A Growth Regime Consistent with the Natural Rate of Profit: A Structural Economic Dynamic Approach to the Post-Keynesian Growth Model

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Abstract

In a disaggregated version of the post-Keynesian approach to economic growth, we consider the natural rate of profit as one of determinants of investment. This approach is according to the view that profit influences investment not only providing the motive for it but also through providing the means as stated by Joan Robinson. From this analysis it is possible to conclude that a wage-led regime is the most probable outcome in a closed economy where the natural rate of profit is one of determinants of investment.

Keywords: Post-Keynesian growth model, structural change, multi-sector models.

JEL Classification: E21, O11.

1. Introduction

> Profit influences investment not only providing the motive for it but also through providing the means. (Joan Robinson 1962, p. 86)

It is not easy to define what the Post-Keynesian growth model – PKGM hereafter – is as long as there are a number of models in this tradition with different assumptions, focuses and results, some of them contradictory[1]. But in general this terminology is adopted to designate the growth model that was initially coined by Kaldor (1956) and Robinson (1956, 1962) and extended by Dutt (1984), Rowthorn (1982) as well as by Bhaduri and Marglin (1990). Integral to its evolution the PKGM passes through three principal phases that are labeled as 'generations'. Although Kaldor (1956) has built his seminal model on the notion of full capacity utilization, Dutt (1984) and Rowthorn (1982), working independently, have built what is known as the second generation of the PKGM by endogenizing the rate of capacity utilization in the lines of Steindl (1952). One of the main contributions of this generation is the possibility of disequilibrium and the presence of a stagnationist regime in which an increase in the profit share implies a reduction in capacity utilization. The key assumption behind this result is that the growth rate of investment is a function not only of the profit rate, as in Kaldor-Robinson but also of the rate of capacity utilization.

Bhaduri and Marglin (1990) have challenged this view by considering that the growth rate of investment is a direct function not of the profit rate but of the profit share. According to them the profit rate has already been implicitly considered in the equation of the growth rate of investment through its relation with the rate of capacity

[1] See Stockhammer (1999) for a survey of the PKGM.

utilization[2]. Hence by substituting the profit rate by the profit share in the expression of the growth rate of investment avoids to consider twice the effects of the former. One of the properties of the third generation model, as it became known, is the possibility of a non-stagnationist regime in which eventual falls in consumption due to a lower real wage are overcompensated by an increase in investment led by a profit share expansion.

Although the PKGM shares some common characteristics with other models in the heterodox view it is subject to the same criticism highlighted by Pasinetti (2005, p. 839-40) to explain why the Keynesian School has somewhat failed as a successful alternative paradigm to mainstream economics[3]. He points out a lack of theoretical cohesion amongst models in this tradition. In this paper we intend to contribute to fill this gap by building a bridge between the Pasinetti model of Structural Change and Economic Growth and the PKGM.

Although sharing the Cambridge's heritage these models belong to different strands of the literature. The Pasinettian model is neo-Ricardian in essence with strong connections with the Sraffian framework and the PKGM has deep influences of the seminal work of Kalecki. While the former focuses mainly on determination of economic growth from the interaction between technical progress and evolution of demand patterns the latter focuses on this issue from a point of view of class struggle, which allows it to consider the existence of different regimes of economic dynamics.

[2] This is given by $r = \pi.u$, where r is the profit rate, π is the profit share and u is the rate of capacity utilization.

[3]Of course some effort was made in order to establish connections among these approaches. The works of Trigg and Lee (2005), Araujo and Teixeira (2002) and Araujo and Lima (2007) trying to connect the Pasinetti's analysis with Keynes, Feldman and Thirlwall's models respectively are just some examples of this pursue but substantive work remains to be done.

Intending to build a reconciliation between the Kaleckian effective demand and Sraffian normal prices Lavoie (2003, p. 53) considers that "a large range of agreement has remained, in particular about a most crucial issue, the causal role played by effective demand in the theory of capital accumulation". Besides, both approaches are built on the notion of vertical integration[4] and consider a simultaneous supply and demand determination of economic growth with disequilibria as an inevitable outcome of economic growth.

However, a key methodological difference between the two approaches remains: the PKGM consider national economies in the aggregate[5]. It is worth to remember that one of the major criticisms Post-Keynesians leveled against the Neoclassical model is that it aggregates the whole economy into one sector, rendering the model incapable of performing an analysis of structural change. Furthermore, implicit in the Neoclassical representation is a well-known and strict definition of balanced growth, assuming that growth is non-inflationary with full-capacity utilisation.

