Long-term sustainability of zero-growth capitalism: activity, employment and unemployment according to different modes of income distribution

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Septembre 2024

Abstract

This paper studies the long-term consequences of a zero-growth regime on the evolution of employment and unemployment, depending on the assumptions we can make concerning the evolution of the working population, labor productivity and working hours. These consequences are examined through three scenarios, corresponding to three different types of institutionalized compromises concerning income distribution and employment management in a world without growth. These institutionalized compromises govern the evolution of distribution and, consequently, determine the level of economic activity, against a backdrop of no capital accumulation. The most worrying question is how a shrinking demand for labor (if productivity gains remain) can guarantee a place for the entire working population in production... especially if the working population continues to grow. The answer is quite obviously to be found in reducing individual working hours (Stagl, 2014 ; Lange, 2014 ; Fontana and Sawyer, 2023). We follow this line of questioning, seeking to grasp more precisely how the elements of this dramaturgy would jeopardize the viability, in terms of employment and unemployment, of a zero-growth regime, by placing under tension the various distributional compromises that could a priori regulate such a regime. This leads us to conclude that the goal of full employment would be put under greater strain by demographic growth (if this were to persist), than by productivity gains (if these were to persist). Admittedly, a sufficiently rapid individual reduction in working hours can counter the negative effects on employment of these two trends combined. But productivity gains are the only way to keep per-capita wages constant.

Keywords: zero-growth, institutionalized compromises, income distribution, employment, unemployment, productivity gains, reducing working hours, per capita wage.

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Acknowledgments: Jacques Mazier thanks the Chair Energie et Prospérité for its support.

Introduction

The ecological damage caused by the development model that most of the world's countries have come to adopt has reached a point where the survival of most living species, including humankind, is increasingly at risk. There's no longer any doubt about it: it's the fact that this model is built around the endless growth of production that has pushed environmental resource extraction and damage to nature to the limit. This model, dedicated to the cult of quantitative growth (Gadrey, 2015), is firmly rooted in our imagination (the commodity as a means of satisfying our idea of happiness), it is solidly instituted politically (private ownership of the means of production and the legitimate quest for profit by this way and to this end; competition as a disciplinary principle), and it is socially framed by more or less progressive compromises aimed at ensuring its social-political viability. Growth is what everything seems to be based on, and what everything risks collapsing on. In this respect, it seems increasingly illusory to bet on a hypothetical absolute decoupling of nuisances from growth, a decoupling that would be sufficiently rapid and lasting to avoid the worst (Parrique, 2022).

The idea that increasingly moderate growth (Galbraith, 2021; Parrique, 2022; Fontana and Sawyer, 2023), or even zero growth, would be a necessary condition for our economies to get back on an ecologically sustainable trajectory is a conjecture that deserves to be taken seriously (Jakson, 2009; Haberl, H. et al., 2020). The aim is not simply to achieve carbon neutrality by 2050, but in practice to reduce the overall ecological impact of our activities, by considerably reducing their pressure on our environment. The scarcity of certain minerals, coastal erosion, land, air and water pollution, droughts and floods, the collapse of biodiversity, etc. are all more or less directly linked to our production methods, the way our products are made and how they grow. Even if the imperative to reduce growth, or even to tend towards zero growth, cannot apply to all countries - in emerging countries, growth is undoubtedly still necessary to raise living standards - and even if this imperative is not sufficient - a whole set of policies and practices must be transformed to achieve it - the prospect of having to resolve, *volens nolens*, to a kind of secular stagnation (Summers, 2015, 2016) is credible enough to arouse legitimate curiosity among economists. What would such an economy look like?

Post-Keynesian economists have devoted more and more studies to this question, and at an increasing pace over the last fifteen years. Two types of curiosity dominate their investigations (Fontana and Sawyer, 2022): on the one hand, they wonder under what conditions a monetary economy of profit-oriented production could converge to a stationary state (how to land? as it were) and, on the other hand, whether a stationary state would be sustainable, in terms of profitability for firms, in social terms for employees (concerning wages and employment in particular), and in financial terms, with regard to the stocks of claims and debts held or owed by the various institutional sectors.

