A neo-kaleckian explanation of the bidirectional relationship between grwoth and distrubution

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Abstract

A neo-kaleckian model is proposed to analyze the bidirectional relationship between growth and income distribution. To do this, the price equation of Kalecki (1971) is modified and the model of Bhaduri and Marglin (1990) is extended. If the growth is wage-led, then the income path is shown to be cyclical. In contrast, if it is profit-driven, it is sustained. In this last scenario, income is concentrated in profits because the profit rate is higher than the growth rate. Finally, it is argued that if the state redistributes income in a greater amount than the market concentrates it, wage-led growth can be sustained.

Keywords: neo-kaleckian; growth; distribution; wage-led growth; earnings-led growth.

1. INTRODUCTION

There is an obsession, justified or not, in economic policy, to achieve sustained growth and reduce the valleys of the economic cycle as much as possible. It is claimed that this is how we can increase society's members' living standards (Altvater, 2015; Dollar and Kraay, 2002 and Hamilton, 2006). However, there is currently great inequality in income distribution and the resulting social, economic, political and human costs place the problem of distribution at the center of the debate, at least in academia. It is not just a question of growing, but doing so with equity. Hence the importance of analyzing the relationship between growth and income distribution.

Neo-Kaleckian growth models typically discuss how changes in functional income distribution affect growth. Nevertheless, not all of them analyze how growth modifies distribution or the bidirectional relationship between growth and distribution (Dutt, 2012).

One of the main difficulties in analyzing the bidirectional relationship between growth and functional income distribution using neo-Kaleckian growth theory is that, on the one hand, it recognizes that distributing income among different social classes determines growth (Hein, 2014) and, on the other hand, it argues that distribution is determined by the overcharge that monopolies manage to impose on their products (Kalecki, 1971). However, a common proposition is that markups change due to exogenous modifications in the wage rate (Loaiza, 2012), in the exchange rate (Bhaduri and Marglin, 1990) and/or in the interest rate (Hein, 2007). This implies that changes in distribution are considered to be independent of growth, which makes it difficult to have an endogenous mechanism for analyzing how growth modifies distribution.

There are at least two ways to establish a link which explains how growth modifies distribution in neo-Kaleckian growth theory. The first is to explore how the degree of monopoly affects growth, a method analyzed by Dutt (2012). The second is this article's proposal, which consists of rethinking the price equation proposed by Kalecki (1971), so that markup depends on the degree of monopoly and factors closely linked to growth, such as the profit rate. Consequently, the distribution function will also depend on the degree of monopoly and the profit rate. This means that according to neo-Kaleckians thinking, a change in distribution will modify growth and, according to the Cambridge equation, when the growth rate changes, the profit rate does so as well. The result is that income distribution will thereby be modified and a bidirectional relationship between income distribution and growth will thereby be established.

The goal of this article is to offer a neo-Kaleckian model which explains the bidirectional relationship between growth and income distribution in a closed economy. To reach this goal, this article consists of eight sections. The first is this introduction while the second lays out how feedback between growth and distribution comes about. The third proposes a modification to Kalecki's (1971) proposed price equation, and argues that the markup can be separated into two parts: the degree of monopoly and the profit rate. This implies that profits' share of income depends on both the degree of monopoly and the profit rate and, thanks to the Cambridge equation, we know that the profit rate is determined by the growth rate. This creates the necessary connection to establish a bidirectional relationship between growth and income distribution. In the fourth section, the model proposed by Bhaduri and Marglin (1990) for a closed economy is expanded in order to analyze the relationship between growth and distribution. However, it is in the fifth section, upon studying the model dynamics, that an analysis is carried out on the bidirectional relationship between growth and distribution. It shows that in profit-driven economies, growth is accompanied by profits accounting for a higher share of income. The increase in income concentration is due to the fact that the profit rate is higher than the economy's growth; this is consistent with Piketty's (2014) proposed hypothesis. On the other hand, a wage-led economy follows a cyclical trajectory. Nevertheless, the sixth section shows that if the state imposes a redistributive fiscal policy and redistributes income more than the market concentrates it, then a wage-led economy will have a stable growth path. The seventh section analyzes the limits of this analytical scheme and its research agenda. Finally, the last section presents the conclusions.

2. FEEDBACK BETWEEN GROWTH AND DISTRIBUTION

It is through Kalecki's (1971) theory of prices that profits' share of income is usually determined and, with it, the distribution of income among different social classes. It demonstrates that profits' share of the output is determined by the degree of monopoly.[1]

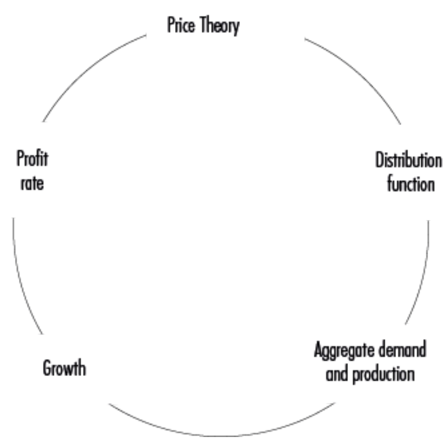
Neo-Kaleckian models study how changes in distribution determine production and growth, usually using Kalecki's price theory and its distribution function to analyze how changes in distribution condition production (Hein, 2014).

Works which analyze the feedback between growth and distribution usually respect this logic, but they also study how production or growth modify the markup and, with it, the distribution function. Dutt (2012) addresses this topic by discussing four ways in which growth and income distribution are linked. *1)* The markup can have a positive relationship with aggregate demand for goods and, as such, the degree of monopoly will then have a positive function with the utilization ratio. Nevertheless, he recognizes that in a recession the degree of monopoly can increase. *2*) Higher growth can reduce the degree of concentration of the industry and, with it, the markup. *3)* Demand and accumulation can have an effect on operating costs. However, Dutt (2012) concludes that these effects are ambiguous. *4)* Growth in demand and, as such in production, increases the level of employment which in turn affects the power unions hold and the degree of monopoly and income distribution along with it.

