Economic Growth Theories and the Relationship between Interest and Investment Rates

C. Alexandre A. Rocha[1]

Abstract

This article compares some of the central features of the Modern Cambridge School with the main results put forward by the Growth Accounting Methodology and the New Growth Theory. The overall purpose of this comparison is to show the importance of the relationship between the interest and investment rates, an aspect generally stressed by Post-Keynesian authors, but rarely considered by mainstream economists.

Keys Words: Growth, Accumulation, Keynesianism.

JEL Classification JEL: B41, O3, F43.

I. Introduction

When we examine the dynamics underlying the economic performance of several countries, there are two possible levels of analysis: the *ultimate* and the *proximate* causes, according to Maddison (1987, p. 651). The first involves considerations about institutional and ideological links in the form of both ruptures and continuities – aspects difficult to be quantified and mainly studied by sociologists and historians.

The causes of the second type, on the other hand, correspond to "causal" relations settled by the measures and models developed by economists, statisticians and econometricians. In this field, the comparison between the macroeconomic aggregates of several countries plays a crucial role, allowing a better understanding of the relative importance of each variable.

The current macroeconomic mainstream contains two main groups of researchers that lean over the *proximate* causes:

a) The partisans of the *Growth Accounting Methodology*: Denison and Maddison, mainly;
b) The econometricians of the *New Growth Theory*: prominence for Barro.

Jorgenson, in turn, occupies an intermediate position. Similarly to the second group, he uses econometric techniques, but its premises are markedly neoclassical, as in the first group.

Opposing the mainstream, there are other sets of researchers trying to identify the causes of economic growth: the Post-Keynesian[2], the New-Ricardian, the Marxist and the Institutionalist.

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[1] Legislative Advisor on Public Finance | Senate of Brazil | Annex II | Block B | 2nd Floor | Room 7

[2] This group emphasises, based on Keynes and Kalecki's works, the role of the investment in the determination of the economic activity level and the income generating effect of the aggregate demand. According to them, the markets do not tend necessarily to an equilibrium, since the economic agents show sub-optimum behaviours in situations of fundamental uncertainty.

This work analyses the main theoretical and empirical features of the *Growth Accounting Methodology*, the *New Growth Theory* and the Post-Keynesian set, the latter illustrated by the "Modern Cambridge School". This analysis highlights the importance of the relationship between the interest and the investment rates for the understanding of the economic growth phenomenon. The *Growth Accounting Methodology* will be presented in section II, the *New Growth Theory* in section III, the "Modern Cambridge School" in section IV and the pertinent conclusions in section V.

II. The "Growth Accounting Methodology"

The *Growth Accounting Methodology* is based on the model of economic growth conceived by Solow (1956). The key-aspect of this approach is the neoclassical format of the aggregate production function – constant returns to scale, decreasing returns for each production factor, which is remunerated according to its marginal product, and the substitution effect between the inputs. The technical progress is given exogenously. It occupies a determinant position in the proposed function – its absence would result in the long-run stagnation of the aggregate production per capita.

In the neoclassical model, the production factors operate independently, so their respective contributions can be added. This important feature can be illustrated by a typical Cobb-Douglas function, as indicated below:

$Y = A.K^{(1-\alpha)}.L^{\alpha}$, with $0 < \alpha < 1$;
Where: Y = aggregate production;
A = technical progress

K = capital stock
L = labour force } production factors;
α = labour factor share;
$(1-\alpha)$ = capital factor share.
Calculating the neperian logarithm:
$lnY = lnA + (1-\alpha).lnK + \alpha.lnL$

Taking the time derivative:

$$\frac{\overset{o}{Y}}{Y} = \frac{\overset{o}{A}}{A} + (1-\alpha).\frac{\overset{o}{K}}{K} + \alpha.\frac{\overset{o}{L}}{L} \Rightarrow g_Y = g_A + (1-\alpha).g_K + \alpha.g_L$$

Where: g_Y = growth rate of the aggregate production;

g_A = rate of technological progress (*Solow's residual*);
g_K = growth rate of the capital stock;
g_L = growth rate of the labour force.

So, the rate of economic growth is determined by the weighed average of the increments in the production factors.