In this article, we address the question of the social sustainability of a zero-growth economy. We ask what will happen to employment, unemployment and wages in a framework where it is taken for granted that economic activity will no longer be growing, trend-wise, in the future. The level at which it can be established remains an issue, but not the pace of its evolution. Few works have tackled this question head-on from a Post-Keynesian perspective. This is perhaps due to the fact, paradoxically, that Postkeynesians most often do not explicitly articulate their theory of growth to the situation on "the labor market". According to Palley (2018) "*Post Keynesian (PK) growth models typically fail to model unemployment. That shows up in the absence of an equilibrium condition requiring the growth of employment to equal labor-supply growth.*". The case may seem too obvious to them: the link between the level of economic activity, as determined by effective demand, and employment does indeed seem trivial, and appears to be well established empirically (Smith and Zoega, 2009; Lavoie, 2022)[3]. However, the question is attracting renewed interest in recent work devoted to zero-growth, surely because the issue of full employment takes on a renewed and accentuated dramaturgy in this perspective. Given that the volume of employment (measured in hours worked) can no longer grow, and is even set to shrink due to productivity gains that are still possible, the question of how a shrinking demand for labour can guarantee a place in production for the entire working population becomes more intriguing... especially if the population continues to grow. The answer is quite obviously to be found in the reduction of individual working hours (Stagl, 2014; Lange 2014, Fontana and Sawyer, 2023).

We follow this line of questioning, seeking to grasp more precisely how the elements of this dramaturgy would jeopardize the viability of a zero-growth regime, by placing under tension the various distributional compromises that could *a priori* regulate such a regime. The arithmetic of the level of economic activity, productivity gains, working hours, demographic growth and employment does not take the same trajectory according to the different institutionalized compromises, politically and socially, which could claim to tule or regulate the distribution between wages and profits, taking more or less into consideration the objective of full employment.

We present three types of distribution compromises that are assumed to be adapted to, or compatible with, a zero-growth regime. These compromises are supposed to reflect the adjustment of actors' expectations or demands (companies, employees, rentiers) to the new situation, either as a result of their necessary accommodation or resignation to the test of facts, or by virtue of the search for what seems fair and reasonable with regard to the "cake to be shared, which is no longer growing". The first compromise envisaged (presented in section 2) assumes that, in a regime of zero growth, actors would be forced to live with a wage-profit distribution that they had not really chosen, resulting from their respective bargaining powers which we suppose stable over the medium-to-long term. The second compromise (examined in section 3) stages the behavior of employees who, in the face of zero growth, demand and succeed in preserving a constant wage per head, in what might appear *prima-facie* to be a defensive strategy. The third compromise (presented in section 4) corresponds to a situation in which the distribution of income is adapted to ensure that effective demand is compatible with full-employment income - what might be described as a social-political compromise à la Kaldor.

In section 1, we present the basic model which, in the following 3 sections, will be used to study the employment and income consequences of zero-growth, depending on the patterns of distribution set out above. This is a very simple model, with no state, no external relations, and in which households - both rentiers and wage earners - can save, but do not invest. We define a zero-growth economy as one in which the medium to long-term growth rate of production is zero, because production capacities no longer vary. The purpose of gross investment is no longer to increase production capacity, but to scrap and replace older generations of productive capital that have become worn-out or obsolete, and/or that no longer meet the requirements of ecological sustainability, in order to keep production capacity constant. In other words, gross investment is

[3] Lavoie (2022, p. 299) wrote: « As an illustration, scholars pondered for many years why the unemployment rate in the USA was systematically lower than in the Canada, using sophisticated econometric analysis to identify causes such as the percentage of the population being incarcerated, unemployment benefits, taxation rates and other supply-side phenomena. When the subprime financial crisis hit the American economy, the unemployment rate in the USA jumped way ahead of that in Canada, thus showing that a lack of aggregate demand may be the simplest and best explanation of the discrepancy between the rate of unemployment in the two countries. ».