The last point involves analyzing the job market and how its incorporation allows for feedback between growth and distribution, a topic taken on by Skott (2017), Assous and Dutt (2013) and Cassetti (2003), among others.

Unlike these authors, this article modifies Kalecki's (1971) proposed price theory so that the profit rate has a role in determining prices as well as in the distribution function. Therefore, as is common in the literature, changes in distribution modify aggregate demand and with it, production and growth. At the same time, growth is a determinant of the profit rate, so it modifies prices and distribution, creating a feedback loop, as illustrated in figure 1.

Figure 1. Proposal of feedback between growth and distribution



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3. REASSESSING THE PRICE EQUATION

Kalecki (1971) distinguishes between two groups of companies: those that sell raw materials and those that produce finished goods. The first group of companies has an inelastic supply with regards to demand in the short term, so increases in demand do not modify their supply and only result in an increase in prices. This means that for this group of companies demand determines prices. On the other hand, the second group of companies has an elastic supply. This means that its supply adjusts to variations in demand without the need for prices to change. This means that companies which make finished goods produce below their maximum productive capacity,[2] making their unit costs constant. For the sake of simplicity, this article assumes that all companies produce finished goods.

The analysis is based on recognizing that in capitalist economies competition is oligopolistic. As such, companies are not price takers as neoclassical theory postulates, but rather price makers.

According to Kalecki (1971), companies set their prices (*p*) taking into account their unit costs (*b*) and the price from companies selling similar goods, that is, their competitors pricing. If the company sets its price well above its competitors, then its sales may be negatively affected, but if it sets its price far below, its profits will be reduced. This article takes up this idea, but unlike Kalecki (1971), it argues that the companies' markup on their unit costs is the industry's average profit rate (*r*). Therefore, the price equation for company *j* is as follows:

$$p_j = (1+r)b_j + d_j\bar{p} \quad (1)$$

It is assumed that companies know the industry's average profits. In equation (1), $1 > d_j > 0$ and d_j show the company's ability to influence the industry's average price weighted for each company's production $(\bar{p})$.

Obtaining the average price weighted by production yields:

$$\bar{p} = (1+r)\left(\frac{1}{1-\bar{d}}\right)\bar{b} \quad (2)$$

Equation (2) shows how the weighted average price in an industry is determined. Here we see that if companies' ability to influence the average industry price is zero $(\bar{d} = 0)$, then the markup is determined exclusively by the average profit rate, similar to what classical and Marxist theory propose. However, unlike these theories, and analogous to Kalecki (1971), this article does not propose that prices are gravitational, that is, it does not assume that investment flows from one sector to another until the same profit rate is guaranteed. It simply assumes that when companies set their prices, they demand a minimum markup equal to the sector's average profit rate (note how in equation (1) that when d_j = 0, then the markup for company *j* equals the industry's average profit rate). On the other hand, when the average profit rate equals zero, then the markup is determined by the companies' ability to influence the average industry price. $\left(\frac{1}{1-\bar{d}}\right) = 1 + m$ where *m* represents the degree of monopoly, which depends on how concentrated the industry is and, therefore, on how much power companies have over prices.

The markup is composed of the degree of monopoly and the profit rate does not negate common explanations from post-Keynesian theory for why the markup changes, but it does require one to identify which of the markup's two components is modified. For example, increasing the power of unions could reduce the profit rate; a technological innovation could likewise increase the degree of monopoly. While this topic is important, it is also too complex to be covered in detail in this article as it goes beyond its objectives.

In order to analyze the relationship between prices and distribution, it is assumed, as usual, that the economy is a vertically integrated industry. This means that unit costs are only unit wage costs, which are considered constant. Therefore equation (2) can be restated as:[3]

$$p = (1 + r)(1 + m)aw \tag{3}$$

In equation (3), *a* is the labor employed per product unit and *w* is the unit wage. This means that *aw* is unit labor costs. From equation (3) we get the profits' share of output *h*:

$$h = \frac{r(1+m)+m}{(1+m)(1+r)} \tag{4}$$

Equation (4) shows that profits' share of output depends on both the degree of monopoly and the profit rate. Do note that if the profit rate is zero, then profits' share of output depends only on the degree of monopoly, as is often postulated. On the other hand, if the degree of monopoly is zero, then profits' share of output depends only on the profit rate. This means that even when there is "perfect competition," companies appropriate a part of the product. According to equation (4), the degree of monopoly and the profit rate are equally important in explaining profits' share of output.

4. GROWTH AND DISTRIBUTION IN A CLOSED ECONOMY

The first part of the model proposed herein is based on the contribution of Bhaduri and Marglin (1990) for closed economies. However, the Bhaduri and Marglin (1990) model is expanded to study the dynamics and interaction between growth and distribution. It is assumed that only capitalists save, such that the saving function is $S_t = s\Pi_t$. Where *S* is savings, *s* is the capitalists' propensity to save, and φ is profit. In all equations the subindex *t* refers to the time when the variable is realized. Savings are normalized by dividing them by capital. As such, the savings rate (g_s) is:

$$g_{st} = s\frac{h_t}{v_t}z_t \tag{5}$$

In equation (5) *z* is the utilization ratio, which is defined as the ratio of output (*y*) to potential output (*y**). The potential output is assumed to be constant and exogenous so that any increase (reduction) in the utilization ratio is due to increases (reductions) in demand.[4] *v* is the capital to potential output ratio, which is assumed to be exogenous.

