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Distribution and Growth: A Dynamic Kaleckian Approach*

by

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Abstract

This paper studies the effects of an (exogenous) increase of nominal wages on profits, output, and growth. Inspired by an article by Michał Kalecki (1991), who concentrated on the effects on total profits, the paper develops a model that explicitly considers the dynamics of demand, prices, profits, and investment. The outcomes of the initial wage rise are found to be path dependent and crucially affected by the firms' initial response to an increase in demand and a decrease in profit margins. The present model, which relates to other Post Keynesian/Kaleckian contributions, can offer an alternative to the mainstream approach to analyzing the effects of wage increases.

Keywords: Distributional Changes; Disequilibrium; Investment; Growth

JEL Classifications: E22, E25, E31

1. INTRODUCTION

This paper deals with the effects on growth of a distributional shock in favor of wages. The analysis is carried out within a Post Keynesian/Kaleckian framework. Post Keynesian and Kaleckian economists have always been very much concerned with the problems of income distribution and growth since the pioneering contributions of Kalecki, Harrod and Domar, followed by those of Kaldor, Joan Robinson, Pasinetti, Harcourt, etc.

The effects of an (exogenous) distributional shock in favor of wages are studied within the framework of an imperfectly competitive economy in which firms form prices by applying a markup on costs. The analysis developed here can be seen as a development and extension of an article by Kalecki published after his death in 1970 (Kalecki 1991). Kalecki considers an exogenous increase in the nominal wage rate and argues that it does not necessarily produce the negative effects predicated by standard economics; in particular it does not imply a fall in aggregate profits, even if prices do not rise in the same proportion as wages or do not rise at all.[1]

Kalecki's conclusions raise a number of interesting analytical issues. Although a wage rise cannot affect negatively the level of profits in the same period when it occurs because current total profits are determined by capitalists' expenditure decisions (consumption and investment) based on past values of profits themselves, this same wage rise can affect the capitalists' decisions in future periods. In fact, an increase in wages not accompanied by a proportional increase in prices causes a decline of markups, which is likely to have an impact on capitalists' expenditure decisions in the following periods.

In our model we deal with these issues by developing a dynamic model, which takes into consideration both the capitalists' expenditure decisions after the wage rise and their pricing policy to restore the initial level of markups. On the one hand, we examine the contrasting effects of the wage rise on capitalists' expenditure decisions. On the other hand, we assume that capitalists react to the shift in distribution by gradually increasing prices to restore their initial share of income.

We concentrate on capitalists' investment decisions and analyze the two contrasting effects of the wage rise: the positive demand effect generated by higher wages and the negative profit effect due to the initial decline in markups.

The model shows under which conditions the positive effect on investment is dominant, so that the economy responds to the initial wage shock by starting a process leading to a new equilibrium characterized by higher levels of output, employment and productive capacity. The new equilibrium is also associated with the same income distribution as the initial, which is restored through price increases over time.

[1] If, following the wage rise, firms increase prices in the same proportion to leave markups unvaried, such a conclusion is obvious.

The possibility for the economy to realize such a result is contingent on two crucial conditions. Capitalists must react to the initial shock by deciding to increase their net investment while, at the same time, they do not contract their consumption. But the possibility to increase the capital stock and to sustain consumption despite the reduction of markups depends on the availability of additional financial resources, which must be provided by the financial sector as a whole.

The theoretical and analytical relationship between our model and the Post Keynesian/Kaleckian literature is evident, but it is worth stressing that the present model can also be easily related to and contrasted with the standard mainstream approach. As is well known, the current mainstream in macroeconomics is, to a large extent, based on the hypothesis that any attempt at modifying the given 'equilibrium' income distribution cannot produce anything but an inflationary process, which must be neutralized by the central bank's intervention. The economy cannot be moved away from its 'natural' position through exogenous changes of demand, even though such a position is associated with the existence of unemployed resources. We argue instead that, in such situations, an initial distributional shock implying an increase in demand can trigger a virtuous growth process leading the economy to a better equilibrium, even though the distribution of income between workers and capitalists is eventually brought back to its initial value.

The paper is organized as follows. Kalecki's analysis of the effects of an exogenous wage rise on total profits is briefly presented in section 2. Our dynamic model is exposited and developed in sections 3 to 5. Section 6 concludes by summarizing our main results and policy implications, which are contrasted to those derived from the mainstream approach.

2. KALECKI'S ANALYSIS OF A DISTRIBUTIONAL SHOCK

Kalecki dealt with the effects of a distributional shock in favor of wages in an article that was published only after his death in 1970 (Kalecki 1991). In this article he concentrated on the impact of the wage shock on aggregate profits and carried out his analysis by considering only one period of time.

Kalecki concluded that, in general, an increase in the wage share of income does not necessarily imply a fall of aggregate profits. Here, to illustrate Kalecki's position, we look at a case in which prices remain unchanged despite an increase in the wage rate. Considering this case is sufficient to point out the basic features of Kalecki's approach and the analytical problems that it raises.

2.1. **Investment and profits.** As is well known, in Kalecki's analysis of a closed economy with no public sector, if it is assumed that the workers' average and marginal propensity to consume is 1, we have that total profit at t are

$$P_t = I_t + C_t^K \tag{1}$$

Aggregate gross profits (P) equal gross investment (I) plus the capitalists' consumption (C^K), which is a function of profits themselves.

Equation (1) must be read "from the right to the left": total profits are determined by the capitalists' expenditure and not the other way around. In fact, capitalists as a class, in any period, can decide how much to invest and consume but they cannot decide how much to receive (Kalecki 1965, pp. 46-7).

The aggregate result as expressed in (1) can be immediately derived by considering a two-sector economy:[2] the first sector produces investment goods (I) and the second produces consumer goods (C). In the first sector, gross profits are

$$P^I = I - W^I$$

where W^I denotes the wage bill of workers employed in the production of investment goods.