[4] Steedman (1996) argues that vertical integration is very useful in some fields of economic analysis but Kaleckian mark-up pricing theory is not one of them. Here we dispute this view by showing that the PKGM may be treated as a particular case of the Pasinetti's model that is also built on the notion of vertical integration. One of the key differences between these approaches is the level in which the analysis of vertical integration is carried on. While in the later the model is disaggregated the former aggregates the whole economy in one sector.

[5] In fact in his analysis Kalecki (1954, 1968) considers an economy with three compartments that can be viewed as a first approximation to a multisectoral analysis. Besides, his digression on mark-ups relies implicitly on reasoning that accrues from a multissectoral viewpoint since he considers crucial the comparison between sectoral and average mark-ups. It is important to emphasize that he already in the 1930's had considered pricing, distribution, employment and the cycle as being simultaneously determined.

This view precludes any analysis of the relationship between growth and inequality. In his challenge to the Neoclassical model, Ocampo (2005, p. 8) considers that: "[t]he contrast between the balloon and structural dynamics views of economic growth can be understood in terms of the interpretation of one of the regularities identified in the growth literature". We interpret that Ocampo is referring to the tendency of per capita GDP growth to be accompanied by regular changes in the sectoral composition of output. According to the balloon view, these structural changes are simply a by-product of the growth in per capita GDP. In the alternative reading, success in structural change proves to be the key to economic development.

In order to overcome this limitation of the PKGM here its analysis is performed in a multi-sector framework by treating them as a particular case of the Pasinetti's model (1981, 1993). Another gain that accrues from considering the PKGM as a particular case of Pasinetti's model is that the latter includes the derivation of normal prices and natural rate of profits. According to Sebastiani (1989, p xiv), "the need to complete the Kaleckian scheme with a theory of the rate of profit and of normal prices is made even more urgent by the necessity to confront the problem of normal productive capacity and that of choice of techniques". This view is confirmed by Nell (1989, p. 163) who considers that "Kalecki's approach implicitly rests on the relationship between the rate of profit and normal prices, and to be complete requires a theory of the determinants of the rate of profits".

Besides, this approach allows us to include the natural rate of profit in the investment equation as giving not only the motive but also the means to promote capital accumulation. Hence, the concept of natural rate of profit as advanced by Pasinetti allows us to consider the roles that the profit rate should play as emphasized by Joan Robinson.

Another important improvement that our approach brings to the PKGM is the possibility of considering that different sectors are under different regimes. If one sector is under a 'stagnationist' regime, then an increase in the wage share of the economy as a whole may bring an increase for the demand of the final good produced by that sector. This fact shows that the structural economic dynamics is conditioned not only to patterns of evolution of demand and diffusion of technological progress but also on the distributive features of the economy that can give rise to different regimes of economic growth.

This article is structured as follows. In the next section we treat versions of the PKGM as particular cases of the Pasinettian model of structural change by using the device of vertical integration. In section 3 we show that the property of the natural of profit as defined by Pasinetti allows us to establish the wage led as the most probable outcome of a closed economy. In section 4 we conclude.

2. A Multi-Sector Approach to PKGM

The main focus of the Pasinettian approach is on the structural economic dynamics but his analysis includes also a macroeconomic determination of economic growth[6]. His analysis is carried out, not in terms of input-output relations, as has become usual in multi-sector models, but rather in terms of vertically integrated sectors. This device is used to focus on final commodities rather than on industries. In this case, it is possible to associate each commodity to its final inputs – a flow of working services and

[6] Trigg and Lee (2005) for instance explore the relation between the Keynesian multiplier and Pasinetti's model of pure production to derive the Keynes's multiplier from multi-sectoral foundations.

a stock of capital goods – thus eliminating all intermediate inputs. From this point of view, such framework may be adopted to approach the PKGM although the latter does not consider the distinction between capital and consumption goods: only one commodity is produced. This view is also supported by Bhaduri and Marglin (1990, p.377) for whom in the PKGM "we can think of the representative firm as vertically integrated using directly and indirectly a constant amount of labour per unit of final output."