The accumulation rate (g_k) used in this article is the one commonly used in neo-Kaleckian distribution models and is formalized in equation (6):

$$g_{kt} = \delta + \beta z_t + \gamma h_t \tag{6}$$

In equation (6) the parameter *δ* represents the motivation for accumulation borne from competition, independent of demand or distribution. This means that it represents Keynes' (2003) animal spirits. Both *β* and *γ* are assumed to be positive parameters; the first shows investment's sensitivity to changes in demand; the second indicates the weight distribution has in accumulation.

Finally, we use the Cambridge equation to link the profit rate with the accumulation rate, as it shows income distribution to be a result of accumulation and not a precondition (Hein, 2014).

$$r_t = \left(\frac{1}{s}\right)g_{kt-1} \tag{7}$$

Equation (7) is the Cambridge equation with a slight change: the accumulation rate has a lag of one period. The reason for the lag is that companies first invest and then, when their investments are validated by the market, they profit. That is, time matters insofar as it shows how events happen and their causality (Robinson, 1980).

The model is solved in equilibrium, that is to say that when the savings rate is equal to the investment rate. However, this does not imply that this model validates Say's law.[5] As is usual in neo-Kaleckian models, the paradox of savings is fulfilled.

Analyzing the bidirectional relationship between distribution and growth is based on the assumption that in the initial period there was an exogenous increase in profits' share of output. However, distribution will be an endogenous variable in subsequent periods. This initial increase in profits' share of income is assumed to be due to an increase in the degree of monopoly caused by a reduction in real wages. Note that according to equations (3) and (4) it is the drop in real wages that causes profits' share of output to increase, such that:[6]

$$\Delta h_t = (1 - h_t)\left(\frac{\Delta p_t}{p_t} - \frac{\Delta w_t}{w_t}\right) \qquad (8)$$

The increase in profits' share of output modifies the utilization ratio. This is seen when equating the savings rate with the investment rate and differentiating *h* and *z*, such that:

$$\Delta z_t = \frac{\left(\gamma - s\frac{z_t}{v_t}\right)}{\left(s\frac{h_t}{v_t} - \beta\right)} \Delta h_t \lesseqgtr 0 \qquad (9)$$

Equation (9) shows the main result of Bhaduri and Marglin's (1990) model for closed economies. This equation indicates how demand changes in the face of an increase in profits' share of income.

The condition of equilibrium stability requires that savings be more sensitive than investment to changes in the utilization ratio, i.e. $s\frac{h}{v} > \beta$. Consequently, whether inequality (9) is positive or negative in value is determined by its numerator. There are two scenarios which can explain how the utilization ratio varies. They both begin the same but have different outcomes. An increase in profits' share of income implies a reduction in the share of wages, thereupon workers' consumption decreases and capitalist consumption increases. However, because workers do not save, their consumption decreases by the same amount as their income; on the other hand, as capitalists do save, the increase in their income increases both their consumption and saving. Therefore, capitalists' consumption only increases by a fraction of what their income increased. As such, the drop in workers' consumption is greater than the growth in capitalist consumption, meaning that aggregate consumption therefore decreases. Note that the drop in total consumption is equivalent to the increase in capitalist savings $\left(s\frac{h}{v}\right)$. On the other hand, the increase in profits' share of income increases the return on investment and investment grows (γ) in turn. We have two contradictory effects on aggregate demand; on the one hand, total consumption decreases $\left(s\frac{h}{v}\right)$, on the other, investment increases (γ). Depending on which effect dominates we have one of the following two scenarios:

a) Wage-led demand. This scenario is true if saving is more sensitive than investment to an increase in profits' share, that is, if $\gamma < s\frac{z}{v}$, then consumption decreases by a greater amount than investment increases and demand is therefore reduced.

b) Earnings-led demand. This scenario is true if savings are less sensitive than investment to changes in distribution, that is, if $\gamma > s\frac{z}{v}$, then consumption falls by a smaller amount than investment increases. Demand then grows as a result.

The change in demand and the increase in profits' share of income modify the accumulation rate. Based on equations (6) and (8) we get:

$$\Delta g_{kt} = \beta \frac{\left(\gamma - s\frac{z_t}{v_t}\right)}{\left(s\frac{h_t}{v_t} - \beta\right)} \Delta h_t + \gamma \Delta h_t \gtrless 0 \qquad (10)$$

Based on equation (10), two scenarios were analyzed:[7]

a) Earnings-led growth. This scenario occurs when demand is driven by profits, i.e., if $\gamma > s\frac{z_t}{v_t}$. Profits' higher share of income then increases both demand and return on investment, thereby increasing the accumulation rate.

b) Wage-led growth. This scenario is true if the following two conditions are met: *1)* demand is driven by wages, that is, $\gamma < s\frac{z_t}{v_t}$, and *2)* investment is more sensitive to changes in demand than to increases in its returns, i.e. $\gamma \Delta h_t < |\beta \Delta z_t|$. When this happens, an increase in profits' share of income reduces accumulation because demand decreases and investment is more sensitive to drops in demand than to increases in profitability.

5. THE DYNAMICS OF GROWTH AND DISTRIBUTION

The change in accumulation modifies the profit rate for the next period. Based on the Cambridge equation (equation (7)) we get:

$$\Delta r_{t+1} = \left(\frac{1}{s}\right)\left(\beta \frac{\left(\gamma - s\frac{z_t}{v_t}\right)}{\left(s\frac{h_t}{v_t} - \beta\right)} + \gamma\right) \Delta h_t \qquad (11)$$

Equation (11) shows how the profit rate changes at t+1 due to an increase in profits' share of output. If growth is profit-driven, then the profit rate will increase. However, if growth is wage-led, then profits' greater share of output reduces the profit rate, so the paradox of costs is true.

