firms indirectly by increasing the demand for goods and services, depending, of course, on the distribution of **GDP** among the agents of production.

One should not confuse productivity[1] with the economic or technical efficiency or profitability. Also a separation of "micro" from "macro" productivity will be useful for our analysis. **Micro productivity** refers either to a **quantitative** ($\mathbf{Q_s / Q_i}$) **or value added** ($\mathbf{p_sQ_s / p_iQ_i}$) change in the ratio between the quantity supplied and the quantity used up as input(s) during production process of a given product. Another common usage of the concept productivity refers to the macro economic changes. When used with reference to micro level changes it did point out to the ratio between a concrete output such as tires, shoes, etc. and input(s) of production. **Macro Productivity**, on the other hand, **implies increase the variety of goods and services supplied in an economy**. When Drucker (1995) points out that productivity, rising at 3-4 percent annually, lies at the foundations of all improvements in the standards of living, he is, in fact, referring to macro economic changes. As a result of continuos and successive productivity increases, i.e., technological changes, there are now ever more products available supplied with much less labor and/or other inputs than a century or a decade or even a year ago. "**Output per hour worked in the US today is 10 times as valuable as output per hour worked 100 years ago**." (Romer,1990)

When output is measured with regard to all inputs, it is called "**Total Factor Productivity**"(**TFP**). If the productivity ratio is acquired against the use of one or more inputs, it is called **"Partial Factor Productivity**"(**PFP**). The most common input used in productivity analysis is the labor input, i.e., **labor productivity** per hour or day (**LP**). The quantitative approach displays some disadvantages with regard to measurement. For instance, a given amount of output may require less unit of energy ($\mathbf{E_{t+1}<E_t}$) compared to the previous production period ($\mathbf{Q_{t+1}}$). Though the quantity supplied has not changed ($\mathbf{Q_{t+1} = Q_t}$), the **VA** would be greater now ($\mathbf{VA_{t+1} >VA_t}$), and there would be no measurement problem of the productivity increase with regard to energy input. The same would apply if energy input were substituted by a unit labor input. But how to measure the quantitative micro productivity change with regard to two or more variable inputs,

say, energy and labor? Or how to measure effectively the quantitative macro productivity? Therefore, it seems more appropriate to use the **value (added) criterion** to measure productivity growth.

How to Raise Productivity ?

Intuitively, 10 different ways can be mentioned to account for the productivity change but **in the long run there is only one way to achieve productivity growth; technological change.** According to Table: 2, only in **Case-1 and Case-2 a new technology is required**. But the rest from Case-3 to Case-10 productivity growth can be achieved even without introducing any technological change. In all 10 cases the rate of profit is expected to rise as a result of productivity growth. In Case-2, there would be no previous data to compare with for the technological changes imply all-new products and/or production methods. But the expectations of entrepreneurs would be in the directions of arrows indicated in Table:2. Otherwise, the entrepreneurs would be indifferent or reluctant to the introduction of any technological changes.

If productivity growth, whether it be at micro or macro level, is the origin of a nation's future standard of living**, what is the genesis of productivity?** Since productivity growth does not come manna from heaven, there has to be an economically rational explanation about its origin. The search for a reply to this critical question is the subject of full-text article. But once advances in productive knowledge (technology) is acknowledged as the origin of all value and wealth accumulated, a related and critical question pump up; **what is the role of productive knowledge in the value-price theory?**

Table:1 Impacts [a] of a New Method of Production on **VA,Q/L, LWP, r**, **π / VA** and **W^b/VA**

Type of technological change	K-saving per unit q	Impact on Output	VA	Q / L	LWP	r	π / VA	W^b /VA
Labor saving	Yes	$q_{t+1} = q_t$	↑	↑	↑	↑	↑	↓
X_i saving (exc. L)	Yes	$q_{t+1} = q_t$	↑	The same	↑	↑	↑	↓
Q increasing	Yes	$q_{t+1} > q_t$	↑	↑	↑	↑	↑	↓
L & X_i saving while Q increasing.	Yes	$q_{t+1} > q_t$	↑	↑	↑	↑	↑	↓

a Prices (p), wage rate (w) and interest rate (i) constant

b Wage Bill (W) includes 1-) all direct wages/salaries including taxes; 2-) all payments for the time not worked; 3-) all payments in kind; 4-) child, family, housing allowances; and 5-) bonuses / gratitutes.

X_i = Inputs (excl. L) i = 1,2,….,n
TFP = VA / K (incl. L)
PFP = VA / X_i * p_i (excl. L)
K = p_i X_i + wL (Capital advanced)
VA = w*L + π (incl. Interest rate)
r = π / K
W = w*L

Need A Value-Price Theory Embodying Productive Knowledge ?

At last, there is an endogenous economic growth model with its merits and demerits based on knowledge and technological change, introduced by Romer (1990). But economic science still lacks an "**acknowledged**" economic theory of value and price based on productive knowledge, e.g., technological change. Rephrasing Romer's question, we can ask: **Where is the productive knowledge** (discussion of innovation, invention, discovery and technological progress) **in the theory of value and price?**

As Toffler (1992,p.96) claimed, **no value added is generated without intellectual contribution**. That means the term value implies something more than just raw inputs of natural resources and unqualified labor force and that changes the concept of value drastically. Closely related concept "price", on the other hand, is the most important impulse and regulator of the system as a whole. The intensity and the magnitude of demand, supply strategy of the firms, efficient allocation of resources are all regulated by the price system. Thus, economic science urgently needs and requires a new theory of value and price with due credit to productive knowledge, capable of explaining technological changes in relation to value generation and price formation both in industrial and service sectors.