Hence, the starting point of the present analysis is to consider that the Post-Keynesian structure is a vertically integrated model in which this device was used to its limit. As pointed out by Lavoie (1997, p. 453), "the concept of vertical integration, although extensively but implicitly used in macroeconomic analysis, has always been difficult to seize intuitively". What is behind this affirmation is that models that are aggregated in one or two sector are based on the device of vertical integration. This range of vision is confirmed by Scazzieri (1990, p.26) for whom "[a]ny given economic system may generally be partitioned into a number of distinct subsystems, which may be identified according to a variety of criteria. However, the utilization of subsystems for the analysis of structural change is often associated with the consideration of subsystems of a particular type. These are subsets of economic relationships that may be identified by the logical device of *vertical integration* (...)". Hence it is possible to view the PKGM as a vertically integrated model because it has the same characteristics of what Sraffa (1960, appendix A) has called sub-systems – i.e. it is self-reproducible, it uses no intermediate goods to produce only a single commodity[7].

[7] Araujo and Teixeira (2002) has adopted this idea to show that the Feldman's bi-sectoral model of economic growth may also be considered a vertically integrated model in each this technique was adopted

This view is confirmed by Steedman (1992, p. 136) for whom "Kaleckian writings frequently appeal to vertically integrated representations of the economy." But we do not fully agree with his view when he considers that vertical integration is not suited to discuss Kaleckian issues such as concentration and selling costs. In our viewpoint the problem related to the use of vertical integration in Kaleckian models is related to the fact that this device is used to its extreme giving rise to an economy aggregated in one sector that does not allow performing a proper analysis of some important issues related to the structural economic dynamics. Here we consider that a multi-sectoral version of the PKGM could highlight some sectoral issues that can be dealt with only in a disaggregated set up but avoiding cumbersome inter-industrial relations.

A possible departing point to establish a bridge between the two approaches is to consider the relationship $r = \pi u$ in a sectoral environment. This is an important point since although vertically integrated 'industries' are merely weighted combinations of real industries [Steedman (1992, p. 149)] it is possible to particularize to each sector a profit share, a rate of capacity utilization and a rate of profit, and to establish a relation among these variables in a multisectoral economy.

Let us consider that X_i denotes the domestic physical quantity produced of consumption good i and X_n represents the quantity of labour in all internal production activities. Besides, considering that p_i is the price of commodity i (i = 1,2,...,n – 1), and w is the wage rate (uniform), the monetary system may be written as:

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to produce a two-sector model. In fact the concept of vertical integration has been widely used in macroeconomics.

$$\begin{cases} X_i p_i - a_{ni} X_n w - r_i K_i p_{ki} = 0 \\ p_{ki} X_{k_i} - a_{nki} X_n w = 0 \\ X_n w + \sum_{i=1}^{n-1} (a_{in} p_{ki} r_i - a_{in} p_i - a_{ki,n} p_{ki}) X_n = 0 \end{cases} \quad (1)$$

Where per capita demand of consumption goods is represented by a set of consumption coefficients a_{in}. In the same vein, $a_{k_i,n}$ stand for the investment coefficients of capital goods k_i. The production coefficients of consumption and capital goods are respectively a_{ni} and a_{nk_i}. The family sector is denoted by n. The set of solution for prices may be expressed as:

$$\begin{cases} p_i = (a_{ni} + r_i a_{nki}) w \\ p_{ki} = a_{nki} w \end{cases} \quad (2)$$

In general, if the rates of profit, r_i (i=1,...,n –1), are positive and the capital intensity is different from one production process to another, relative prices of consumption goods will depend both on labour inputs and on the rate of profit. Note that although the Pasinettian model is built in terms of vertically integrated sectors the price of the consumption goods may be given by a mark-up rule according to:

$$p_i = (1 + \tau_i) a_{ni} w \quad (3)$$

where τ_i is the mark-up rate for sector i. Note from the first expression of system (1) that:

$$X_i p_i - a_{ni} w X_i = r_i p_{k_i} K_i \quad (4)$$

where the right hand side is nothing but profits in the i-*th* sector, that is $\prod_i = r_i p_{k_i} K_i$. Therefore, expression (4) may be rewritten as:

$$\prod_i = X_i p_i - a_{ni} X_i w \qquad (4)'$$

By replacing the mark-up expression into expression (4)' one obtains:

$$\prod_i = X_i (p_i - a_{ni} w) = X_i [(1+\tau_i) a_{ni} w - a_{ni} w] = \tau_i a_{ni} w X_i \qquad (5)$$