Another important feature of this model is the absence of an investment function – the amount invested is determined by the amount saved.[3] Furthermore, the adjustment costs are not included.

[3] This feature can be demonstrated through the examination of *Solow's fundamental equation*:
$\overset{o}{k} = s.f(k) - g_A.k$,
Where: $k = K/[A(t).L]$ = capital stock per unit of labour adjusted by the technical progress;
$f(k) = F[K(t), A(t).L]/[A(t).L]$ = aggregate production per unit of adjusted labour;

The potentials of the Growth Accounting Methodology, as well as its limitations, are synthesised by Maddison (1987). He estimated the contribution of several inputs for the annual rates of economic growth, getting the corresponding residual (i.e., the fraction of the economic increment not directly generated by the inputs considered). The following residuals have been gotten:

a) 1st residual (labour productivity): difference between the rates of economic growth and of the labour force $\left(g_Y - g_L\right)$;
b) 2nd residual (capital productivity): difference between the rates of economic growth and the capital stock $\left(g_Y - g_K\right)$;
c) 3rd residual (total factor productivity or Solow's residual): difference between the rate of economic growth and the sum of the labour force and capital stock increments, weighed by the participation of each input in the aggregate production $\left\{g_A = g_Y - \left[\alpha . g_L + (1-\alpha). g_K\right]\right\}$;
d) 4th residual (adjusted total factor productivity): adjustment of the 3rd residual by the incorporation of the increments in the quality of the labour force and of the capital stock $\left\{g_A^* = g_Y - \left[\alpha . g_L^* + (1-\alpha). g_K^*\right]\right\}$;
e) 5th residual: addition of nine supplemental influences to the 4th residual – modifications in the economic structure; the convergence toward the most advanced economies; foreign trade; national economies of scale; the explosion of the energy prices in the period 1973-84; the discovery of new natural resources; the costs of the governmental regulation and crime incidence; the hoarding and dishoarding of labour; and the use of the installed capacity.

The five residuals have been calculated based on the following measures: the Gross Domestic

Product (GDP), in the case of the aggregate production; the employment level, the amount of hours worked weekly and the annual incidence of strikes, holidays and non-attendances, in the case of the labour factor; and the estimate of the gross capital stock, based on the perpetual inventory method (i.e., the difference between the gross accumulated investment and the capital stock scrapped annually), in the case of the capital factor. Furthermore, Maddison assumed that the capital factor answers for 30% of the aggregate production – 7% owing to the residential capital stock.

The measures above lead to the average rates shown in the four first rows of Table 1. As for the 3rd residual, it should be noted that the total factor productivity $\left(g_A\right)$ answers for up to 70% of the average annual increment in the aggregate production (i.e., the ratio between the rates of increment of the 3rd residual and of the aggregate production).

However, as the neoclassical model treats the technical progress as an exogenous variable, the economic growth remains, at large, theoretically unexplained.

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s = propensity to save as a share of the aggregate production;

$\overset{o}{K} = s.F\left[K(t), A(t).L\right] = s.f(k).A(t).L$, in other words, the capital stock variation is equal to the saving;

$\overset{o}{k}$ = time derivative of k with constant L.

Table 1: Average Annual Variation of the Residuals Defined by the *Growth Accounting Methodology* (weighed by the countries analysed)

Component	Period			Variation	
	1913-50 (A)	1950-73 (B)	1973-84 (C)	[(B) - (A)]	[(C) - (B)]
GDP (g_Y)	1,85	5,31	2,10	3,46	-3,21
1st residual $(g_Y - g_L)$	1,74	4,84	2,48	3,10	-2,36
2nd residual $(g_Y - g_K)$	0,46	0,73	-1,78	0,27	-2,51
3rd residual (g_A)	1,30	3,58	1,19	2,28	-2,39
4th residual (g_A^*)	0,49	2,73	0,50	2,24	-2,23
5th residual	0,42	1,17	0,38	0,77	-0,79

Source: Maddison, 1987.