The second sector, after having paid wages to its workers (W^C), is left with gross profits

$$P^C = C - W^C$$

To have equality between demand and supply of the consumer good, the portion of output that is not purchased by workers of the same sector (W^C) must be bought by workers in the investment-good sector and by capitalists of both sectors, i.e.

$$P^C = C - W^C = W^I + C^K$$

Therefore, total profits are

$$P = P^I + P^C = I + C^K \tag{2}$$

2.2. **The effects of a wage rise.** In a non-perfectly competitive economy in which prices are cost-determined, an increase in the wage rate generally determines an increase in prices.[3] Here, however, we follow Kalecki (1991) and look at the effects of a wage rise when prices do not change in response to it.

Let L^I, L^C, denote employment in the two sectors and w the uniform wage rate. Profits in the two sectors are

$$\begin{aligned} P^I &= I - wL^I \\ P^C &= C - wL^C \end{aligned}$$

Total profits are given by (2).

If the wage rate increases by $\gamma\%$ ($w' = w(1+\gamma)$) while prices remain unchanged, profits in the two sectors are

$$\begin{aligned} \bar{P}^I &= I - (1+\gamma)wL^I = P^I - \gamma wL^I \\ \bar{P}^C &= (1+\gamma)wL^I + C^K = P^C + \gamma wL^I \end{aligned}$$

[2] Kalecki, drawing on Marx's schemes of reproduction, dealt with a three-sector economy by distinguishing between the production of consumer goods for capitalists and consumer goods for workers.

[3] If labor productivity is constant or it increases less than the wage rate.

which means that total profits are left unvaried:

$$\bar{P} = P^I - \gamma w L^I + P^C + \gamma w L^I = P^I + P^C \tag{3}$$

Profits in the first sector decrease by an amount $\gamma w L^I$, but profits in the sector that produces consumer goods increase exactly by the same amount.

The increase in the wage rate leaves total profits unvaried despite a decline of markups.[4] This outcome essentially depends on the fact that the wage rise determines an increase in the workers' demand for the consumer good but does not affect either investment expenditures or capitalists' consumption because both the capitalists' consumption and investment are determined by past profits.[5]

In so far as one remains within the analytical context of Kalecki's article, his results do not raise any significant problem. However, if one looks at the problem from a more general perspective, some important questions arise. What are the effects of the decline in markups on investment and capitalists' consumption in the following periods? How do capitalists try to restore their markups? We deal with these issues in the next three sections by using a simple dynamic model.

3. A DYNAMIC MODEL FOR THE ANALYSIS OF A DISTRIBUTIONAL SHOCK

In this section we develop a model to study the effects of a wage rise in a non-perfectly competitive economy with unemployment of labor. The model retains a number of Kaleckian features, but we also make some changes and simplifications with respect to Kalecki's standard model in order to deal with the issues mentioned in the previous section in a simpler and more manageable way. The main features of the present model are detailed below.

3.1. **Production.** There are only two goods: a consumer good (C) for capitalists and workers and a capital good (I). The consumer good is produced by means of capital (K) and labor (L^C) with a linear technology with factor complementarity:

$$C_t = A \min(K_t, \lambda^C L_t^C) \tag{4}$$

Without loss of generality we can set $A = 1$ and λ^C is the productivity of labor producing the consumer good.

The capital good is produced by labor only (L^I):

$$I_t = \lambda^I L_t^I \tag{5}$$

(λ^I is the productivity of labor producing the capital good).

[4] Kalecki also considers cases in which prices vary in response to the wage rise. If all prices rise in the same proportion as the wage rate, there are no effects on profits, which remain unchanged. If prices rise but less than proportionally with respect to the wage rate, it can be easily seen that total profits increase even though the markup decreases in both sectors.

[5] "...it may be assumed that the volume of investment and capitalist consumption are determined by decisions taken prior to the short period considered, and are not affected by the wage rise during that period." (Kalecki 1991, p. 96).

Capital depreciates at a rate δ and investment is realized with a time lag:

$$K_t = (1 - \delta)K_{t-1} + I_{t-1} \ . \tag{6}$$

3.2. **Profits.** Gross profits in the two sectors are:

$$\begin{aligned} P_t^I &= p_t^I I_t - wL_t^I \\ P_t^C &= p_t^C C_t - wL_t^C \end{aligned}$$

Total gross profits are:

$$P_t = P_t^C + P_t^I = p_t^C C_t + p_t^I I_t - wL_t^C - wL_t^I$$

In the capital-good sector, net and gross profits ($\tilde{P}^I$ and P^I respectively) coincide

$$\tilde{P}_t^I = P_t^I$$

In the consumer-good sector, instead, gross profits include the cost of capital replacement, so that net profits are

$$\tilde{P}_t^C = P_t^C - p_t^I \delta K_t$$

Aggregate net profits then are

$$\tilde{P}_t = p_t^C C_t + p_t^I I_t^N - wL_t^C - wL_t^I$$

($I_t^N = I_t - \delta K_t$ is net investment).

3.3. **Pricing.** We make the hypothesis that firms fix prices, and determine income distribution, by applying a uniform markup on their unit costs. In the investment-good sector, the unit cost obviously coincides with the unit prime cost:

$$p_t^I = (1 + \mu_t)\frac{wL_t^I}{I_t} = (1 + \mu_t)\frac{w}{\lambda^I} \tag{7}$$

In the consumer-good sector, the unit cost is the unit prime cost plus the unit cost of capital replacement:

$$p_t^C = (1 + \mu_t)\frac{wL_t^C + p_t^I \delta K_t}{C_t} = (1 + \mu_t)\left(\frac{w}{\lambda^C} + p_t^I \delta\right) \tag{8}$$

We introduce a notion of 'equilibrium' markup μ_*, with which equilibrium prices p_* are associated. μ_* is the capitalists' markup target, that is to say the markup that they aim at realizing through their price policy. We also make the hypothesis that prices are 'sticky'. Whenever a change in unit costs makes the markup deviate from its equilibrium value, prices initially vary less than proportionally with respect to unit costs. However, the actual markup and prices keep on increasing over time until their equilibrium values, μ_* and p_*, are restored.