The profit share in sector *i* , π_i , is given by:

$$\pi_i = \frac{\prod_i}{p_i X_i} = \frac{\tau_i a_{ni} w X_i}{(1+\tau_i) a_{ni} w X_i} = \frac{\tau_i}{1+\tau_i} \qquad (6)$$

Besides $\prod_i = r_i p_i K_i$ which implies that:

$$r_i = \frac{\prod_i}{p_i K_i} = \frac{\tau_i w a_{ni} X_i}{p_i K_i} = \frac{\tau_i w a_{ni} X_i}{(1+\tau_i) w a_{ni} K_i} = \pi_i u_i \qquad (7)$$

Assuming that $u_i = \frac{X_i}{K_i}$ the relationship $r = \pi u$ remains valid for a multi-sectoral economy but now it has to take into account that π_i is the sectoral profit share and u_i is the sectoral rate of capacity utilization[8]. Note that if $u_i = \frac{X_i}{K_i} = 1$ then the *i*-th sector experiences full capacity utilization. The dynamic equilibrium of capacity utilization requires that $\dot{K}_i = \dot{X}_i$, where the dot stands for the time derivative. But we know that the equilibrium amount of physical quantity is $X_i = a_{in} X_n$ which implies that $\dot{X}_i = (\theta_i + g) X_i$ where *g* is the growth rate of population and θ_i is the growth rate of demand. Besides, the change in the stock of capital of *i*-th sector is given by the

[8] This result will be used later in order to establish a value of the mark-up rate related to the natural rate of profit.

sectoral investment according to $\dot{K}_i = x_{k_i n} = a_{k_i n} X_n$. By equalizing these last expressions, we obtain: $a_{k_i n} X_n = (r_i + g) X_i$ which implies that $a_{k_i n} = (\theta_i + g)\frac{X_i}{X_n}$. In equilibrium $X_i = x_{in}$, and we can rewrite the latter formulae as:

$$a_{k_i n} = (\theta_i + g) a_{in} \tag{8}$$

Equation (8) may be interpreted as follows: it shows the level of investment in order to guarantee that the *i*-th sector will be endowed with the amount of capital goods necessary to produce the amount of final goods required by an increase in the labour force and per capita demand. If $a_{k_i n} > (\theta_i + g) a_{in}$ the *i*-th sector will face lack of capital utilization while if $a_{k_i n} < (\theta_i + g) a_{in}$ the *i*-th sector will not be able to produce the amount of consumption goods that are required by consumer requirements. In this vein the Pasinettian approach provides us with the concept of natural rate of profit, that is, a rate of profit that must be adopted in order to endow each sector with the capital goods required to allow each sector to at least fulfil the demand requirements of that sector with no capacity excess. This rate is given by:

$$r_i^n = g + \theta_i \tag{9}$$

Note that if $r_i^n < g + \theta_i$ then capitalists in the *i*-th sector will not have the necessary amount of resources to invest in such sector in order to meet the expansion of demand. If $r_i^n > g + \theta_i$ then capitalist will overinvest in the *i*-th sector leading to excess of productive capacity.

As pointed out by Araujo and Teixeira (2003) the proportionality between the rate of profit to the sectoral rate of growth emerges as a natural requirement to endow

the economic system with the necessary productive capacity to fulfil the expansion of demand. Therefore, a growing economy does imply a natural rate of profit, which is given by the expression (13). In this vein the concept of 'natural rate of profit', introduced by Adam Smith (1776), is reinterpreted by Pasinetti (1981, 1988). Whereas the former argues that – due to the competition amongst capitalists – the ordinary rate of profit is – in the long run – uniform across sectors, Pasinetti (1981, p. 130) postulates that "there are as many natural rates of profit as there are rates of expansion of demand (and production) of the various consumption goods."

A possible interpretation of the disparity between the Pasinettian and Smithian concept of the 'natural rate of profit' is that the former is a warranted rate of profit that when adopted allows to endow each sector with the units of productive capacity necessary to fulfil demand requirements. The actual rate of profit does not necessarily lead to equilibrium in all sectors: some of them may operate with less capital goods than what is required and others may operate with excess of capacity utilization.