Hoping to reduce the Solow's residual, the adepts of the *Growth Accounting Methodology* have searched ways to expand the participation of the labour and capital factors in the aggregate production. Accordingly, Maddison tried to incorporate in his estimate of the labour force the effects of the increase in both the educational level of the population and the women share of the labour market. The capital stock also was adjusted, although more moderately. He states:

"It is quite clear that some of the impact of technical progress is disembodied and arises from improvements in the content of knowledge acquired by employees and managers in school and on the job, and by retrofitting and recombining old capital assets; however, insertion of a modest element of embodied technical progress in the analysis does illuminate the nature of the growth process and clarifies the impact of changes in the age of capital in a way that is not possible outside the vintage context." (Maddison, 1987, p. 662)

Despite these adjustments, the 4th residual answers for 50% of the increment in the aggregate production in period 1950-73 and for 25% of the increment in the other periods.

To reduce this residual yet, the author appealed to the supplemental influences mentioned previously. Since the new variables are *ad hoc*, it would be superfluous to provide a detailed account of them. It is enough to show that the residual continues significant – approximately 20%.

Thus, the 1st and the 2nd residuals correspond to the usual measures of productivity. It is important to notice that the labour productivity rarely decreases from one period to another, while the capital productivity diminishes significantly during recessions. In the long run, they both are positive: the first is strict and the second moderate.

The 5th residual is an attempt to solve the deficiencies of the neoclassical conception illustrated by the 3rd and 4th residuals. This effort demonstrates the eclecticism of the *Growth Accounting Methodology* when trying to overcome the empirical problems that come across. However, the residual remains expressive and the dependence of the model in relation to exogenous variables is not modified.

An extension of the neoclassical conception that deserves attention is the sectoral production functions proposed by Jorgenson. He argues that:

"... the existence of an aggregate production function requires the existence of sectoral value-added functions. Furthermore, these value-added functions must be identical for all sectors. These highly restrictive assumptions are appropriate for studies of long-term growth, but can be seriously misleading for shorter periods. To explain important changes in rates of economic growth, such as the recent growth slowdown in industrialized countries, a disaggregated approach is required." (Jorgenson, 1995, p. 72)

Assuming that the substitution patterns among the inputs are restricted, *a priori*, by the Cobb-Douglas functions, the author chose a sectoral approach. So, the U.S. economy was decomposed in 35 sectors, a production function for each branch was estimated and the interaction between the several inputs was also considered. In general terms, the following function was calculated:

$Y_i = F^i(E_i, X_i, K_i, L_i, T)$
Where: i = industrial sector;
Y_i = sectoral product;
F^i = sectoral production function;
E_i = sectoral energy input;
X_i = sectoral material input;
K_i = sectoral capital input;
L_i = sectoral labour input;
T = time (*proxy* for technical progress).

Based on the functions estimated, he concludes that the decline in the sectoral rates of productivity growth was the main responsible for the reduction of the U.S. economic growth during the 70's and 80's.

Table 2: Industrial Sectors Classified According to the Bias Associated to Productivity Increments

Classification	Sectors
Capital using, labor using, energy using, material saving	textile mills; apparel; lumber & woods (3 sectors)
Capital using, labor saving, energy using, material using	agriculture; construction; food & kindred products; furniture & fixtures; paper & allied; printing & publishing; stone, clay & glass; electrical machinery; miscellaneous manufacturing; transportation services; wholesale & retail trade (11 sectors)
Capital using, labor saving, energy using, material saving	nonmetallic mining; tobacco; leather; fabricated metal; machinery, except electrical; instruments; communications; services; government enterprises (9 sectors)
Capital using, labor saving, energy saving, material using	coal mining; petroleum & coal products (2 sectors)
Capital saving, labor using, energy using, material using	finance, insurance & real estate (1 sector)
Capital saving, labor using, energy using, material saving	motor vehicles (1 sector)
Capital saving, labor using, energy saving, material using	metal mining (1 sector)
Capital saving, labor saving, energy using, material using	oil & gas extraction; chemicals; rubber & miscellaneous plastics; transportation equipment & ordnance, electric utilities (5 sectors)
Capital saving, labor saving, energy using, material saving	primary metals; gas utilities (2 sectors)

Source: Jorgenson, 1995

To understand how the sectoral functions influence the aggregate production, Jorgenson estimated the bias of the productivity increments. The capital stock bias represents the technologically induced changes of this factor share in the aggregate production. An increment in the productivity is capital using (saving) depending on the corresponding bias being positive (negative). The sum of each input bias is zero. Furthermore, when the productivity increments are capital using (saving), any price increase of this factor reduces (augment) the rate of productivity growth.