entirely devoted to depreciation. A zero-growth economy does not mean that the level of production can no longer vary. The latter is determined by the conditions of the short-term equilibrium of effective demand, i.e. by the level of current gross investment (in this case, depreciation), income distribution and the various propensities to save. The level of investment spending may vary as a result of depreciation decisions taken by firms (in particular, in line with political objectives setting the trajectory for a sustainable transition); income distribution may change (in the wake of the new social compromises that a stationary regime would impose); household saving propensities may vary to adapt to the new situation; etc.., but we assume here that if such changes do occur, they happen once and for all, i.e. without carrying a tendency to vary beyond their one-off movement (conceived as definitive). We also assume that investment does not respond to possible short-term variations in equipment utilization rates, and that "animal spirits" have correctly integrated the prospect of zero long-term growth. Investment therefore depends solely on decisions to depreciate part of the capital stock in each period (at a rate that we'll also assume to be constant). As a result, the model no longer includes an acceleration effect, and we are brought back, as it were, to a short-term model, as far as the determination of the level of economic activity is concerned.

In section 5, we take a brief look at the financial sustainability of the stationary state. Given that we do not assume at the outset of our study, as is often done (Lavoie and Cahin-Fourrot, 2016, Hein and Rimenez, 2022), that the financial equilibrium of each institutional sector must be assured *a priori*, there may be growing imbalances of claims and debts between institutional sectors. This is even certain: since households continue to save in a world where the stock of real assets is no longer growing, companies must continually finance themselves externally. So we need to say something about this. We shall see that a solution to this "tension" or "contradiction", at the heart of zero-growth, can be found in the continuous decline in equity returns. This solution will be evoked rather than discussed in detail. But in our view, it deserves to be stated as a "logical" consequence of zero growth, as well as a plausible route to the extinction of net household savings.

Finally, as we examine each of the distributional patterns studied (sections 1, 2 and 3), we will discuss sustainability in terms of profits. Unlike Gordon and Rosenthal (2003) or Biswanger (2009), and in line with more recent work on the subject (Lavoie and Cahin-Fourot, 2018; Montserand , 2019; Hein and Rimenez, 2022; Fontana and Sawyer, 2022 and 2023), we conclude that profits (gross and net) are possible in equilibrium... under certain conditions, which strongly depend on how dividends are thought to be distributed. Profits are more likely to be positive when dividends are derived from gross profit than from net profit.

1. The basic model: an economy without a state and without external relations

In the basic model we propose, production (PQ) is divided between wages (W) and profits (Π). Employees consume a large part of their wages (C_w) and save the rest. Firms distribute part of their profits in the form of dividends (DIV) to capitalist households (rentiers), who spend part of these dividends on consumer goods (C_Π) and save the rest. Production is determined by demand, which is made up of the demand for investment goods (I_{brut}) and the demand for consumption goods $(C_w + C_\Pi)$ coming from wage earners and rentiers respectively. Given that the economy is not (no longer) growing, firms' gross investment is assumed to be intended solely for the decommissioning and scrapping of generations of capital that were previously installed, are worn out or obsolete, and/or do not, or no longer, meet the ecological sustainability requirements of production. Gross investment is therefore equal to the depreciation (A) of the existing capital stock (K) during the period under consideration (usually one year). The productive capital stock is therefore also constant $(K = K_{-1} + I_{gross} - A = K_{-1})$. In addition to these institutional and behavioral assumptions, we adopt the following standard definitions of financial variables: gross profit (Π_{gross}) is the difference between the value of production and wages (there is no intermediate consumption) ; net profit (Π_{net}) is gross profit less depreciation; retained profit, or self-financing (Π_f), is gross profit less dividends paid to shareholders. The financing need of businesses (BF) is equal to their gross investment minus the retained profit. Rentiers' savings (S_Π) are equal to dividends received less consumption. Employees' savings (S_w) are equal to their wages minus their consumption. Since households do not invest, their financing capacity is equal to their savings. As a result, the balance of agents' capital accounts shows that the financing needs of companies are necessarily covered by the savings of rentiers and employees $(BF = S_\Pi + S_W)$. This is the unwritten equation, deduced from the accounting framework, which results from the model we explain below (see Table 1.). Finally, as we are reasoning at constant prices (P), we can assume for simplicity that these are equal to 1.