3.4. **Consumption.** As for the workers' consumption, we make the Classical-Kaleckian hypothesis that their marginal and average propensity to consume is 1, so that wages are entirely consumed. As for capitalists' consumption (B), the standard Kaleckian function is $B_t = qP_{t-\lambda} + A_t$, where λ denotes the time lag with which consumption reacts to profits, $0 < q < 1$ and A_t is an autonomous component that can be taken as constant ($A_t = A$) only in the short period (Kalecki 1965, p. 53). We adopt a capitalist consumption function that, although different from Kalecki's, retains the same basic features.

We assume that capitalist consumption at t is a certain proportion β of total net profits in the same period plus an additional component, which evolves over time as it is a certain proportion of the economy's level of activity. In turn, for simplicity, the level of activity is expressed by the total wage bill, $W_t = w(L_t^I + L_t^C)$. More precisely, the capitalist consumption function is

$$B_t = (1-\beta)bW_t + \beta\tilde{P}_t \tag{9}$$

This consumption function can be seen as an intermediate case between two extremes: the capitalists' consumption is independent of profits and simply is proportional to the level of activity (i.e. $\beta = 0$ in equation 9); capitalists consume their income (net profits) entirely ($\beta = 1$).[6]

Total demand for the consumer goods at t is

$$D_t = W_t + B_t \tag{10}$$

3.5. **Investment.** In the Kaleckian tradition investment essentially depends on demand and profits. We follow this tradition by assuming that investment is driven by these two variables. However, the investment function adopted here takes on a specific form. We express the demand and profit effects on *net* investment in terms of deviations of actual demand and markups from their respective steady-state levels.[7]

For simplicity, we assume that the capital good is produced to order, so that whatever level of demand for it is always met. Therefore, disequilibria between demand and supply can occur only in the market for the consumer good. We make the hypothesis that when the demand (in real terms) for the consumer good is higher than C_t (the actual output), the market is rationed, i.e. the short-side of the market prevails.

[6]Since production is linear, the level of activity and the total capital stock evolve together. This implies that the autonomous component of capitalist consumption can also be expressed as a proportion of total capital, which amounts to assuming that the capitalists' consumption depends also on their wealth (K) and not only on their income ($\tilde{P}$). However, to simplify the equations of the model, we approximate the total level of activity with the total wage bill.

[7]Which obviously means that net investment is nil at steady state. See also section 5 for some further considerations on the investment function.

The demand gap at t is

$$\Delta C_t = \frac{D_t}{p_t^C} - C_t \tag{11}$$

Having set $A = 1$, ΔC_t also denotes the gap between the capital required to produce the output demanded (D_t) and the existing capital stock K_t.[8]

When the markup is below its equilibrium value, capitalists experience a loss equal to the difference between the profits that they would receive by selling the same quantities at the equilibrium prices and actual profits.

$$\Delta M_t = (p_*^C - p_t^C)C_t + (p_*^I - p_t^I)I_t \tag{12}$$

(p_*^C and p_*^I are the equilibrium prices in the two sectors.)

Our hypothesis is that net investment (in real terms) is a linear function of the two gaps (11) and (12) with a time lag:

$$I_N^{t+1} = \eta \Delta C_t - \zeta \frac{\Delta M_t}{p_t^C} \tag{13}$$

If firms perfectly adjust their capital stocks to the change in demand at $(t-1)$, we have $\eta = 1$ and $\zeta = 0$.

3.6. **The steady state equilibrium.** In this simple model, we assume that the economy's steady state is characterized by a nil growth rate, so that investment is equal to capital depreciation. However, it would be easy to generalize the model to consider a positive steady-state growth rate without any significant implication for our general results.

Therefore, in steady state we have

$$I_* = \delta K_* \tag{14}$$

and

$$D_* = p_*^C C_* \tag{15}$$

(the market for the consumer good is in equilibrium).

Since net investment is nil, capitalists' consumption is equal to net profits:

$$B_* = p_*^C C_* - wL_*^C - wL_*^I = \tilde{P}_* \tag{16}$$

[8]By following the standard Kaleckian approach, we could consider the case in which the market for the consumer good clears every period by assuming that firms react to the higher demand by bringing capacity utilization above its normal level. In this case ΔC_t would denote the gap between the capital required to produce the output demanded at the normal degree of utilization and the actual capital stock. Since we focus our attention on growth and investment, we do not further develop the analysis of variations of the capacity utilization. In other words, we concentrate on the long-period rather than the short-period effects of a change in demand. On this, see also Palley (2011).

In order for the capitalist consumption to be compatible with equilibrium, it must be[9]

$$b = \mu_* \left(1 + \delta\mu_* \frac{1 + \mu_*}{\frac{\lambda^I}{\lambda^C} + \delta}\right) \tag{17}$$

There is no demand disequilibrium, the markup is at its equilibrium value, but there is no reason why labor should be fully employed. Indeed, there are no incentives for capitalists to make the complementary net investment needed to absorb unemployment.

3.7. **Summing up.** The model illustrated in this section retains some basic Kaleckian features, but we have introduced some changes with respect to the standard Kaleckian model, the most important of which concern pricing, the capitalists' consumption function, the investment function and the possibility to change the degree of capacity utilization.

As for pricing, we assume that firms are able to restore their target markup with a certain time lag. In other words, capitalists are unable to restore the 'equilibrium' income distribution immediately after a wage shock.[10]

As for capitalists' consumption, we retain Kalecki's hypothesis that it depends on net profits[11] and assume that the component of their consumption independent of profits evolves with the economy's level of activity.