Concerning the U.S., 11 out of 35 analysed sectors present productivity increments that are capital, energy and materials using and labour saving, as the Table 2 shows. Therefore, any price increases of the capital, energy and intermediate material factors reduce the rate of productivity growth, while price increases of the labour factor augments this rate.

Finally, he affirms that the decline, after 1973, of the rates of productivity growth of the 35 sectors for the U.S. industry is a result of energy price increases. Such a fall would have been enough to explain the reduction of the growth rate of the whole economy. Unlike this sectoral approach, the aggregate production models do not include inputs like energy and materials, since the supply of intermediate products is entirely counterweighted by the demand for them (Jorgenson, 1995, p. 80).

III. The "New Growth Theory"

The appearance, in the middle of the 80's, of the *New Growth Theory* marks a refreshing academic interest in the economic growth phenomenon. The articles published by Romer (1986) and Lucas (1988), among others, have launched the bases of a new trend. They have emphasised the relationship between the rate of technological innovation and the growth rates of the physical and human capital supplies. Unlike the traditional neoclassical model, they treated the technological progress as an endogenous variable; in other words, they tried to understand how the choices made by the public and private sectors influence the national economic growth rates. Furthermore, while the neoclassical perspective states that increases in investment present decreasing return, the new approach indicates that technological externalities induce constant or increasing returns.

The *New Growth Theory* supports the idea that the economies can grow indefinitely, since the income-generating investment opportunities are not predestined to exhaustion. If for Solow the developed (i.e., near the technological frontier) and the underdeveloped economies (i.e., with bigger returns on investment) have a tendency to converge, the new approach does not observe a similar trend – the economies may diverge or converge depending on their organisation and factor endowment, defined in quantitative and qualitative terms. Romer (1994, p. 4) remembered that:

"Both Robert Lucas (1988) and I (Romer, 1986) cited the failure of cross-country convergence to motivate models of growth that drop the two central assumptions of the neoclassical model: that technological change is exogenous and that the same technological opportunities are available in all countries of the world."

The reduction of the labour factor share (α) in the aggregate production is a way to make compatible the neoclassical perspective and the available empirical data. With the reduction above, the decreasing returns of the capital accumulation would be attenuated. However, it represents a theoretical challenge for the mainstream, because the labour force remuneration (i.e., the private return) would be higher than its marginal product (i.e., the public return).

Trying to explain the differences between these returns, Romer (1987) proposed a model in which the technical progress (A) is determined by positive externalities induced by the accumulation of knowledge. Each unit of capital invested raises both the stock of physical capital and the technological level available to all firms.

Additionally, increases in the labour factor supply provoke negative externalities, since they reduce the incentives for the firms to discover and implement innovations that save this factor.

The resultant model establishes a functional relation between the technical progress and the others factors of production: $A = A(K,L)$. Thus, the production of each firm is determined by the following equation:

$$Y_j = A(K, L).K_j^{(1-\beta)}.L_j^{\beta}$$

Where: j = firm;

K_j, L_j = inputs controlled by the j firm;

A, K, L = macroeconomic aggregates;

β = private effect of increases in the labour factor share in the aggregate production, equivalent to the labour force remuneration.

Romer shows that, for $A(K,L) = (K/L)^{\gamma}$, with $\gamma > 0$ the aggregate production function becomes: $Y = K^{(1-\alpha)}.L^{\alpha}$, where $\alpha = (\beta - \gamma)$ represents the aggregate effect of any increase in the employment level, capturing both the private (β) and the public (γ) effects.

In this simplified model, α may be lower than the labour factor share of the aggregate production.

Romer and Lucas have analysed extensively this theoretical subject and their work has given rise to several econometric studies. De Long and Summers, for instance, have concluded that economic growth and equipment investments are strongly correlated, being their conclusions based on the following stylised facts:

a) The hoarding of machines is one of the most important determinants of the national rates of productivity growth;
b) The private return spawned by equipment investments differs from the social one.