Table 1: Equations of the basic model

1	$PQ = W + \Pi_{gross}$	The value of production sold (PQ) is necessarily divided between employees and companies. Since profit is a leftover, the part of the product that goes to companies (Π_{gross}) is obviously what they have not distributed in wages (W).
2	$PQ = I_{gross} + C_w + C_\Pi$	The level of economic activity is determined by the extent to which production (Q) valued at price (P) - including the required profits - can actually be sold by overall expenditure.
3	$C_w = c_w W$	Households receiving wages spend a fixed proportion (c_w) of their wages on consumption.
4	$S_w = W - C_w$	By definition, employees' savings (S_w) is the part of their disposable income (here their wages) that they do not consume.
5	$S_\Pi = DIV - C_\Pi$	By definition, shareholders' savings (S_Π) is the part of their disposable income (in this case their dividends) that they do not consume.
6	$C_\Pi = c_\Pi DIV$	Rentier households spend a fixed proportion (c_Π) of their dividends on consumption.
7	$DIV = d\Pi_{gross}$	Companies pay shareholder households a constant fraction (d) of their gross profits.
8	$I_{gross} = A$	Gross investment is limited to capital depreciation.
9	$A = \delta K_{-1}$	In each period, companies decide to replace a constant fraction (δ) of the capital stock existing at the end of the previous period.
10	$\Pi_{net} = \Pi_{gross} - A$	By definition, net profits are equal to gross profits less the value of depreciation.
11	$\Pi_f = \Pi_{gross} - DIV$	By definition and construction, retained earnings, or self-financing (Π_f), are those not distributed as dividends.

12	$BF = I_{gross} - \Pi_f$	By definition and construction, a company's financial need (BF) corresponds to the portion of its gross investments that it does not finance itself.

As it stands, the model comprises 12 equations for 13 unknowns:

$PQ, \Pi_{brut}, W, C_w, S_w, C_{\Pi,} S_{\Pi}, DIV, I_{brut}, \mathrm{A}, \Pi_{net}, \Pi_f, BF$

The model is therefore indeterminate. This is because we cannot deduce the equilibrium level of effective demand (PQ^*) resulting from equation (2) until we know what wage-earners' and rentiers' consumption respectively represent as a function of current income (PQ), i.e. until we know how income (wages and profits) is distributed in the economy. The main purpose of this article is precisely to present several scenarios on this subject, with a view to comparing the resulting zero-growth regimes. These regimes will be characterized: i) by the different levels of stationary economic activity resulting from the different institutionalized compromises governing distribution, ii) by the changes in employment and unemployment resulting, within each regime, from the assumed pace of productivity gains and changes in the working population, iii) by the changes in per capita wages resulting from these distributional schemes, technical progress and changes in the working population.

In sections 2, 3 and 4, we examine three types of institutional compromise that may govern income distribution. The first corresponds to a situation in which companies and employees are able to defend or preserve a long-term *status quo* regarding income distribution (i.e., the profit share is given in the long term). The second reflects a loss of bargaining power on the part of employees, who, faced with zero growth, resign themselves to preserving and demanding a fixed amount of per capita wage. The last type corresponds to a different scenario, where income distribution is not directly the object of the institutionalized compromise: politicians and employees manage to impose a kind of "forced" full employment, by adapting income distribution to achieve this objective. In this third case, the logic of the model is inverted, as supply becomes the driving force, and demand (determined by distribution) becomes "the stewardship that always follows". The question is whether this makes sense.

Although not the main focus of our study, we point out in passing what the conditions are for profits to remain positive in the steady state. As we shall see, the judgment that can be inferred about the economic sustainability of the stationary state is not the same depending on whether we assume that dividends are distributed as a function of gross profit or net profit.

2. Employees and companies manage to defend the *status quo* in terms of income sharing.

In the first distribution compromise considered here, the profit share (α) and the wage share $(1 - \alpha)$ are stabilized at a level that is perpetuated as long as the relative bargaining power of employees and companies is perpetuated. Looking at the profit share :

$$\frac{\Pi_{gross}}{PQ} = \alpha \quad (1)$$

The level of economic activity is established at the point where production deemed profitable by companies (i.e. containing their expected share of profits) can actually be sold:

$$PQ = A + c_w(1-\alpha)PQ + c_\Pi \alpha d PQ \quad (2)$$

Hence, after a little calculation aimed at extracting PQ, the effective demand equilibrium is:

$$PQ^* = \frac{A}{1 - c_w(1-\alpha) - c_\Pi \alpha d} \quad (3)$$

In equilibrium, gross profit is :

$$\Pi_{gross} = \alpha PQ = \alpha \frac{A}{1 - c_w(1-\alpha) - c_\Pi \alpha d} \quad (4)$$