The basic Kaleckian idea that investment depends on demand and profits is expressed here in terms of the effects on investment of demand and profits gaps, i.e. deviations from their steady-state equilibrium values. Since our focus is on the long-period process of growth we do not consider the possibility for firms to respond to demand gaps by varying their degree of capacity utilization.

4. **THE DYNAMICS**

After having defined the equations of the model and its equilibrium, in this section we study the out-of-equilibrium dynamics of the economy when subjected to an exogenous distributional shock in favor of wages.[12] We concentrate on the

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[9]From (16), at steady state we must have have $bW_t = \tilde{P}_*$; thus, considering (7) and (8), we have

$$b = \frac{p_*^C C_t - W_t}{W_t} = \frac{(1+\mu_*)[\frac{1}{\lambda^C} + \frac{\delta}{\lambda^I}(1+\mu_*)]wC_t}{w(\frac{1}{\lambda^C} + \frac{\delta}{\lambda^I})K_t} - 1 = \mu_* + \delta\mu_*^2 \frac{1+\mu_*}{\frac{\lambda^I}{\lambda^C} + \delta}$$

[10]The rationale of this hypothesis can be found in some considerations by Kalecki (1991, pp. 100-1). In certain situations, strong trade unions can obtain higher wages and lower markups because of the capitalists' reluctance to increase prices proportionally to wages and make their products too expensive.

[11]Even though, for simplicity, we do not introduce any time lag in the capitalist consumption function.

[12]The model could be extended and generalized to study also the effects of a distributional shock in favor of profits. Here, however, this case is not considered.

dynamics of capital accumulation, i.e. on the behavior of net investment. In fact, once the paths of capital accumulation are determined the paths of all the other variables are also determined.

With some manipulations and substitutions, from equation (13) we obtain the following approximate expression for the growth rate of the capital stock, $g_{t+1} = \frac{I^N_{t+1}}{K_t}$:[13]

$$\begin{aligned} g_{t+1} &\simeq [\eta(1-\beta)-\zeta](\frac{p^C_* - p^C_t}{p^C_t}) + \\ &+ \left\{[\eta(1-\beta)-\zeta]\left(\frac{p^I_* - p^I_t}{p^C_t}\right) + \eta\left(1+\beta\frac{b-\mu_*}{1+\mu_*}\right)\frac{p^I_*}{p^C_t}\right\} g_t \end{aligned} \tag{18}$$

The term $[\eta(1-\beta)-\zeta](\frac{p^C_* - p^C_t}{p^C_t})$ of (18) represents the direct effect on net investment of the demand and profit gaps, i.e. the combined effect of a higher demand and lower markups generated by the wage increase. This term is clearly increasing in η and decreasing in ζ, the two parameters of the net investment function (13).

It is interesting to point out that this term is also decreasing in β: the larger is the proportion of net profits devoted to capitalist consumption and the smaller is its autonomous component (see equation 9), the smaller is the effect on capital accumulation produced by the increase in the wage rate. In fact, the more capitalists' consumption depends on current net profits, the more the positive demand effect produced by higher wages is offset by the negative effect produced by lower profit margins.[14]

The term $\left\{[\eta(1-\beta)-\zeta]\left(\frac{p^I_* - p^I_t}{p^C_t}\right) + \eta\left(1+\beta\frac{b-\mu_*}{1+\mu_*}\right)\frac{p^I_*}{p^C_t}\right\} g_t$ is a sort of multiplier effect, which denotes the effect on the consumer-good sector's investment of the increase in demand for the investment good that generates additional demand for consumption from workers producing it. This term is increasing in β. The larger is the consumed proportion of net profits, the larger is the multiplier effect of investment.

Since we assume that the initial wage rise at a certain time t produces a shift in income distribution that is eventually wiped out, prices at t must be lower than equilibrium prices but they converge to them over time.[15] In other words,

$$\begin{gathered} p^i_t < p^i_* \\ p^i \to p^i_* \\ (i = C, I) \end{gathered} \tag{19}$$

[13]For the proof and the approximation, see Appendix A below.

[14]The limiting case is when $\beta = 1$ and the increase in the workers' consumption is entirely compensated by an equal decrease of the capitalists' consumption.

[15]See Appendix B for a specific case of convergence.

When prices have converged to their equilibrium values, (18) reduces to[16]

$$g_{t+1} \simeq \frac{\eta}{\frac{\lambda^I}{\lambda^C} + \delta} g_t \tag{20}$$

which clearly shows that the economy has not yet reached a new steady state since $g_{t+1} \neq 0$. This depends on the fact that net investment is still subject to the multiplier effect even though the positive and negative effects of the demand and profit gaps do not operate any longer.

In order for the economy to converge to a new steady state, it is necessary to assume that $\eta \leq 1$, which amounts to assuming that firms do not overreact to capital gaps. With $\eta \leq 1$, a sufficient condition for the stability of (20) is

$$\frac{1}{\lambda^C} + \frac{\delta}{\lambda^I} > \frac{1}{\lambda^I} \tag{21}$$

which means that the amount of labor employed by a unit of capital (including the labor needed to replace the capital worn out) is less than the amount of labor required to produce a unit of capital.[17] If this stability condition is fulfilled, the economy converges to a new steady state equilibrium.

In Appendix A we prove that if $g_1 > 0$ all g_t are positive as well. Thus, since $g_0 = 0$,[18] the sign of the overall effect is positive if

$$\eta(1-\beta) - \zeta > 0 \tag{22}$$

If (22) is fulfilled, the capital stock and the economy grow at a positive rate. This also means that the outcome of the initial wage shock is path-dependent. The economy's new steady state crucially depends on the sign of the first impact of the wage increase.