In this context, the social return is equal or even higher than 30% per year and would almost totally explain the post-war performance of economies like the Japanese. (De Long & Summers, 1991, p. 446).

Barro and his companions emphasised in several opportunities the importance of the human capital in the process of economic growth (Barro, 1991; Barro & Lee, 1994). Furthermore, Barro and Sala-i-Martin (1995) have concluded that the initial distribution of the technical progress is given by the history of each region [$A = A(t)$], slowly spreading out from the areas situated in the technological frontier to the less developed ones. Thus, the observed differences in the labour productivity levels are not necessarily the results of differences in the marginal product of capital. In this vein, the convergence rate between economies is determined by the knowledge diffusion rate and is not related to the labour factor share of the aggregate production (α). The process of convergence only occurs under certain conditions (i.e., *conditional convergence*).[4].

Mankiw, Romer and Weil have incorporated to the Solow's model considerations on the accumulation of physical and human capital stocks and have concluded that the neoclassical model is still valid. Accordingly, while adjusting the data to keep constant the population growth and the capital accumulation, they have stressed that the economies tend to converge, demonstrating that even a pure version of the neoclassical model – closed economy and uniform technology – is compatible with an α lower than the one originally defined, being enough to treat the human capital[5] as a production factor.

[4] The developed and underdeveloped economies would converge when their policies, institutions and, mainly, human resources are similar.

[5] As unit of measure, it was adopted the share of the economically active population with access to the secondary school.

These authors have proposed the following aggregate production function: $Y = A(t).K^{1/3}.H^{1/3}.L^{1/3}$ (Mankiw, Romer & Weil, 1992, p.432).

The model analysed shows that the neoclassical perspective may be reconciled with the available statistical series. However, these series do not represent all the existing evidences concerning the process of economic growth. So, the limitations of the *Growth Accounting Methodology* and the potentials of the *New Growth Theory* must be analysed in a wider perspective. To this respect, Romer (1994, p. 20) argues that:

"If macroeconomists look only at the cross-country regressions deployed in the convergence controversy, it will be easy to be satisfied with neoclassical models in which market incentives and government policies have no effect on discovery, diffusion, and technological advance. But if we make use of all of the available evidence, economists can move beyond these models and begin once again to make progress toward a complete understanding of the determinants of long-run economic success.

Ultimately, this will put us in position to offer policy-makers something more insightful than the standard neoclassical prescription – more saving and more schooling."

The stylised facts that must guide both the theoretical analysis and the empirical studies concerning the process of economic growth have been synthesised by Romer (1994, p. 12-3) as follows:

1st. there are many firms;
2nd. innovations differ from other inputs, because they can be simultaneously used by several economic agents (i.e., they are non-rivals goods);
3rd. physical and human capital stocks can be replicated (i.e., the rival goods of the aggregate production function are homogeneous of degree one);
4th. innovations are results of human actions;
5th. many economic agents possess market power and gain monopolistic incomes through innovations.[6]

The first three facts have been picked-up by the neoclassical perspective. While treating innovations as public goods, it conciliated the non-rival nature of the new technologies (2nd fact) with the perfect competition principles. However, the partially or temporarily exclusive character of the innovations (5th fact) was ignored.

The *New Growth Theory* looked for to incorporate the 4th fact, but did not pay attention, initially, to the 5th fact. The first models of Romer and Lucas, for example, have also treated the technology as a public good or, similarly, as a secondary effect of private decisions about investment with the firms operating in competitive markets.

The linear models (Rebelo, 1987), in turn, have treated all the inputs as rival goods, adding them in a single and ample measure of capital.[7] Endogenous growth becomes possible when it is assumed that a constant fraction of the aggregate production is saved and used to generate new inputs. In this case, the incorporation of the 4th fact resulted in the violation of the 2nd one.

The 5th fact only became object of attention by the end of the 80's, when Grossman and Helpman (1989), and Romer (1987; 1990), among others, have incorporated the principles of monopolistic competition in their models.

[6] In general, the relevant innovations are partially or temporally exclusives from the economic point of view. Even though they are non-rivals, they can not be typified as public goods.
[7] In the linear production function $Y = AK^*$, K^* embraces the physical and human capital stocks.