And net profit is :

$$\Pi_{net} = \Pi_{gross} - A = \alpha \frac{A}{1 - c_w(1-\alpha) - c_\Pi \alpha d} - A \quad (5)$$

Grouping the terms under the same denominator and noting $s_w = 1 - c_w$, we obtain:

$$\Pi_{net} = \frac{A[c_\Pi \alpha d - (1-\alpha)s_w]}{1 - c_w(1-\alpha) - c_\Pi \alpha d} \quad (6)$$

In this framework, we find the usual conclusions: the level of economic activity (see equation (3)) is determined by the principle of effective demand, i.e.: by autonomous expenditure (here gross investment, entirely devoted to depreciation) divided by society's propensity to save (here the share of unconsumed profits and wages in national income).

When the condition $(c_w(1-\alpha) + c_\Pi \alpha d < 1)$ is met, so that the equilibrium level of economic activity is positive, gross profit is itself always positive, since it represents a given part (α) of production. This condition is necessarily met, given that not all income is distributed to households (firms retain part of it), and given that on each distributed share the propensity to consume is less than or equal to 1.[4]

Net profit, meanwhile, will be positive only if profits consumed are greater than wages saved $(c_\Pi \alpha d > (1-\alpha)s_w)$. This is a condition that is easy to understand when we have Kalecki's relationship in mind. At the macroeconomic level, in fact, when we assume, as here, that there is no state (or that the budget is balanced), that there is no trade with the outside world (or that the current account is balanced) and that there is no autonomous consumption (from credit or based on household wealth), gross profits are generated by gross investment expenditure and dividends consumed, from which employee savings must be subtracted. Following this :

$$\Pi_{gross} = I_{gross} + c_\Pi DIV - s_w W \quad (7)$$

To obtain the net profit, we need to subtract depreciation from the term on the right. Since depreciation represents the total gross investment, we arrive at :

[4] In other words, even in the extreme case where the propensities to consume wages and profits are equal to 1, the left-hand term would be equal to $\alpha(1-d)1$. Unless the gross profit distribution rate is itself greater than 1 (which is frankly unrealistic), this expression is less than 1.

$$\Pi_{net} = c_\Pi DIV - s_w W \quad (8)$$

This means that in the institutional framework chosen here, the formation of net profits by demand - more precisely, by aggregate expenditure minus production costs - is ultimately fuelled by the Widow's Jar mechanism (Keynes, 1930), to which savings from wages are a significant brake.[5] We can assume that for plausible parameter values, congruent with the rudimentary model adopted here, net profits could be positive.[6] This would no doubt be less obvious in a more "realistic" approach, taking into account all the intricacies of the macroeconomic circuit of a "complex" modern economy. To get an idea, we'd need to carry out a more detailed study, on a case-by-case basis (country by country), taking into account not only the functional distribution of income and the different propensities to consume, but also the auxiliary "drivers" of profit formation: public deficits, direct aid to companies, current account surpluses (for countries with a neo-mercantilist strategy)[7], and consumption on credit or coming from the wealth effect.[8]

The level of employment corresponding to the equilibrium of effective demand is not generally compatible with full employment. Different assumptions can be made regarding labor productivity in the context of zero growth. Productivity can be constant or increasing, probably at a fairly low rate. Different factors suggest that there will always be some productivity gains, due to the replacement of old equipment with newer and greener ones, to the persistence of learning effects, to the maintenance of R&D expenditures that can have positive effects through new processes and the creation of new, greener products. By definition, hourly productivity (π) is written as:

$$\pi = \frac{PQ}{lN} \quad (9)$$

Where N represents the number of jobs in the economy and l represents the annual individual working hours. Assuming that productivity increases at a constant rate γ, we have:

$$\pi_t = \pi_0 e^{\gamma t} \quad (10)$$

The volume of employment at time t is consequently:

$$N_t = \frac{PQ^*}{l\pi_0 e^{\gamma t}} \quad (11)$$

That is, by replacing $PQ^*$by its value in equation (3):

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[5] Keynes refers in this way to the fact that the distribution of profits, and their consumption, reconstitutes profits. In the model chosen here, the distribution of profits is anchored (or backed) to gross profit. This has the effect of robustly fueling the payment of dividends (gross profits themselves being fueled by gross investment) and correctly activating the Widow's Jar mechanism generating profits. In other models, the distribution of profits is anchored to net profit (which is not fueled by net investment, since the latter is zero). This tends to make the persistence of profits very precarious in a zero growth regime. See Appendix 1.