However, it is important to stress the importance to establish a theory of natural prices in the Kaleckian framework. According to Nell (1989, p. 163), "Kalecki's theory of effective demand requires a theory of 'normal prices', independent of the short-period changes studied by that theory. These prices are required to establish the level of normal capacity utilisation and the realization of profits. Moreover the normal rate of profit is required in order to study the problem of the choice of technique."

It is important to bear in mind that the Pasinettian model has a strong normative flavour, that is, it shows the requirements for an economic system to be in equilibrium but it does not say that this equilibrium will prevail.

3. The Assessment of the PKGM from a Multi-sector Viewpoint

The main assumptions behind the PKGM are noted: the economy is closed and produces only one good that can be both a consumption as well as a capital good. Technology is characterized by fixed coefficients. Likewise, there are constant returns to scale. There is no government, and the monetary side is ignored. All firms are equal in the sense that they wield no differences in market power. In such an economy, the value of net aggregate output is equal to the sum of the wages and profits, namely:

$$pX = wN + rpK \tag{1}$$

where p is the price level, X is the level of real output, w is the nominal wage rate, N is the level of labour employment, r is the rate of profit and K is the stock of capital. Expression (1) may be rewritten as:

$$p = w\frac{N}{X} + rp\frac{K}{X} \tag{1'}$$

Now define $l = \frac{N}{X}$ as the labour per unit of output, $v = \frac{K}{X_{fe}}$ as the capital-output ratio and $u = \frac{X}{X_{fe}}$ as the rate of capacity utilization, where X_{fe} stands for the full employment output. By using this notation $\frac{K}{X} = \frac{u}{v}$ and assuming that v is constant and normalized to one we can rewrite expression (1)' as:

$$p = wl + rpu^{-1} \tag{1''}$$

Let us assume that prices are given by a mark-up rule over wage according to:

$$p = (1+\tau)wl \tag{2}$$

Where τ is the mark-up rate. By substituting expression (2) into (1)'', simple algebraic manipulation allows us to obtain the following relationship between the profit share, the rate of profit and the rate of capacity utilization:

$$r = \pi u \tag{3}$$

Implicit in this result is the fact that the profit share is given by: $\pi = \frac{\tau}{(1+\tau)}$.

Expression (3) gives us the profit rate from the supply side of the model. Here we will focus on the Neo-Kaleckian version of the Post-Keynesian model as advanced by Dutt (1984) and Rowthorn (1982). In this model capacity utilization is now depicted as an endogenous variable that can be different from full capacity utilization. Such approach gives rise to the main difference in relation to the original Kaldor and Robinson approach: the variable measuring capacity utilization enters the growth rate equation of investment. It means that the higher the rate of capacity utilization the higher the growth rate of investment [Steindl (1952)], the latter being found in the following expression:

$$g_I = g_o + \alpha r + \beta u \tag{5}$$

where β measures the sensibility of the growth rate of investment to the capacity utilization and captures the accelerator effect. A high rate of capacity utilization induces firms to expand capacity more rapidly in order to keep up with anticipated demand. The growth rate of savings is given by the Cambridge Equation in which workers are not supposed to save:

$$g_S = sr \tag{6}$$

By replacing $u = r\pi^{-1}$ into expression (5) and by equalizing (6) to (7) we conclude, after some algebraic manipulation, that the profit rate

$$r^* = \frac{\pi g_o}{\pi(s-\alpha)-\beta} \tag{7}$$

We have the rate of capacity utilization given by:

$$u^* = \frac{g_o}{\pi(s-\alpha)-\beta} \tag{8}$$

and the balanced growth rate is:

$$g^* = \frac{s\pi g_o}{\pi(s-\alpha)-\beta} \tag{9}$$

Taking the derivative of expression (8) in relation to π we conclude that:

$$\frac{\partial r^*}{\partial \pi} = -\frac{g_o \beta}{\left[\pi(s-\alpha)-\beta\right]^2} < 0 \tag{10}$$

$$\frac{\partial g^*}{\partial \pi} = -\frac{s g_o \beta}{\left[\pi(s-\alpha)-\beta\right]^2} < 0 \tag{11}$$

This result shows that a redistribution of income towards wages may result in a higher rate of capacity utilization, as shown by Blecker (1989) and is known in the literature as the 'stagnationist view'.