The change in the profit rate modifies profits' share of output. Based on equations (4) and (11) we get:

$$\Delta h_{t+1} = \frac{(1-h_{t+1})}{(1+r_{t+1})}\left(\frac{1}{s}\right)\left(\beta \frac{\left(\gamma - s\frac{z_t}{v_t}\right)}{\left(s\frac{h_t}{v_t} - \beta\right)} + \gamma\right) \Delta h_t \qquad (12)$$

Equation (12) links the change in distribution in period t + 1 with the events in period t and shows that income distribution is an endogenous process. This means that the accumulation process determines it, but it in turn also conditions accumulation.

How profits' share of output changes at t + 1 depends on accumulation's characteristics in the previous period. This means there are at least two possible scenarios:

a) If there is profit-led growth in period t, then profits' share of output at t + 1 increases. This is because greater accumulation increased the profit rate and, with it, increased profits' share of output. Note that according to the Cambridge equation, the profit rate grows more than the accumulation rate. As such, capitalists' income grows more than the economy's income, thereby explaining why profits' share of income increases.

b) If there was wage-led growth in period t, then profits' share in period t + 1 is reduced. This is due to profits' higher share in period t reducing accumulation and thus the profit rate at t + 1 decreases, which causes profits' share of output to decline in this period.

The change in profits' share of output will have effects analogous to those already explained for demand, accumulation and the profit rate. The model thereby becomes recursive. Solving the model's recursion yields:[8]

$$\Delta h_{t+n} = \prod_{i=1}^{n} \frac{(1+h_{t+i})}{(1+r_{t+i})} \left(\frac{1}{s}\right)^{n} \left[\frac{\beta\left(\gamma - s\frac{z_{t+i-1}}{v_{t+i-1}}\right)}{s\frac{h_{t+i-1}}{v_{t+i-1}} - \beta} + \gamma\right] \Delta h_t \qquad (13)$$

$$\Delta z_{t+n} = \prod_{i=1}^{n} \frac{(1+h_{t+i})}{(1+r_{t+i})} \left(\frac{1}{s}\right)^{n} \frac{\left(\gamma - s\frac{z_{t+n}}{v_{t+n}}\right)}{\left(s\frac{h_{t+n}}{v_{t+n}} - \beta\right)} \left[\frac{\beta\left(\gamma - s\frac{z_{t+i-1}}{v_{t+i-1}}\right)}{s\frac{h_{t+i-1}}{v_{t+i-1}} - \beta} + \gamma\right] \Delta h_t \qquad (13)$$

$$\Delta g_{kt+n} = \prod_{i=1}^{n} \frac{(1+h_{t+i})}{(1+r_{t+i})} \left(\frac{1}{s}\right)^{n} \left[\frac{\beta\left(\gamma - s\frac{z_{t+i}}{v_{t+i}}\right)}{s\frac{h_{t+i}}{v_{t+i}} - \beta} + \gamma\right] \Delta h_t \qquad (15)$$

$$\Delta r_{t+n+1} = \prod_{i=1}^{n} \frac{(1+h_{t+i})}{(1+r_{t+i})} \left(\frac{1}{s}\right)^{n+1} \left[\frac{\beta\left(\gamma - s\frac{z_{t+i}}{v_{t+i}}\right)}{s\frac{h_{t+i}}{v_{t+i}} - \beta} + \gamma\right] \Delta h_t \qquad (16)$$

Equations (13), (14), (15) and (16) show the long-term behavior of distribution, demand, the accumulation rate and the profit rate. To simplify the analysis, the scenarios presented will be used to analyze the model's dynamics.[9]

Profit-led growth

As was previously stated, this scenario is true when $\gamma > s\frac{z_{t+i}}{v_{t+i}}\ \forall i = 1 \dots n.$. Therefore, equations (13), (14), (15) and (16) are always positive; profit's share of output, demand, accumulation rate, and profit rate tend to grow over time. The reason for this is that when profits' share of output increases, capitalist consumption and investment grow more than workers' consumption drops, meaning that demand increases. Investment's greater profitability and greater demand causes accumulation to increase and, in turn, greater accumulation causes the profit rate to increase in the next period. This makes profits' share of output grow once again and the process is then repeated. Note that if the capital-output ratio is assumed to be constant, then the accumulation rate equals the economy's growth rate. Profits' share of output therefore tends to increase over time since the profit rate is higher than the economy's growth rate. In other words, it is the scenario Piketty (2014) described.

Wage-led growth

This scenario is true whenever $\gamma < s\frac{z_{t+i}}{v_{t+i}}$, $\gamma \Delta h_{t+i} < \beta|\Delta z_{t+i}|$, $\forall i = 1 \dots n.$. When this happens then $\frac{\beta\left(\gamma - s\frac{z_{t+i-1}}{v_{t+i-1}}\right)}{s\frac{h_{t+i-1}}{v_{t+i-1}} - \beta} + \gamma < 0 \quad \forall i = 1 \dots n$. As such, equations (13), (14), (15) and (16) are negative for the odd periods and positive for the even ones. This means that the paths taken by demand, accumulation, the profit rate, and profits' share of income are cyclical. In order to analyze why these paths are cyclical, it is assumed that wages' share of output increases, causing workers' consumption to grow more than the drop in capitalists' consumption. Then, as investment is more sensitive to demand than to returns, accumulation increases. Accumulation's growth causes the profit rate to grow in the next period, which causes profits' share of output to increase, that is, wages' share of output falls. A process opposite to the one described will then be triggered for the following period culminating in the fall of the profit rate and, consequently, a reduction in profits' share of output for the next period. Ergo, the initial process is reverified. In other words, the cyclical process is due to the fact that profits' lower share of output causes growth, but growth increases the profits' share of output, which reduces growth and, with it, profits' share of income decreases by repeating the initial process. In this scenario the source of growth is an improvement in wages' share of income, but growth concentrates income in favor of profits. It therefore decimates its foundation to sustain itself.