[6] As an illustration, assuming $d = 0{,}5$; $S_w = 0{,}1$; $C_\Pi = 0{,}6$; $\alpha = 0{,}4$; the dividends consumed would represent 12% of the national income (PQ). They would be able to "counter" the depressing effect of savings from wages, representing 6% of the national income.

[7] See Lucarelli, B. (2011).

[8] A quick glance at national accounting data shows, however, that the condition for net profits to be positive (see equation (8)) is not out of reach in practice. For example, in the USA, property income (all combined: owner's income, rental income, personal income receipts on assets) represents almost 1/3 of household disposable income, compared to around 2/3 for employee compensation. Since households save very little on average (4% of their disposable income in 2022), it is easy to admit that the consumption of owners can be much higher than the savings of employees.

$$N_t = \frac{\mathrm{A}.\,e^{-\gamma t}}{[1 - c_w(1-\alpha) - c_\Pi \alpha d] l \pi_0} \quad (12)$$

As we have supposed that the wage share is constant ($W/N = (1-\alpha)$), the wage per head ($\widehat{w}$) evolves in line with the pace of productivity gains:

$$\widehat{w_t} = (1-\alpha) l \pi_0 e^{\gamma t} \quad (13)$$

Quite obviously, in such a regime, as the level of activity (PQ^*) is constant, employment will also be constant, if there are no productivity gains ($\gamma = 0$) and if working hours remain constant ($l = l_0$). Conversely, if there are productivity gains, employment will decrease, while wages per capita ($\widehat{w}$) will increase. Fewer and fewer workers employed, but benefiting from increasing wages… this is probably not the most sustainable social situation in the long term, including from a political point of view. In this regime, the question of the fair distribution of jobs and income within the workforce would arise more than ever. A reduction in annual working hours, programmed at the same rate as productivity gains ($l_t = l_0 e^{-\gamma t}$) could be the instrument for this. It would counter the negative effect of productivity gains on the number of jobs (keeping the latter constant) while guaranteeing a constant wage per capita. At first glance, this solution may appear to be a regressive "deal" offered to employees, a solution inspired by the classic doctrine on employment and wages: "give up wage increases per capita to defend employment". This is of course not what it is about. It is about allocating productivity gains to more free time (rather than more wages and consumption), with a view to maintaining employment and wages for all.

However, if the active population continued to grow at a constant rate n ($PA_t = PA_0 e^{nt}$), the situation could become more critical in terms of employment and unemployment. The employment rate N/PA would decrease, even in the absence of productivity gains, and the unemployment rate would tend to increase. We would have:

$$\frac{N_t}{PA_t} = \frac{PQ^*}{l \pi_0 e^{\gamma t} PA_0 e^{nt}} \quad (14)$$

If working hours were to decrease to compensate for both productivity gains and population growth ($l_t = l_0 e^{-(\gamma+n)t}$), the employment rate and the unemployment rate would remain stable, of course, but wages per head would decrease at a rate inverse to that of population growth, since « the cake to be shared » (the mass of wages) is constant:

$$\widehat{w_t} = (1-\alpha) l_0 \pi_0 e^{-nt} \quad (15)$$

Such a development could be tricky to manage in the long term. There are undoubtedly possibilities for redistributing (very) high incomes to the lowest, but it would be difficult to also benefit the intermediate categories, which could be problematic in a zero growth context. Not to mention that redistribution would have to deepen over time, at the rate of population growth.