Another important feature of this approach it that the profit rate plays a role on the decisions of investment in two different ways: it has a straight impact on investment decisions, which was also considered by Kaldor and Robinson, and an impact through its effect on the capacity utilization. By considering that $u = r\pi^{-1}$ then it is implicitly assumed that increasing capacity utilization is related to an increasing profit rate. For this reason Amadeo (1986a, 1986b) omits the realized rate of profit and only includes

the rate of capacity utilization in the investment equation obtaining essentially the same results as Dutt and Rowthorn.

The critique of the Kaleckian investment function on neo-Ricardian grounds is not new. Its roots may be found for instance in the works of Kurz, Vianello and Garegnani (ano). The main focus of their criticism relies on the role of current rate of profit as conveying expected profitability in the investment function. According to them, the investment function depends on the (expected) normal rate of profit rather on the actual rate of profit. [see Lavoie (1995, p. 796)]. Arguably, entrepreneurs cannot make future plans based on a variable, namely the actual rate of profit, that does not take into account neither the expected profitability nor the over-utilization of capital.

It is worth to mention that the normal rate of profit according to the neo-Ricardian view is the one which entrepeneurs will base their decision to invest and that has a close relation with the concept of the normal rate of capacity utilization. The view that the degree of utilization of productive capacity relevant to the determination of normal prices and the general rates of profits is the normal, or planned, one is emphasized by Vianello (1989, p. 174). According to him the "normal, or 'planned' degree of utilization of productive capacity is the only one compatible with the conception of normal prices as 'central ones', and the guiding lights for investment decisions". In this view, the normal rate of profit represents 'the guiding light for investment and pricing decisions, cannot possibly be either an abnormally high or an abnormally low one'. (Vianello, 1985, p. 84).

The background to this view may be found in the writings of Joan Robinson. According to her, the profit rates provide both the motive and the means to capital accumulation. Besides, Robinson's (1956, 1962) concept of 'normal' rate of capacity

utilization is related to that degree of utilization of productive capacity that producers consider as ideally suited to fulfill demand requirements, which is exactly the same requirement made here. But the actual profit rate that enters the investment equation in the Neo-Kaleckian model does not fully convey these roles. Firstly, the equilibrium rate of profit is a function just of the capitalist propensity to save. No parameters related to the workers consumption determine it. In a one sector model in which workers are assumed not to save this may not seem to be a serious shortcoming. In this case, not only the intertemporal workers' decision on consumption but also the decisions of consumption amongst different types of goods are completely ignored.

When moving from a one sector to a multi-sectoral view of the growth process, it allows us to consider dimensions of the consumer choice that cannot be taken into account in a one-sector model, where the only possibility of substitution occurs between current and future consumption. Hence, when we move to a multi-sectoral view, a key change arises: workers may choose different patterns of consumption according to the evolution of their preferences. In this case, a conventional version of the PKGM in which actual rate of profit enters the sectoral investment equations will be able to take into fully consideration the patterns of consumption. The actual profit rates that enter the sectoral growth rate of investment fail to take into account the evolution of workers' preferences.

In this vein, the actual profit rate even considered particular to each sector does not convey any information about the prospective evolution of workers' preferences. As a consequence, it does not provide any information about the expected profitability of a specific sector. If a specific sector, for instance, the growth rate of demand is above the growth rate of demand in other sectors this information will not be conveyed by the

actual profit of rate. In this sense, we believe that the actual rate of profit does not provide the motive to capital accumulation as emphasized by Joan Robinson.

Meanwhile, it is also possible to show that the actual profit of rate does not provide the means too. Due to the failure of this concept to take into fully account the growth rate of demand, its level may be fixed at a level below or above to the one required to endow the capitalist class with the required funds to reinvest fulfilling the expansion of demand in a specific sector. In this vein, considering the actual rate of profit as a mean to endow the capitalists with the necessary funds to reinvest may result in a situation in which they will have less capital that what is necessary to invest in a sector to fulfil the demand requirements.

Arguably, this possibility is even more plausible if we are considering a growing multi-sector economy in which the dynamics of demand are determined by the Engel's Law. In this context, if we consider alternatively the concept of natural rate of profit as advanced by Pasinetti we may conclude that it plays exactly the roles emphasized by Joan Robinson. Hence by substituting the actual rate of profit by the natural rate of profit allows us to consider both the motive and the means to promote capital.