If (22) is fulfilled and a process of accumulation and growth is started, the implication is that the capitalist class needs not only additional finance for investment but also additional finance to sustain a level of consumption larger than current net profits, which amounts to[19]

$$B_t - \tilde{P}_t = (1-\beta)[\Delta M_t + (b - \mu_*)\frac{w}{\lambda^I} I_t^N] \simeq (1-\beta)\Delta M_t \tag{23}$$

that is, a share of the profit loss due to lower markups.

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[16]See Appendix A.

[17]Otherwise one unit of labor employed to produce net investment would activate in the next period more than one unit of labor and then, if η were not sufficiently small, this would entail that the production of one unit of net investment requires more than one unit of labor and so on. In other words, an explosive spiral would be set in motion. The cross-productivity constraint introduced here is common to other linear two-sector growth models.

[18]0 is the initial period when the economy's steady state is shocked by the wage rise, so that $\frac{p_*^C}{p_0^C} \neq 0$.

[19]See the note in Appendix A.

If the capitalists' consumption is constrained by current net profits, the higher workers' demand is completely offset by a lower capitalists' consumption, so that there is no positive overall demand effect and the lower profit margins determine a decline of net investment. The economy system experiences a crisis and converges to a lower new equilibrium level.[20]

Since the final equilibrium depends on the value taken by each single g during the transition, we can conclude that the final equilibrium level of all the variables is increasing in the coefficient of the reaction to the demand gap η. The equilibrium instead is decreasing in the coefficient of the reaction to the decline of markups, ζ and on the sensitivity of capitalists' consumption to the change in net profits (β).

5. SOME FURTHER DEVELOPMENTS

In the two previous sections we kept the model at the simplest possible level to point out its basic features and outcomes; now we introduce some further additional hypotheses and features. In this section we introduce an investment function in which financial factors play an explicit role and we admit the possibility that workers try to defend their initial improvement in income distribution through further wage increases in response to price increases. However, these developments and extensions are simply outlined, without providing a fully analytical treatment of them here.

5.1. **The role of finance.** In sections 3 and 4, we stressed the important role of finance to make a process of growth possible despite the initial distributional shock in favor of wages. Nonetheless, we did not introduce any financial variable into our investment function (13). Here we eliminate this incongruence by introducing a financial variable.

This financial variable is not the interest rate but a variable that expresses the availability of external finance to firms.[21] Sylos Labini, significantly influenced by Kalecki, pointed out that what is relevant for investment essentially is the availability of credit, which can be measured by total liquidity (Sylos Labini 1967, pp. 327-31).[22]

[20]In fact, this case amounts to set $\beta = 1$ in (9), so that (22) cannot be fulfilled, i.e. the sign of the overall effect of the wage shock is negative. The dynamics of this process of de-cumulation, which is more complex than the dynamics of accumulation, is not analyzed here.

[21]We accept Kalecki's idea that the (long-term) interest rate is not a significant variable to explain investment decisions because it is too stable to affect a typically much more volatile variable (Kalecki 1965, p. 99).

[22]Sylos Labini also argued that the availability of credit is particularly relevant for small-medium rather than large firms, because the latter can benefit from a larger amount of retained profits to finance their investment (internal finance). Here, however, we do not draw any distinction between firms and assume that the availability of external finance is relevant for all firms.

Along these lines, the investment function (13) can be generalized to take account of the financial factor. The simplest way to do so is to assume that the two parameters η and ζ, which measure the sensitivity of investment to the demand gap and to the markup gap respectively, are functions of the amount of financial resources available (F). More precisely, we can assume that η is an increasing function of F while ζ is a decreasing function.

Equation (13) can then be written as

$$I_N^{t+1} = \eta(F)\Delta C_t + \zeta(F)\frac{\Delta M_t}{p_t^C} \tag{24}$$

By adopting the function (26), the analysis carried out in section 4 can be immediately extended to take account of the financial factor. In particular, it is immediately seen that the condition (22) for an expansionary process to take place becomes less restrictive for larger values of F, i.e. for larger availability of finance to firms.

In stressing the importance of external finance for firms our model could appear as different from other Post Keynesian/Kaleckian models that, starting from Kalecki's principle of increasing risk, stress the importance of internal finance and also derive a direct functional relation between investment and pricing. In this perspective, one of the determinants of the firms' markups and prices is their financial requirements for investment. Harcourt (2006, pp. 27-28), in particular, assumes that higher levels of accumulation are associated with higher markups and prices to provide firms with the additional internal finance required.

Harcourt, however, also points out that the distributional shift in favor of profits can have a negative multiplier effect due to the assumed lower propensity to consume of the capitalist class.[23] It is this aspect that represents a point of conjunction with our approach to distribution and investment.

In order for the economy to be able to move to higher levels of capital, output and employment, firms must start an expansionary investment process in the presence of markups that are below their equilibrium level. In other words, the investment process must be driven by the demand effect produced by higher real wages and by the availability of external finance and in spite of the lower profitability of production and the higher degree of financial risk for firms due to their larger indebtedness. In this perspective, it is evident that external finance, and the terms on which it is made available, is of crucial importance.

We do not deny or underestimate the importance of internal finance for firms, but we stress that if the firms' preference for internal finance, and their consequent pricing policy, prevails over the drive to invest produced by a higher demand, the effects of the initial distributional shock is likely to be negative.

[23] "It is immediately obvious . . . that a higher level of accumulation need not necessarily be associated with a higher level of income" (Harcourt 2006, p. 28). See also Harcourt and Kenyon (1976) and Araujo (1999).

The availability of finance is crucial also for capitalist consumption. It allows the capitalist class to consume more than their current net profits and, hence, to sustain a process of growth in spite of the wage rise and the reduction of markups. This aspect can be formally embodied into the model by assuming that the autonomous component of consumption is increasing in the availability of finance.