The long-term consequences of a zero growth economy in which a *status quo* in terms of wage-profit distribution would prevail are ultimately the following. Since the volumes of production and employment are determined by effective demand, if autonomous expenditure no longer grows ($I_{brut} = A = cte$), economic activity itself stagnates. Therefore, if the replacement of generations of old (brown) capital by more "green" capital goods were to be accompanied by more or less continuous productivity gains, unemployment could only increase (*a fortiori* if the working population continue to grow) and the gap would widen between those who have a job (and continue to see their wages increase) and those who are unemployed. This is the drama that everyone must surely have in mind. The sustainability of such a regime is ultimately less threatened by the disappearance of profits than by the accumulation of social or financial imbalances. We have seen that the former can be responded to by a continuous reduction in the annual working time, at the cost of a stagnation in wages per capita, or even a reduction, if the working population continues to grow. We will see what happens to financial imbalances in section 5.

3. Employees defend a constant level of wages per head

In the above, the stagnation of wages per head appeared as a sort of "defensive" measure, aimed at preserving employment within an institutionalized compromise establishing as a principle the stability of the wage-profit distribution. What would happen if it were the stagnation of wages per head that were established as a principle? On reflection, in an economy without growth in the stock of productive capital, this would be a more "defensible" than "defensive" position from the employees' point of view. Once the prospect of a long-term stagnation of the wealth produced is integrated, *volens-nolens*, each employee could judge the maintenance of their income in the long term to be fair and defensible. It is this second type of compromise concerning distribution that we are now examining. In this context, the mass of wages depends solely on the volume of employment:

$$W = \widehat{w}^* N \quad (16)$$

As the wage per head $\widehat{w}^*$ is fixed, it does not depend, in particular, on any productivity gains. If the wage per head targeted by employees were indexed to productivity gains, the result would be a constant wage share. We would be back to the previous case.

Assuming constant or increasing labor productivity at a constant rate γ, which we can imagine to be moderate $(\pi_t = \pi_0 e^{\gamma t})$, we obtain, according to the principle of effective demand:

$$PQ = A + c_w W + c_\Pi d\Pi \quad (17)$$

By replacing wages and profits by their value and taking into account their dynamics due to productivity gains:

$$PQ_t = A + c_w \frac{\widehat{w}^*}{l\,\pi_0} PQe^{-\gamma t} + c_\Pi d\left(pQ - \frac{\widehat{w}^*}{l\,\pi_0} PQe^{-\gamma t}\right) \quad (18)$$

That is, after a little calculation:

$$PQ_t^* = \frac{A}{1 - c_\Pi d\left(1 - \frac{\widehat{w}^*}{l\,\pi_0} e^{-\gamma t}\right) - c_w \frac{\widehat{w}^*}{l\,\pi_0} e^{-\gamma t}} \quad (20)$$

Where we see, as usual, that the equilibrium product is equal to autonomous demand divided by society's propensity to save, resulting from the respective shares of profits earned and wages paid.

What is less usual is that equilibrium income now varies over time, as the distribution of income evolves in line with productivity gains. The share of profits in income is in fact :

$$\frac{\Pi_t}{PQ_t} = 1 - \frac{\widehat{w}^*}{l\,\pi_0} e^{-\gamma t} \quad (21)$$

As wages per head remain constant, the share of wages in product declines as productivity gains eliminate jobs. The share of profits therefore increases in a complementary fashion. This, in turn, necessarily affects the equilibrium level of income: as profits are less well spent than wages ($c_w > c_{\Pi d}$), this has a recessionary effect on the level of activity (we'll come back to this later).

In mass terms, gross profits now depend on the equilibrium level of effective demand, which in turn depends on the distribution :

$$\Pi_{brut}^t = \frac{A\left(1 - \frac{\widehat{w}^*}{l\,\pi_0} e^{-\gamma t}\right)}{1 - c_\Pi d\left(1 - \frac{\widehat{w}^*}{l\,\pi_0} e^{-\gamma t}\right) - c_w \frac{\widehat{w}^*}{l\,\pi_0} e^{-\gamma t}} \quad (22)$$

The latter are always positive and increasing. We can verify (see Appendix 3 for a demonstration) that the derivative of profits in relation to the profit share is positive. This is because the recessionary effect of the increase in the profit share on national income (which reduces profits through the base effect) is more than offset by the increase in the profit share (the rate effect).