The first two authors, while investigating the effect of foreign trade on growth, have concentrated their attention on the dynamic process of convergence of the income level toward a steady state, while the last author tried to extend the original models, conciliating sustained growth with the five mentioned facts.

Even though the *New Growth Theory* has revitalised the research on economic growth, deepening the analyses about the relationships between technical progress, economies of scale and the formation of physical and human capital stocks, as well as on the limits of the convergence hypothesis, many criticisms have been made concerning its assumptions. Maddison's commentaries illustrate some of the problems posed by the *Growth Accounting Methodology*:

"The basic contention of the new growth theory about the importance of increasing returns has left most observers as skeptical as an earlier generation was about Kaldor's (...) arguments in a similar vein.

The new growth theorists ignored previous work which was relevant to their discussion of the interaction between investment and technical progress, e.g. (...) [the] analysis of vintage effects and the distinction between embodied and disembodied technical progress. They also ignored virtually all the growth accountants..." (Maddison, 1995, p. 4-5).

Furthermore:

"... some of the new growth theory that has emerged since 1986 does not adequately acknowledge the specificity of the nation-state as the basic unit of analysis, and it tries to assimilate the problem of explaining the growth performance of nations to that of explaining the equilibrium behavior of individuals or firms." (Maddison, 1994, p. 21).

He points out that the technological innovation is endogenous only for the nations next to the technological frontier (i.e., U.S., Japan and Western Europe), remaining exogenous for the other countries.

Pasinetti's criticism to the models of the *New Growth Theory* also deserves mention. His opinion summarises the failure identified by the "Modern Cambridge School", of which he is an important member. According to him (Pasinetti, 1994, p. 356):

a) the analyses, in general, limit themselves to sustainable growth situations (i.e., *steady growth*);
b) "reasonable" restraints for the growth rate of the aggregate production were established;
c) there are cumulative effects that make difficult to explain the convergence processes eventually observed;
d) the relevant macroeconomic variables can not be distinguished from microeconomic ones;
e) institutional aspects are not thoroughly treated;
f) the inclusion of behavioural hypotheses concerning the technology, the nature of the research activity, the use of learned abilities, the market structure, the intertemporal preferences, etc. does not follow clear criteria.

As a result of these criticisms, it is time to examine the main features of the "Cambridge School", whose central assumptions are more real, as we show in the next section.

IV. The "Cambridge School"

The *Growth Accounting Methodology* and the *New Growth Theory* are not the only perspectives dedicated to the study of economic growth. As Araujo reminds us (1996, p. 1-2):

"Several models of Keynesian inspiration, starting with the traditional models of Harrod and Domar, have been presented since after the War, and their production did not stop even during the 70's, when this subject lost much of its space in the economic mainstream (...). Owing to its association with the intellectual production of economists of the University of Cambridge, United Kingdom, (...) the discoveries induced by these models started being treated as (...) the 'Cambridge approach' and its adepts as members of the 'Cambridge School'."

The present approach distinguishes itself by the aspects indicated below:

a) The Keynes' principle of the effective demand: the demand for goods and services supported by the actual availability of resources, therefore suitable to be communicated through the price mechanism;
b) The bilateral relationship between profits and investment: the current accumulation rate determines the profit that may be gotten, what defines the expected profit rate for a given investment level, which influences the first rate.

The exponents of the "Modern Cambridge School"[8] have been, among others, Robinson, Pasinetti and Kaldor. These authors have understood, as Keynes, in his work *The General Theory of Employment, Interest, and Money*, that the investment decisions logically precede the saving decisions. So, the Post-Keynesian models invert the causal relationship generally assumed between investments and saving. The existing differences between the economical policies recommended by the *New Growth Theory* and the "Cambridge School" are a result of such inversion. While the first one prioritises the saving, the second not only advocates the stimulation of investment but also states that increases in the propensity to save from the profits reduce the rhythm of growth of the economy. This is the *paradox of parsimony*, illustrated by the growth model adapted by Araujo (1996, p. 11-13). His model approaches only the demand side of the economy and contains two functions:

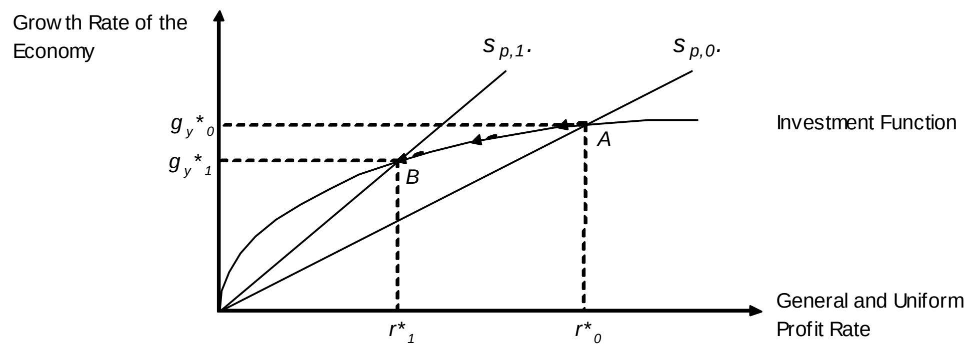
a) The investment function: $g_y = \{ g_y(r) \mid g_y' > 0, g_y'' \leq 0, g_y(0) = 0\}$;
b) The saving function: $g_y = s_p.r$.

In this context, g_y is the growth rate of the economy; r, the general and uniform profit rate[9]; and s_p, the propensity to save a share of the profits. Graph 1 shows that the equilibrium (points g_y* and $r*$) is determined by the equality between the two functions [$g_y(r) = s_p.r$]. It is important to notice that any increases in s_p reduce, *ceteris paribus*, the growth rate of the economy, as well as the general and uniform profit rate. Looking at the graph, the rates mentioned above fall from $g_{y\ 0}^{*}$ to $g_{y\ 1}^{*}$ and from r^*_0 to r^*_1, respectively, between the periods t_0 and t_1 (interval $\left[\overline{AB}\right]$), given that $s_{p,1} > s_{p,0}$.

[8] The original "Cambridge School" had Pigou and Keynes as members, among others, and it was influenced by Marshall's writings, but most of their contributions are associated to Kalecki, Kaldor and scholar publishing in the "Cambridge Journal of Economics" as well as in the volumes of "Structural Change and Economic Dynamics", and in the "Post-Keynesian Journal of Economics", among others.

[9] "... the general and uniform rate of profits possesses three basic attributes: (i) it is a rate of equilibrium, which corresponds to the ceasing of the migration of capitals; (ii) it is a macroeconomic concept (...); (iii) it is not, necessarily, an 'optimum' one from the social point of view." (Araujo, 1996, p. 15)

Graph 1
Paradox of Parsimony



Source: Araujo, 1996.

The members of the "Cambridge School" have explored the implications of this model through the following instruments:

a) making endogenous the rate of use of the capacity utilisation: the adjustment toward a state of equilibrium does not involve changes in prices, but in the amounts produced, with an income distribution in favour of wage-earners stimulating growth (Taylor and Lavoie, among others);
b) the analysis of the regimes of capital accumulation: the investment function put forward by the models treated above is modified to better portray the economic performance of the advanced capitalist countries in the post-war period, providing a non-trivial relation between the growth and the distribution of the income in favour of the wage-earners (Bhaduri, Il-You and Marglin);
c) making the technical progress endogenous: the technological change is incorporated in the capital goods through a technical progress function, like the one proposed by Nicholas Kaldor, establishing a relationship between the labour productivity growth and the capital accumulation;
d) The analysis of structural changes: the diffusion of the technical progress and the expansion of the consumption are not uniform among the several sectors of the economy, establishing different sectoral growth rates [Reati (1998), Teixeira and Araujo (1997), and Pasinetti (1981)[10]].

Through the technical progress function, Kaldor rejects the *Growth Accounting Methodology* based on the perceptions that shifts *along* the production function can not be distinguished from shifts *of* the whole function.