For example, the capitalist consumption function can be written as

$$B_t = (1-\beta)b(F)W_t + \beta\tilde{P}_t \tag{25}$$

with b increasing in F.

5.2. **Workers' response to price increases.** Following Kalecki, our model so far was developed by assuming an exogenous wage rise, which implies a shift in income distribution. For Kalecki, such a shift in favor of wage-earners could be explained by the fact that it takes place in a situation in which markups are relatively high and trade unions are able to impose a redistribution of income through an increase in wages larger than the increase in prices (Kalecki 1991, pp. 100-1). Kalecki, however, also points out that, in the longer term, the capitalist class will react to curb the workers' strength and restore its economic and political power.[24]

In our model, we assume that the capitalist class reacts immediately to the distributional shock, even though the initial 'equilibrium' distribution is not restored at once but gradually over time. In fact, it is this sort of capitalist response that makes it possible for the economy to start a growth process driven by the increase in the consumption demand not fully neutralized by the price rise.

This way to approach income distribution, however, is somewhat 'asymmetric'. Whereas employers do not accept the distributional outcome of the wage rise and react through price rises, workers are assumed not to react to the price rises by asking for a higher nominal wage rate, so that they allow employers to return to the initial distribution of income. Moreover, so far we have assumed that workers do not ask for higher wages despite the increase in employment generated by investment. These assumptions about workers' behavior, however, can be removed.

In the present analytical context, the simplest way to deal with wage dynamics is to establish a functional relation between the nominal wage rate, the level of employment (L) and other 'institutional' factors (h) affecting wages:[25]

$$w_t = w_t(L_t, h_t) \tag{26}$$
$$\frac{\delta w_t}{\delta L_t} > 0,\ \frac{\delta w_t}{\delta h_t} > 0$$

[24] Kalecki (1990) is a clear exposition of his views in this respect.

[25] In terms of mainstream analysis, this amounts to introducing a simple Phillips curve. It would be easy also to use an expectation-augmented Phillip curve but it would not affect our conclusions significantly.

Under this new hypothesis the process described in the previous sections can be depicted as follows.

Assume that an initial change in the value of h determined an increase in the nominal wage, even though the level of employment has not varied. The increase in the nominal wage rate can set in motion an expansionary process like that described in sections 3 and 4. Now, however, the increase in investment and the consequent increase in employment determine an increase in the workers' bargaining power. For simplicity, but with no loss of generality, we can suppose that, in each period, workers obtain a rise of wages equal to the price rise, so that employers fail to modify the distribution of income and bring it back to its initial value.

Such a kind of wage and price dynamics cannot converge to a new equilibrium associated with the initial income distribution. The workers' and employers' attempts to defend their income shares gives rise to an inflationary spiral, which can be stopped only thanks to diminished workers' or employers' claims to income. If we do not consider the possibility that employers accept a permanent reduction of markups, the inflationary spiral can be ended either through a reduction of employment and, consequently, of the workers' bargaining power or by a change of the institutional variable h, which prevents nominal wages from increasing in the same proportion as prices.

If the dynamics of wages can be kept under control only through variations of level of employment, the expansionary process considered in our model cannot take place unless it is accepted that inflation keeps on rising indefinitely. If price rises have to stop, the economy must converge to its initial equilibrium with the same distribution of income and the same level of employment.

Instead, if the wage dynamics can be regulated through institutional factors, the expansionary process could take place essentially in the form already described in sections 3 and 4. Institutional changes operate in such a way that the wage rate remains constant after its initial increase. The institutional factor that obviously comes to mind is the implementation of an incomes policy. In the present specific case, the incomes policy would take the form of a social contract according to which workers accept the existing distribution of income in exchange for a higher level of employment.[26]

Thus, in conclusion, the model of sections 3-4 can be interpreted as depicting an economy in which some sort of incomes policy is at work. A case of growth triggered by an initial increase in wages can be described as follows. A policy mix affecting simultaneously the labor market and the financial sector is implemented. As for the labor market and industrial relations, a sort of incomes policy is implemented

[26]In this context, further wage increases could occur without inflationary consequences only if accompanied by increases in the labor productivity, which however we took as constant for the sake of simplicity. For some more detailed considerations on incomes policy see, for example, Sardoni (2011).

that allows for an initial increase in the nominal wage rate but not for further wage increases as a consequence of employment increases.

At the same time as when wages are allowed to rise, an expansionary monetary policy is implemented. This policy must be such as to increase the amount of financial resources available to capitalists, so that they can start the investment process and their consumption is not restrained because of the temporary decline of net profits. Such expansionary monetary policy must be implemented while the economy is experiencing an inflationary process, due to the capitalists' attempt to restore their equilibrium markups.

From the point of view of workers, such a policy mix can be justified by its benefits in terms of employment; from the point of view of employers, the policy mix can be regarded as convenient because it ensures an increase in demand without implying a permanent modification of their income share.

6. CONCLUSION

Kalecki analyzes the effects of a distributional shock in favor of wages on aggregate profits. His analysis is concerned only with the single period in which the wage rise takes place. The model developed in this paper deals with a similar distributional shock in a long-period context to analyze its effects on capital accumulation and growth in an economy characterized by the existence of unemployment.

The model shows that the initial distributional shock can give rise to a process of capital accumulation and growth that brings the economy to a new steady state, characterized by a larger capital stock, output and employment. In a situation of unemployment, an increase of the nominal wage rate can produce more prosperity; a conclusion at which also Joan Robinson (1975) had arrived. Such a conclusion is coherent with the Kaleckian/Post Keynesian approach followed here and it is in contrast with the standard approach according to which unemployment can be reduced through wage reductions.