It is important to point out that in this scenario the source of growth is real wages. Thus, the upward phase of the cycle is due to wage growth. In contrast, the downward phase is due to the fall of these. However, moving from a downward to an upward phase implies that the fall in the profit rate increases real wages, thus driving growth anew. The reason why a fall in the profit rate would drive up real wages is because companies' lower profitability is caused by declining demand. Lower demand forces firms to lower prices, which drives up real wages.

Arguing that in the downturn of the cycle, wages' share of the economy can increase is similar to the results that Dutt (2012) reached. However, just as he observed, these results are rather questionable for it is unusual for real wages to rise in a declining economy as a result of the business cycle itself. This discrepancy between what this theory predicts and what actually normally happens can be avoided as long as we take into account Kalecki's (1943) arguments. He argues that when the economy declines, the degree of monopoly usually increases. The increase in the degree of monopoly in the downturn phase of the cycle causes real wages not to grow or even to fall, thus nullifying the redistributive effect of a drop in the profit rate.

The previous paragraph implies that, if the degree of monopoly is considered to be fixed, wage-led growth is cyclical, but if it is assumed that it increases when the economy decreases, then wage-led growth only makes the economy grow in the beginning (when wages rise) and the economy then enters a recession or stagnates. This means that, the struggle for income can cancel out (and actually usually eliminates) the redistributive effects that the market may have.

6. REDISTRIBUTIVE POLICY AND GROWTH IN A CLOSED ECONOMY

The previous section shows how neither profit-driven nor wage-driven economies are capable of creating sustained growth with improvements in income distribution for the majority of society. Sustained growth is only possible when concentration of income favors profits, meaning that the main beneficiaries of growth are the owners of the means of production. In contrast, workers see their real wages reduced. This result is compatible with what we can currently see in the real world. In this regard, Vázquez Pimentel *et al.* (2018) argue that in 2016, 82% of the growth of global wealth went to the richest 1%, while the poorest 50% of the population did not benefit at all from said growth. What, therefore, is the point of growth if the vast majority of the population is not going to benefit?

Next is an analysis of whether fiscal policy can bring about sustained growth along with an improved distribution, or whether redistributive fiscal policy can make growth work for the majority of society.

Piketty (2014) proposes establishing social states where governments coordinate to tax economic elites and use that income to improve distribution. It is beyond the scope of this article to address the viability of social states, but there will be an analysis of the effects that a redistributive fiscal policy would have on growth and distribution.

This article models redistributive fiscal policy on the assumption that the government transfers capitalist resources to workers without any transaction costs. As such, capitalist income after paying taxes is $(1-\tau)\Pi$ and the subsidy given to the workers is $\tau\Pi$. This article refers to τinterchangeably as the tax rate or transfer rate. Based on this hypothesis, the savings rate is $g_{st}=(1-\tau)sh_t\frac{z_t}{v_t}$. Meanwhile, the accumulation rate and the Cambridge equation are:

$$g_{kt}=\delta+\beta z_t+\gamma(1-\tau)h_t \quad (17)$$

$$r_t=\left(\frac{1}{s(1-\tau)}\right)g_{kt-1} \quad (18)$$

Equation (4) remains unchanged as it is assumed that capitalists are charged income tax once they have received their profits from companies.

The previous section demonstrated that, regardless of whether growth is driven by earnings or wages, a higher accumulation rate increases inequality by increasing profits' share of income. Therefore, the analysis of redistributive fiscal policy is based on the assumption of a simultaneous increase in both the tax rate and profits' share of income (it can be assumed the latter was caused by accumulation growth in the previous period). Using this hypothesis and assuming equality between savings and investment, and based on equations (17), (18) and (4), we reach the following results:

$$\Delta z_t=\frac{(1-\tau)\left[\gamma-s\frac{z_t}{v_t}\right]\Delta h_t+h_t\left[s\frac{z_t}{v_t}-\gamma\right]\Delta\tau_t}{\left[s(1-\tau)\frac{h_t}{v_t}-\beta\right]} \quad (19)$$

$$\Delta g_{kt}=(1-\tau)\left[\frac{\beta\left(\gamma-s\frac{z_t}{v_t}\right)}{\left((1-\tau)s\frac{h_t}{v_t}-\beta\right)}+\gamma\right]\Delta h_t+h_t\left[\frac{\beta\left(s\frac{z_t}{v_t}-\gamma\right)}{(1-\tau)s\frac{h_t}{v_t}-\beta}-\gamma\right]\Delta\tau_t \quad (20)$$

$$\Delta r_{t+1}=\left(\frac{1}{s(1-\tau)}\right)\left[(1-\tau)\left[\frac{\beta\left(\gamma-s\frac{z_t}{v_t}\right)}{\left((1-\tau)s\frac{h_t}{v_t}-\beta\right)}+\gamma\right]\Delta h_t\right.$$
$$\left.+h_t\left[\frac{\beta\left(s\frac{z_t}{v_t}-\gamma\right)}{(1-\tau)s\frac{h_t}{v_t}-\beta}-\gamma\right]\Delta\tau_t\right]+\frac{r_{t+1}}{(1-\tau)}\Delta\tau \quad (21)$$

$$\Delta h_{t+1}=\left(\frac{1-h_{t+1}}{1+r_{t+1}}\right)\left[\frac{1}{s}\left(\frac{\beta\left(\gamma-s\frac{z_t}{v_t}\right)}{\left((1-\tau)s\frac{h_t}{v_t}-\beta\right)}+\gamma\right)\Delta h_t\right.$$
$$\left.+\frac{h_t}{s(1-\tau)}\left(\frac{\beta\left(s\frac{z_t}{v_t}-\gamma\right)}{(1-\tau)s\frac{h_t}{v_t}-\beta}-\gamma\right)\Delta\tau+\frac{r_{t+1}}{(1-\tau)}\Delta\tau\right] \quad (22)$$