Regarding the sustained economic growth, both the adepts of the *New Growth Theory* and the members of the "Cambridge School" are faced with a similar problem. In Araujo's words (1996, p. 8-9):

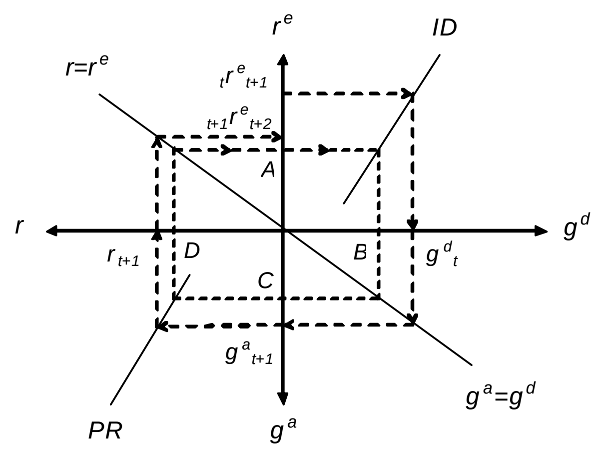
[10] "Reproducible commodities and the 'learning process' pervades Pasinetti's conception of structural dynamics. He presents an original treatment of the problems of full employment in a multi-sector economic system with growing population and unequal rates of technical change across sectors. This is achieved through adaptation of the linear model of production so as to allow for unequal rates of growth both of production coefficients of different sectors and of the coefficients of final demand" (Teixeira, 1998, p. 275). Further comments on structural change may be found on Reati (1998).

"... the search for some endogenous mechanism that hinders the decline of the capital rate of return toward the level dictated by the interest rate, in the case of Keynes, or by the intertemporal discounting rate, in the neoclassical case, while the capital accumulates. While the new growth theory has found this mechanism in the technological scope of the economy, the Keynesian economists discovered in the expectation generation process that affects the private investment decisions the key to understand the process of sustained growth."

The role of the expectations in the Post-Keynesian models is clear in the model adapted by Araujo (1997) concerning the bilateral relation between profits and investment. This is illustrated by Graph 2, which contains the relations indicated below:

a) the curve of investment decisions (*ID*), which shows these decisions (g^d) in response to changes in the expected profit rate (r^e);
b) the relationship between the decision to invest and its accomplishment ($g^a = g^d$);
c) the curve of profits realised (*PR*), showing how the current profit rate (r) is affected by the carried through investment (g^a);
d) the relationship between the current and expected profits ($r = r^e$), which defines how the expectations are formed.

Graph 2
Bilateral Relationship Between Profits and Investments



Source: Araujo, 1997.

Graph 2 is formed by four quadrants, one for each relation. A simple solution for this model can be obtained by means of the following assumptions:

a) the expected profit rate at moment *t* in relation to the moment *t+1* is equal to the current rate (${}_t r^e_{t+1} = r_t$);
b) the gross investments carried through at the moment *t+1* is equal to the value of the planned gross investments at the moment *t* ($g^a_{t+1} = g^d_t$)
c) the interval between the decision taking and the accomplishment of the investment corresponds to a unit of time.

Based on these assumptions, the previously fixed relations determine, endogenously, the equilibrium growth rates of the aggregate production and capital stock, as well as the long-run profit rate.[11] The ID and PR slopes guarantee that the points *A*, *B*, *C* and *D* correspond to an equilibrium state with sustained growth, where the expectations about the profits and the investment are fully confirmed.

The points ${}_tr^e_{t+1}$, g^d_t, g^a_{t+1}, r_{t+1} e ${}_{t+1}r^e_{t+2}$ reflect a disequilibrium situation, with $r_{t+1} < {}_tr^e_{t+1}$, or, in other words, the expected profits have been overestimated, creating an excessive volume of investments. So, the economic agents are induced to reduce their expectations and the point *A* is reached by the end of a few cycles.

V. Conclusion

In this article, we presented some theoretical and empirical problems treated by the *Growth Accounting Methodology*, the *New Growth Theory* and the "Modern Cambridge School", each one based on different theoretical premises.

We also observed that the results of the first two perspectives present important limitations, what should re-position the solutions proposed by the Post-Keynesian authors in the centre of the economic debate. Effectively, the economic phenomena are far too complex for the mainstream to show aversion to the contributions of other schools.

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[11] It is important to notice that the growth models of the "Cambridge School" do not claim the equality, in the long run, between the profit and interests rates. For this school, the equilibrium is better defined as the state in which the price level is constant, without excess demand or supply. (Araujo, 1997, p. 155)

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