The present model clearly relates to the large Post Keynesian/Kaleckian literature concerned with distribution and growth, in particular to those contributions that focus on the distributional conflict between wages and profits and the contrasting effects on investment and growth of demand and profitability.[27]

A distinctive feature of the present model is that firms are able to restore the initial income distribution only gradually. In fact, it is the relative stickiness of prices that makes it possible to have a virtuous growth process, which allows the economy to move to a 'better' new steady state. If prices respond to the initial wage shock by rising in the same proportion, there would be no expansionary effect.

[27]For example, Sylos Labini (1967) dealt with this issue by distinguishing between the "employers' view", which stresses the importance of a high profitability for investment and growth, and the position of the unions, which argue in favor of higher wages that imply a higher demand. Other important contributions are Rowthorn (1977), Bhaduri and Marglin (1990), Harcourt (2006) and Bhaduri (2008).

If prices rise gradually, it is the shift in income distribution that can essentially trigger the expansionary process. When eventually the equilibrium distribution is restored, the economy finds itself in a 'better' steady state, characterized by a larger capital stock and larger employment.

The possibility of a virtuous growth process is contingent on the availability of credit and finance to the capitalist class. After the initial shock, capitalists need additional finance for investment and consumption. The additional financial resources must be provided despite the inflationary process started by firms to restore their profit margins.

Our model can also be interpreted as an analysis of the economy's traverse from an initial to a new equilibrium. In particular, we look at the conditions under which the economy can traverse to a 'superior' steady state. From this point of view, our model relates to the Hicksian/Neo-Austrian approach. In fact, some dynamic features of our model are related to the out-of-equilibrium analytical context (Amendola and Gaffard 1998), in which economic changes are driven by market disequilibria.[28] Moreover, the neo-Austrian approach also points to the crucial importance of complementarity between the real and the financial sectors in the process of change. The transition from the initial steady state to a new steady state, characterized by larger output, employment and capital stock, can occur only if the entrepreneurial class is provided with additional credit.

Finally, the present model and its main results can be related to and contrasted with the mainstream approach to income distribution, inflation and policy. As is well known, in the mainstream New Keynesian literature an increase in wages of the sort considered here occurring when the economy is in its 'natural' equilibrium, necessarily triggers an inflationary process and cannot produce any real effect. Either endogenously (through the reduction of the real supply of money) or exogenously (through the intervention of an anti-inflation central bank), the economy is inevitably brought back to its 'natural' equilibrium, characterized by a certain rate of unemployment and a certain income distribution.

Also in our model the possibility for workers to modify the distribution of income set by firms is ruled out. As in mainstream models, we allow the initial income distribution to be restored through the firms' pricing policy. But our model does not lead to the conclusion that the economy must eventually go back to its initial 'natural' equilibrium. The initial wage shock can yield higher levels of output and employment.

The wage shock can produce positive real effects if firms are provided with additional credit. This implies that the adopted monetary policy should be exactly

[28]On the other hand, since we assume that capital goods are produced only by labor, our model can be easily translated into an analytical setting in which there is only one vertically integrated firm producing a final (consumer) good and deciding the quantity of labor to allocate to the production of intermediate (capital) goods to increase its productive capacity, a typical feature of neo-Austrian models.

the opposite of that called for by the mainstream. Whereas the mainstream approach calls for restrictive monetary policies to fight inflation, our model calls for the establishment of more favorable credit conditions, which can be determined by an expansionary monetary policy at the time when the inflationary process starts as a consequence of the firms' attempt to restore their markups.

Thus, in conclusion, although it is conceded that workers cannot modify the distribution of income, we point to the possibility to implement policies that allow the economy to realize equilibria that are economically and socially more satisfactory. Such policies imply the possibility for wages to rise despite unemployment and the availability of additional credit to finance investment and capitalist consumption. The policy conclusions derived from the the present model are far from the mainstream.

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Appendix A. proof (18)

Let us divide the total wage bill at t, W_t, into two components W_t^K and W_t^N. W_t^K is total wages paid to workers producing the output C_t and the capital goods to replace the capital worn out; W_t^N is total wages paid to workers producing additional capital goods (net investment).

From (4)-(6) we have that

$$\begin{aligned} W_t^K &= \left(\frac{1}{\lambda^C} + \frac{\delta}{\lambda^I}\right) C_t \\ W_t^N &= \frac{1}{\lambda^I} I_t^N \end{aligned}$$

By denoting with $\tilde{P}_*$ total net profits associated with selling the actual outputs at t at their equilibrium prices p_*^C and p_*^I,[29] we have

$$\tilde{P}_* = p_*^C C_t - W_t^K + p_*^I I_t^N - W_t^N \tag{A.1}$$

From the definition of prices in (7) and (8) and the definitions of b and W_t^K, (A.1) can be written as

$$\tilde{P}_* = \mu_* W_t^K + \mu_* \delta p_*^I C_t + \mu_* W_t^N = \mu_* W_t + \frac{\mu_* \delta p_*^I}{\left(\frac{1}{\lambda^C} + \frac{\delta}{\lambda^I}\right)} W_t^K = \mu_* W_t + (b - \mu_*) W_t^K$$

As a result, the component of capitalists' consumption independent of net profits reduces to[30]

$$bW_t = \mu_* W_t + (b - \mu_*)(W_t^K + W_t^N) = \tilde{P}_t^* + (b - \mu_*) W_t^N \tag{A.2}$$

Now, from the definition of demand in (9) and (10) and rearranging,

$$\begin{gathered} p_t^C \Delta C_t = (1-\beta) b W_t + \beta \tilde{P}_t + W_t - p_t^C C_t = \\ (1-\beta)[\tilde{P}_* + (b - \mu_*) W_t^N] + \beta \tilde{P}_t + W_t - p_t^C C_t = \\ \tilde{P}_t + (1-\beta)(\tilde{P}_* - \tilde{P}_t) + (1-\beta)(b-\mu_*) W_t^N + W_t - p_t^C C_t \end{gathered}$$