This issue was also indicated by Nell (1989, p.163) according to whom "[s]o the problem boils down to finding the determinants of the normal rate of profit. Once this is known, the normal mark-up can be calculated in each industry." Due to the properties of the natural rate of profit derived by Pasinetti (1981) and emphasized in the previous section, the concept of the Pasinettian natural rate of profit fits well the concept of normal profit rate as emphasized by Nell. Besides, once the normal rate of profit is established as the natural rate of profit, then it is possible to establish the normal mark-

up for each sector. We consider that it is a more reliable concept to convey the roles of rate of profit in the investment equation.

$$g_I^i = g_o^i + \alpha_i r_i^n + \beta_i u_i \tag{12}$$

According to this view firms take into account the natural rate of profit while still responding to the actual rate of profit through its relation to the measure of capacity utilization. By adopting this specification we obtain the following solutions for the equilibrium values of the actual profit rate, rate of capacity utilization and sectoral growth rate:

$$r_i^* = \frac{\pi_i(g_o^i + \alpha_i r_i^n)}{\pi_i s - \beta_i} \tag{13}$$

$$u_i^* = \frac{g_o^i + \alpha_i r_i^n}{\pi_i s - \beta_i} \tag{14}$$

$$g_i^* = \frac{s\pi_i(g_o^i + \alpha r)}{\pi_i s - \beta_i} \tag{15}$$

These expressions show that the higher the growth rate of demand in a particular sector the higher the profit rate, the rate of capacity utilization and the growth rate of the *i*-th sector. These results may be explained as follows. In order to meet a higher rate of demand a higher rate of profit is necessary to provide capitalists with the funds to reinvest. By taking the derivative of the sectoral rate of profit and the sectoral growth rate we conclude that the signs of the derivatives rely on the relation between the sectoral growth rate of demand and other parameters of the model.

$$\frac{\partial r_i^*}{\partial \pi_i} = -\frac{\beta_i[g_o^i + \alpha_i(g + \theta_i)]}{(\pi_i s - \beta_i)^2} \gtrless 0 \tag{16}$$

$$\frac{\partial g_i^*}{\partial \pi_i} = \frac{s[g_o^i + \alpha(g + \theta_i)]}{(\pi_i s - \beta_i)^2} \gtrless 0 \qquad (17)$$

Note that if $\theta_i > -\left(\frac{\alpha}{\beta_i} + n\right)$ then the numerator is positive and we face a wage led regime. If $\theta_i < -\left(\frac{\alpha}{\beta_i} + n\right)$ then we numerator is negative and we have a profit led regime. It is important to emphasize that the most probable outcome is the wage led regime since the profit led regime requires not only a negative growth rate of demand but one that is lower than the combination of parameters given in the inequality above. This result is according to the empirical evidence presented by a number of authors such as Hein and Vogel (2008), Ederer, Onaran, and Stockhammer (2009), Naastepad and Storm (2007) and Elder and Stockhammer (2008) that have shown that a wage led regime is the most probable outcome in a closed economy. Then here by taking into account the natural rate of profit as one of the variables that drives investment we are able to provide further basis to this empirical evidence.

4. Concluding Remarks

One of the key distinctions between the orthodox view and the Post-Keynesian growth models is the importance given to the supply and demand determination of economic growth. While the later focuses on demand the former stresses the supply side as determinant of the process of economic growth. But this is not the only difference between these two approaches. The dominant neoclassical literature on economic growth is inadequate to deal with the technological issues since its frameworks cannot take into account the complexities of the innovation process and conditions particular to

the economies. But what is known as the original PKGM in fact is subject to the same criticism as the Neoclassical model since these models are aggregated in one sector. In the present paper what is being offered is a vision of a canonical Post-Keynesian approach to conceptualizing growth based on the principle of effective demand, with which each individual Post-Keynesian traditions – Kaleckian and Pasinettian – can be shown to be consistent.

In fact, we learn from this analysis that the actual structural dynamics depends ultimately on the distributive features of the economy and not only on the evolution patterns of demand and technological progress as in the Pasinettian view. This is a step further in order to build a unified Post-Keynesian theory of economic growth. By considering the natural rate of profit as one of determinants of investment, it is possible to conclude that the most probable outcome is a wage led demand regime, in which the growth rate of demand plays a decisive role. This result is consistent with empirical findings that show that for a closed economy the most probable outcome is a wage led regime.

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