Redistributive fiscal policy and wage-led growth

As has been mentioned, wage-led growth is true if saving is more sensitive to changes in distribution than investment, $(1-\tau)\gamma<s\frac{z_t}{v_t}$, and investment is more sensitive to demand than to its returns, $\Delta h_t\gamma<|\Delta z_t|\beta$. On the other hand, the condition of equilibrium's stability in this model requires that $s(1-\tau)\frac{h_t}{v_t}>\beta$. If these conditions are true, then an increase in the transfer rate increases (reduces) demand and accumulation if and only if:

$$\frac{\Delta\tau}{(1-\tau)}\gtrless\frac{\Delta h_t}{h_t} \quad (23)$$

The inequality $\frac{\Delta\tau}{(1-\tau)} > \frac{\Delta h_t}{h_t}$ is a sufficient, albeit not necessary, condition for the profit rate and profits' share of the output to increase in the next period. In contrast, the inequality $\frac{\Delta\tau}{(1-\tau)} < \frac{\Delta h_t}{h_t}$ is a necessary, albeit not sufficient, condition for the profit rate and profits' share of output to decrease in the next period.

On the left side of inequality (23) is the quotient of the increase in the transfer rate of income to workers over the percentage of income left to capitalists after paying taxes, on the right side is the growth rate of profits' share of income. Please note that to have a clear interpretation of inequality (23) that $\Delta(1-\tau) = -\Delta\tau$. Therefore, inequality (23) can be restated as:

$$\left|\frac{\Delta(1-\tau)}{(1-\tau)}\right| \gtrless \frac{\Delta h_t}{h_t} \qquad (24)$$

Inequation (24) is analogous to (23) provided that $\Delta(1-\tau) < 0$. That means that there was an increase in the transfer rate or a reduction in capitalists' available income.

The advantage of (24) over (23) is that on both sides of the inequality there are growth rates. Note that (1 - τ) is the percentage of income that is available to capitalists after paying taxes. Thus, the left side of inequality (24) shows the rate at which the state reduces capitalists' income (as an absolute value). On the right side is the growth rate of profits' share of output (which is a consequence of the market). As the resources taken from capitalists by the state are transferred to workers, the left side can be read as the rate at which the state redistributes income while the right is the rate at which the market concentrates income. The result is that inequalities (23) and (24) indicate that if the state redistributes income in a greater amount than the market concentrates it, then demand and accumulation will increase. If this happens, then it is most likely that for the next period the profit rate and profits' share will increase. This means that for growth to be sustained, without wages' share falling, the redistributive policy needs to be constant.

Redistributive policy and profit-led growth

Profit-led growth is true if saving is less sensitive to changes in distribution than investment, i.e., if $(1-\tau)\gamma > s\frac{z_t}{v_t}$. As long as this condition is met and the equilibrium is stable, then:

$\Delta z_t \gtrless 0$ and $\Delta g_{kt} \gtrless 0$ if and only if $\frac{\Delta\tau}{(1-\tau)} \lessgtr \frac{\Delta h_t}{h_t}$

Thus, $\frac{\Delta\tau}{(1-\tau)} \lessgtr \frac{\Delta h_t}{h_t}$ is a sufficient, albeit not necessary, condition for the profit rate and profits' share of income to increase in the following period. In contrast, $\frac{\Delta\tau}{(1-\tau)} > \frac{\Delta h_t}{h_t}$ is a necessary, albeit not sufficient, condition for the profit rate and profits' share of income to decline in the next period.

In this scenario, sustained growth is achieved if the State redistributes income at a lower rate than the market concentrates it. Therefore, income redistribution puts an end to growth.

7. THE LIMITS AND AGENDA OF THIS RESEARCH

This section explores the limits of the proposed analytical scheme and the research agenda derived from it.

The proposed model argues that profit-led economies tend to grow in a sustained manner along with an increase in income concentration. Yet, what is the limit of this growth? A possible limit to growth is gotten if one assumes that capitalists' marginal propensity to save depends on their income. Therefore, the higher the profits, the greater the marginal propensity to save. Consequently, the greater concentration of income could lead to a greater drop in consumption such that the increase in investment is not enough to increase aggregate demand. In other words, one would go from a profit-driven demand to a wage-driven one.

If this transition occurs, there are two possible outcomes: *1)* investment could be more sensitive to its returns than to demand. In this scenario, demand decreases, but accumulation also increases, resulting in overaccumulation. This is an unstable scenario as sooner or later it leads to a realization crisis, one of overinvestment and insufficient demand. *2)* Investment is more sensitive to demand than to its returns. In this scenario, we go from a profit-driven economy to a wage-led one.

On the other hand, statistical evidence shows that most profit-driven economies are open economies whose exports are critical in explaining their growth (Hein, 2017), in other words, their growth is sustained by their trade surplus. However, for surplus economies to exist, there must be deficit economies. This means that for profit-driven economies to exist, there must be economies driven by wages and/or debt. As such, an analysis of open economies is fundamental in studying both profit-driven and wage-driven economies.

The limits of redistributive fiscal policy lie in capitalists' resistance to redistributing income. In this regard, Kalecki (2011) analyzes some of capitalists' objections to employing fiscal policy to ensure full employment. On the other hand, Assous and Dutt (2013) argue that as profits' share of income is reduced, capitalists' resistance to decreasing their share of income increases. So, as redistributive fiscal policy succeeds in increasing wages' share of income, there will be greater resistance from capitalists, even if such a policy makes the economy grow.