After having criticized the economic theories for their inadequacy to explain the actual economies, Drucker (1981) draws the conclusion that: "**The Next Economics may again have a Theory of Value. It may proclaim that productivity -that is, knowledge applied to resources through human work- is the source of all economic value**." (p.20) He claims that non-of the great non-Marxist economists of the last 100 years like Marshall, Schumpeter, Keynes were "**comfortable with an economics that lacked a Theory of Value altogether. But as Keynes anecdote illustrates, they saw no alternative.**" (p.21) And he expects the next economics to "**be dynamic and assume risk, uncertainty and change in technology, economic conditions, and markets**." (p.16)

Table: 2 10 Different Ways to Increase the Productivity [a]

New technology	Type of change	VA / K	VA / L	r	π / VA	W [b] / VA
Yes	New Method of Production but given product	↑	↑	↑	↑	↓
Yes	New Product & Prod. Method	↑ *	↑ *	↑ *	↑ *	↓ *
No	Transfer of Technology	↑	↑	↑	↑	↓
No	Reorganization	↑	↑	↑	↑	↓
No	Increased Capacity Util.	↑	↑	↑	↑	↓
No	Shift-work	↑	↑	↑	↑	↓
No	Reallocation	↑	↑	↑	↑	↓
No	Gen. Education & Training	↑	↑	↑	↑	↓
No	On-the-job Training	↑	↑	↑	↑	↓
No	Improved Health-Safety	↑	↑	↑	↑	↓

a Prices (p), wage rate (w) and interest rate (i) constant

b Wage Bill (W) includes 1-) all direct wages/salaries including taxes; 2-) all payments for the time not worked; 3-) all payments in kind; 4-) child, family, housing allowances; and 5-) bonuses / gratitutes.

* There is no previous data to compare. But expectations of the entrepreneurs would be in the directions of arrows. Otherwise, there would be no incentives to introduce technological change.

Economic science is in urgent need of a new synthesis, a new Theory of Value and Price based on productive knowledge and knowledgeable labor force. Drucker (1993) claimed that there is nothing at sight, yet. Perhaps the more proper phrase would be “nothing at sight to my knowledge”. There was an attempt to introduce a new alternative approach based on productive knowledge of human mind some years ago as a premise for discussion and further development (Gürak,1993).

CONCLUDING REMARKS:

Productive knowledge (technology), which is the mental product of mind (the intellectual labor), is **the genesis** of all man generated prosperity, e.g., **value generation and growth**. The initial inputs of production are the natural endowments and the labor of man while the latter consists of both mental and manual components. In our present societies, the inputs and outputs of production are, in principle, still the same being composed of labor and (transformed-rearranged) natural endowments. The only difference is that men have now access to a tremendous amount of means of production (transformed natural endowments) embodying productive knowledge to assist the labor of man in production. In other words, there is more productive knowledge, more means of production and more products to consume, but no less or more natural endowments. They neither increase nor decrease in quantity but only change shape by productive knowledge. Judging from this angle, there is no distinction in substance between **the means of production** (capital goods) and **consumer goods**; both are **transformed natural products embodying productive knowledge**.

Technological change is the key word for long-run economic growth. But, one should not confuse the improvement of skills and abilities of the labor force through training, education, on-the-job learning with the advances in technology. Improved quality of human resources is a necessary condition, especially in the developing countries, to produce the contemporary commodities and services. Increasing productivity by improving the skills of human resources does not require any technological changes, though it might pave the way for it. But, **for technological change and long run growth**, the contribution of **creative intellectual labor is imperative**.

The institutional framework, i.e., the public and private establishments, social values, traditions as well as habits in different countries may foster or be impediments to, economic growth. For instance, though countries like Russia, Ukraine and many former Eastern Block countries have more engineers and scientists per 1,000 inhabitants than the USA or West European countries, they are far from having the same (micro-macro) productivity levels due to, mostly, their different institutional and cultural environment including the lack of competitive enterprises and economic policies.

The growth in prosperity continues to take place due to the technological change while world economies display great disparities with regard to both domestic and global income distributions. LDC citizens enjoy much less prosperity than the US citizens due to their much lower per capita productivity level and there is in LDCs a great potential unsatisfied demand for all commodities and services available with existing technologies. That implies that even without any technological change there is a great potential for global economic growth to arise from LDCs for a long time to come. To be more specific, even in the absence of any technological change, global economies can continue to grow by extensive (expansive) investments with existing technologies in LDCs until these markets are saturated. What needs to be done is to assist the LDC citizens to acquire contemporary standards of education / training, assist to reorganize-restructure the institutional settings and to transfer technology through direct investments or patent-license agreements, preferably without abusive clauses. (Gürak,1990). Such steps would not only help to reduce disparities among nations but also be cure to many social and political evils.

To conclude, given the natural endowments and the level of existing knowledge, the **creative mind of the labor force (intellectual labor), is the only value-producing source** of all past, present and future prosperity **in the long-run**. To put it in William Petty's words;

"**... labor is the father of (material) wealth, the earth is its mother."**
(in Marx,Vol. I,pp.133-134)

or; as Marshall indicated;

"**In a sense there are only two agents of production, nature and man."**
(Marshall,1990,p.116)

Final words: The global prosperity of mankind depends on the same source;

the producer as well as the user of productive knowledge, that is the

knowledgeable & creative human resources.....

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[1] Productivity should not be confused with economic efficiency, technical efficiency and profitability.
a-**Productivity** = Total Output / Total Inputs or; Total Output / Given Input(s)
b-**Economic Efficiency** =Total Revenue/Production Costs (max. revenue, minimizing costs)
c-**Technical Efficiency** = Max. Total Output / Given Inputs
d-**Profitability** = Profit / Capital