By adding and subtracting $p_t^I I_t^N$ and recalling the definition of net profits, we obtain

$$p_t^C \Delta C_t = (1-\beta)(\tilde{P}_* - \tilde{P}_t) + p_t^I I_t^N + (1-\beta)(b-\mu_*) W_t^N$$

which can be written as

$$p_t^C \Delta C_t = (1-\beta)(\tilde{P}_* - \tilde{P}_t) + p_t^I \left(1 + \frac{b - \mu_*}{1 + \mu_*}\right) I_t^N \tag{A.3}$$

since it is

$$W_t^N = \frac{w}{\lambda^I} I_t^N = \frac{w}{\lambda^I} \frac{p_t^I}{p_t^I} I_t^N = \frac{p_t^I}{1 + \mu_*} I_t^N$$

[29] So that it is $\Delta M_t = \tilde{P}_t - \tilde{P}_*$, where $\tilde{P}_t$ is actual total profits.

[30] Notice that in this way also (23) is proved. In fact, it is $B_t - \tilde{P}_t = (1-\beta)\tilde{P}_t^* + (b - \mu_*) W_t^N + \beta \tilde{P}_t - \tilde{P}_t = (1-\beta)\left[\tilde{P}_t^* - \tilde{P}_t + (b-\mu_*)\frac{w}{\lambda^I} I_t^N\right]$.

By substituting (A.3) into (12) and recalling the definition of net profits, we obtain

$$
\begin{aligned}
I_{t+1} &= \eta\frac{(1-\beta)(\tilde{P}_t^* - \tilde{P}_t) + p_t^I(1+\frac{b-\mu_*}{1+\mu_*})I_t^N}{p_t^C} - \zeta\frac{(\tilde{P}_t^* - \tilde{P}_t)}{p_t^C} \qquad \text{(A.4)}\\
&= [\eta(1-\beta)-\zeta]\left(\frac{p_*^C - p_t^C}{p_t^C}\right)K_t + \\
&+ \left\{[\eta(1-\beta)-\zeta]\left(\frac{p_*^I - p_t^I}{p_t^C}\right) + \eta\left(1+\beta\frac{b-\mu_*}{1+\mu_*}\right)\frac{p_*^I}{p_t^C}\right\}I_t
\end{aligned}
$$

If all terms in (A.4) are divided by K_t and g_t is approximated by the ratio $\frac{I_t}{K_t}$, we obtain (18). Notice that the first term of (18) has always the same sign as long as the markup gap does not change its sign. Furthermore, this sign is equal to the sign of g_1. If $[\eta(1-\beta)-\zeta] > 0$, both the coefficient of K_t and the coefficient of I_t are positive.[31] Hence, by induction, it follows from (18) that all the growth rates g_t have a positive sign.

When prices converge to their equilibrium values we have that

$$
\begin{aligned}
g_{t+1} \to \eta\left(1+\beta\frac{b-\mu_*}{1+\mu_*}\right)\frac{p_*^I}{p_*^C}g_t &= \eta\left(1+\beta\frac{\delta\mu_*\frac{1+\mu_*}{\frac{\lambda^I}{\lambda^C}+\delta}}{1+\mu_*}\right)\frac{1}{\frac{\lambda^I}{\lambda^C}+\delta\left(1+\mu_*\right)}g_t \\
= \eta\left(1+\beta\frac{\delta\mu}{\frac{\lambda^I}{\lambda^C}+\delta}\right)\frac{1}{\frac{\lambda^I}{\lambda^C}+\delta\left(1+\mu_*\right)} &= \eta\left(\frac{\frac{\lambda^I}{\lambda^C}+\delta+\beta\delta\mu}{\frac{\lambda^I}{\lambda^C}+\delta}\right)\frac{1}{\frac{\lambda^I}{\lambda^C}+\delta(1+\mu_*)}g_t
\end{aligned}
$$

which amounts to

$$
g_{t+1} \to \eta\left(\frac{1}{\frac{\lambda^I}{\lambda^C}+\delta} + \frac{(\beta-1)\delta\mu}{\frac{\lambda^I}{\lambda^C}+\delta}\right)g_t \qquad \text{(A.5)}
$$

The second term of (A.5) contains the product $\delta\mu$, a second order argument that, by taking account also of our cross-productivity condition, can be approximated to zero. In this way (A.5) reduces to (20), with its stability condition (21).

[31] In fact, $b-\mu_*$ certainly is positive (see equation 17).

Appendix B. a specific transition path of prices and markups

In section 4 above, we simply assumed that, after the initial shock, markups and prices will converge to their equilibrium values; here we make a specific hypothesis about the path along which markups and prices converge to equilibrium over time.

Since we start from a perturbation of equilibrium, the markup before the shock is μ_*. An increase in unit costs of a fraction γ at $t = 0$ determines a markup at 0, which is

$$\mu_0 = \frac{\mu_*}{1+\gamma}$$

From the occurring of the initial wage shock at time zero an inflationary process starts to restore the equilibrium markups. But in each period only a fraction $(1-\alpha)$ $(\alpha \in (0,1))$ of the gap is recovered:

$$(\mu_t - \mu_*) = (1-\alpha)(\mu_* - \mu_{t-1}) \tag{B.1}$$

Thus, the path of markups to equilibrium is

$$\mu_t = (1-\alpha)\mu_* + \alpha\mu_{t-1} = \mu_* - \alpha(\mu_* - \mu_{t-1}) = \mu_* - \alpha^t(\mu_* - \mu_0) = \mu_* - \alpha^t \frac{\mu_*\gamma}{1+\gamma} \tag{B.2}$$

where α denotes the speed of adjustment of markups.

Prices have a similar dynamics, which can be easily derived from (B.2), (7) and (8). The price dynamics denotes an inflationary process following the initial increase in wages. Inflation is positive and decreasing up to the full recovering of the equilibrium markup.