Finally, throughout this work it has been assumed that the degree of monopoly was constant. It can however vary due to changes in demand, growth, costs and the labor market (Dutt, 2012). If we consider the degree of monopoly to be flexible, the results obtained in the analytical scheme proposed herein could change.

All these limits merit further analysis and therefore constitute the research agenda of this work.

8. CONCLUSIONS

This article has modified Kalecki's (1971) proposed price theory to include the profit rate among the determinants of prices and distribution. Based on this modification, the model proposed by Bhaduri and Marglin (1990) was expanded in order to analyze the bidirectional relationship between growth and distribution. Earnings-led and wage-led growth were both analyzed.

It has been shown that if growth is driven by profits, then it is stable and income tends to concentrate in profits. This is because an increase in profits' share of income reduces consumption but increases investment by a greater amount than the drop in consumption, leading to an increase in demand. Higher demand and higher profitability in turn motivate companies to increase their investment. The increase in the accumulation rate causes the profit rate to increase and, in turn, the higher profit rate causes profits' share of income to grow, causing a new boost in demand and growth. In this scenario, profits' share of income tends to increase as the profit rate is higher than the economy's growth rate. This lines up perfectly with Piketty's (2014) hypothesis.

Wage-led growth is cyclical because a reduction in profits' share of income increases consumption by an amount greater than the reduction in investment, so demand increases. The higher demand increases accumulation despite the fact that returns on investment are reduced. This is because investment is more sensitive to demand than to its returns. The increase in the accumulation rate then causes the profit rate to increase in the following period, which causes profits' share of income to increase. In other words, wages' share of income decreases, which triggers a process opposite to that described. One of the main limitations of this scenario is its apparent contradiction with empirical evidence as it implies that in the valley of the cycle real wages increase so that growth recovers. Kalecki (1943) offers a possible explanation as to why this does not normally happen; he argues that in the valley of the cycle the degree of monopoly usually grows and if this happens then real wages cannot increase, which would put an end to the cycle.

It is implied in both the profit-led and wage-led growth scenarios that growth causes the profit rate to be higher than the growth rate. This is consistent with Piketty's (2014) hypothesis and requires reflection on how sustained growth with better income distribution could be achieved so that the majority of the population benefits from said growth. This article explores one possible answer: a redistributive fiscal policy.

It has been shown that, if the government redistributes income by a greater amount than the market concentrates it, then the scenario of wage-led growth can lead a path of sustained growth. This invites one to reflect upon the importance of the State in creating a growth which brings improvements to the quality of the majority of lives.

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APPENDIX

Using equation (12), expressed in the period *t* + 1, *t* + 2 and *t* + 3, to get equations (13), (14), (15) and (16) results in:

$$\Delta h_{t+1} = \frac{(1-h_{t+1})}{(1+r_{t+1})}\left(\frac{1}{s}\right)\left(\beta\frac{\left(\gamma - s\frac{z_t}{v_t}\right)}{\left(s\frac{h_t}{v_t}-\beta\right)}+\gamma\right)\Delta h_t \qquad (12)$$

$$\Delta h_{t+2} = \frac{(1-h_{t+2})}{(1+r_{t+2})}\left(\frac{1}{s}\right)\left(\beta\frac{\left(\gamma - s\frac{z_{t+1}}{v_{t+1}}\right)}{\left(s\frac{h_{t+1}}{v_{t+1}}-\beta\right)}+\gamma\right)\Delta h_{t+1} \qquad (A1)$$

$$\Delta h_{t+3} = \frac{(1-h_{t+3})}{(1+r_{t+3})}\left(\frac{1}{s}\right)\left(\beta\frac{\left(\gamma - s\frac{z_{t+2}}{v_{t+2}}\right)}{\left(s\frac{h_t}{v_t}-\beta\right)}+\gamma\right)\Delta h_{t+2} \qquad (A2)$$

Substituting (12) into (A.1) yields:

$$\Delta h_{t+2} = \frac{(1-h_{t+2})}{(1+r_{t+2})}\left(\frac{1}{s}\right)\left(\beta\frac{\left(\gamma - s\frac{z_{t+1}}{v_{t+1}}\right)}{\left(s\frac{h_{t+1}}{v_{t+1}}-\beta\right)}+\gamma\right)\frac{(1-h_{t+1})}{(1+r_{t+1})}\left(\frac{1}{s}\right)\left(\beta\frac{\left(\gamma - s\frac{z_t}{v_t}\right)}{\left(s\frac{h_t}{v_t}-\beta\right)}+\gamma\right)\Delta h_t \qquad (A3)$$

Rearranging (A.3) yields:

$$\Delta h_{t+2} = \prod_{i=1}^{2}\frac{(1-h_{t+i})}{(1+r_{t+i})}\left(\frac{1}{s}\right)^2\left(\beta\frac{\left(\gamma - s\frac{z_{t+i-1}}{v_{t+i-1}}\right)}{\left(s\frac{h_{t+i-1}}{v_{t+i-1}}-\beta\right)}+\gamma\right)\Delta h_t \qquad (A4)$$

Substituting (A.4) into (A.2) yields:

$$\Delta h_{t+3} = \frac{(1-h_{t+3})}{(1+r_{t+3})}\left(\frac{1}{s}\right)\left(\beta\frac{\left(\gamma - s\frac{z_{t+2}}{v_{t+2}}\right)}{\left(s\frac{h_t}{v_t}-\beta\right)}+\gamma\right)$$

$$\prod_{i=1}^{2}\frac{(1-h_{t+i})}{(1+r_{t+i})}\left(\frac{1}{s}\right)^2\left(\beta\frac{\left(\gamma - s\frac{z_{t+i-1}}{v_{t+i-1}}\right)}{\left(s\frac{h_{t+i-1}}{v_{t+i-1}}-\beta\right)}+\gamma\right)\Delta h_t \qquad (A5)$$

Rearranging (A.5) yields:

(A6)

$$\Delta\, h_{t+3} = \prod_{i=1}^{3} \frac{(1-h_{t+i})}{(1+r_{t+i})} \left(\frac{1}{s}\right)^3 \left(\beta \frac{\left(\gamma - s\frac{z_{t+i-1}}{v_{t+i-1}}\right)}{\left(s\frac{h_{t+i-1}}{v_{t+i-1}} - \beta\right)} + \gamma\right) \Delta\, h_t$$

If equation (A.6) is generalized, one gets:

$$\Delta\, h_{t+n} = \prod_{i=1}^{n} \frac{(1+h_{t+i})}{(1+r_{t+i})} \left(\frac{1}{s}\right)^n \left[\frac{\beta\left(\gamma - s\frac{z_{t+i-1}}{v_{t+i-1}}\right)}{s\frac{h_{t+i-1}}{v_{t+i-1}} - \beta} + \gamma\right] \Delta\, h_t \tag{13}$$

Equation (9), expressed in *t + n,* is used to get (14), such that:

$$\Delta\, z_{t+n} = \frac{\left(\gamma - s\frac{z_{t+n}}{v_{t+n}}\right)}{\left(s\frac{h_{t+n}}{v_{t+n}} - \beta\right)} \Delta\, h_{t+n} \tag{A7}$$

Substituting (13) into (A.7) yields:

$$\Delta\, z_{t+n} = \prod_{i=1}^{n} \frac{(1+h_{t+i})}{(1+r_{t+i})} \left(\frac{1}{s}\right)^n \frac{\left(\gamma - s\frac{z_{t+n}}{v_{t+n}}\right)}{\left(s\frac{h_{t+n}}{v_{t+n}} - \beta\right)} \left[\frac{\beta\left(\gamma - s\frac{z_{t+i-1}}{v_{t+i-1}}\right)}{s\frac{h_{t+i-1}}{v_{t+i-1}} - \beta} + \gamma\right] \Delta\, h_t \tag{14}$$

Equation (10) in *t + n* is used to obtain (15), such that:

$$\Delta\, g_{kt+n} = \left(\beta \frac{\left(\gamma - s\frac{z_{t+n}}{v_{t+n}}\right)}{\left(s\frac{h_{t+n}}{v_{t+n}} - \beta\right)} + \gamma\right) \Delta\, h_{t+n} \tag{A8}$$

Substituting (13) into (A.8) yields:

$$\Delta\, g_{kt+n} = \prod_{i=1}^{n} \frac{(1+h_{t+i})}{(1+r_{t+i})} \left(\frac{1}{s}\right)^n \left[\frac{\beta\left(\gamma - s\frac{z_{t+i}}{v_{t+i}}\right)}{s\frac{h_{t+i}}{v_{t+i}} - \beta} + \gamma\right] \Delta\, h_t \tag{15}$$

Finally, to obtain (16) equation (10) expressed at the time *t + n* is used, such that:

$$\Delta\, r_{t+n+1} = \left(\frac{1}{s}\right) \left(\beta \frac{\left(\gamma - s\frac{z_{t+n}}{v_{t+n}}\right)}{\left(s\frac{h_{t+n}}{v_{t+n}} - \beta\right)} + \gamma\right) \Delta\, h_{t+n} \tag{A9}$$

Substituting (13) into (A.9) yields:

$$\Delta\, r_{t+n+1} = \prod_{i=1}^{n} \frac{(1+h_{t+i})}{(1+r_{t+i})} \left(\frac{1}{s}\right)^{n+1} \left[\frac{\beta\left(\gamma - s\frac{z_{t+i}}{v_{t+i}}\right)}{s\frac{h_{t+i}}{v_{t+i}} - \beta} + \gamma\right] \Delta\, h_t \tag{16}$$

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[1] Kalecki himself points out the reasons why the degree of monopoly can vary and with it, income distribution.

[2] It is argued that the reason why companies do not operate at their maximum capacity is to avoid circumstances where unexpected increases in demand would allow other companies to enter the market and reduce their share.

[3] The sake of simplicity, the supra index is dispensed with.

[4] Do note that in monopolistic or oligopolistic scenarios companies adjust their output to current demand. This means that we will use demand or output interchangeably.

[5] Say's law argues that all supply creates its own demand. This, in an economy with currency and time, implies that saving (supply) equals investment (demand) (Velázquez *et al*., 2017)

[6] Throughout this document the increase in variables is considered to tend towards 0. As such: $\frac{\Delta X}{\Delta x} \equiv \frac{dX}{dx}$ and $\frac{\Delta X}{\Delta x}\Delta x \equiv \frac{dX}{dx}dx$ for whatever *X* and *x* may be.

[7] There is a third scenario: overaccumulation. This scenario happens when demand is led by wages $(\gamma < s\frac{z_t}{v_t})$ and investment is more sensitive to its returns than to demand, that is $\gamma\Delta h_t > |\beta\Delta z_t|$. In this scenario investment increases due to greater returns, in spite of a drop in demand. Nevertheless, this scenario is not sustainable in the long-run given that if demand continues to drop, it will be impossible to sell the output. This would then result in a realization crisis. As such, this scenario is not analyzed when studying the model's dynamics.

[8] For further details see the appendix.

[9] For the record, there is no guarantee that a wage or profit driven economy will maintain its regime of stable growth in the long run. However, it is precluded in order to simplify the analysis.