Net profits ($\Pi_{net} = \Pi_{gross} - A$) become :

$$\Pi_{net}^t = \frac{A\left[c_\Pi d\left(1 - \frac{\widehat{w}^*}{l\,\pi_0} e^{-\gamma t}\right) - s_w\left(\frac{\widehat{w}^*}{l\,\pi_0} e^{-\gamma t}\right)\right]}{1 - c_\Pi d\left(1 - \frac{\widehat{w}^*}{l\,\pi_0} e^{-\gamma t}\right) - c_w \frac{\widehat{w}^*}{l\,\pi_0} e^{-\gamma t}} \quad (23)$$

This brings us back to the condition set out above: net profit is positive if rentiers consumption exceeds employee savings, i.e. if the Widow's Jar mechanism is sufficiently powerful to counter the effect of profit capture by employee savings. This condition will be all the easier to achieve if productivity gains are high, leading to a faster decline in the wage share and an increase in the profit share. If we had assumed that it is net profit, rather than gross profit, that is distributed in the form of dividends ($DIV = d_2(\Pi_{net} - A)$), gross profit would remain positive but net profit would become negative (see demonstration in Appendix 2.).

Employment volume, for is part, is equal to total product divided by productivity:

$$N_t^* = \frac{PQ_t^*}{l\,\pi_0 e^{\gamma t}} \quad (24)$$

At the end of the calculation :

$$N_t^* = \frac{A}{(1 - c_\Pi d)l\,\pi_0 e^{\gamma t} + c_\Pi d\widehat{w}^{**} - c_w\,\widehat{w}^*} \quad (25)$$

Trivially, we observe that the volume of employment falls continuously, if there are productivity gains. If there were no productivity gains $(\gamma = 0)$, output, employment and the wage/profit split would be constant. We would be in a complete stationary state. The return on capital (the profit rate Π/K) would itself be invariant. A zero-growth regime such as this would be socially sustainable, assuming that all actors, and wage earners in particular, have indeed broken with the imaginary of benevolent growth - in other words, that they no longer expect, nor hope for, a continuous increase in their per capita income in the future, and that they can live with it. This is what we have been assuming, arguing that long-term per-capita wage stability is a reasonable and congruent requirement with the prospect of zero growth.

However, in this seemingly appeased configuration, things could get complicated if there were still population growth $(PA_t = PA_0 e^{nt})$. The employment rate (N/PA) would fall and the unemployment rate would trend upwards. Inded, he employment rate evolves as follows:

$$\frac{N_t}{PA_t} \equiv \frac{N_t}{PQ^*}\frac{PQ^*}{PA_t} = \frac{1}{l_t \pi_0}\frac{PQ^*}{PA_0 e^{nt}} = \frac{PQ^* e^{-nt}}{l_t \pi_0 PA_0} \qquad (26)$$

With unchanged annual working hours $(l_t = cte)$, the employment rate would fall at the same rate as growth in the working population (n). No further calculation is needed to observe that a reduction in annual working hours at the same rate as growth in the working population $(l_t = l_0 e^{-nt})$ would counteract the continuing downward trend in the employment rate. But this "sharing of work" (or employment, to be exact) would undoubtedly be incompatible with maintaining the initial distribution compromise of constant per capita wages. For this to continue to be guaranteed, each worker would have to be granted hourly wage increases that would fully compensate for the reduction in their working hours, i.e. increases in line with the growth in the active population (which would be immediately employed, thanks to "work sharing"). The share of profits in national income would inexorably fall. From the firms' point of view, this would certainly not be in the spirit of the original compromise. And it would conflict head-on with the economic constitution of a monetary economy esting on profit-driven production.

The situation would become even more unfavorable, from the employees' point of view, if there were gains in labor productivity $(\gamma > 0)$. Production and employment would be in decline! With productivity gains, in fact, the employment required for a given level of production falls, as does the mass of wages $(\widehat{w}^* N)$ and the share of wages in national income $(\widehat{w}^* N/PQ^*)$. As a corollary, the share of profits increases.

$$\widehat{w}^* N = \frac{\widehat{w}^* A}{(1 - c_\Pi d_2) l\, \pi_0 e^{\gamma t} + c_\Pi d_2 \widehat{w}^* - c_w\, \widehat{w}^*} \qquad (27)$$

With a distribution compromise providing for stable per capita wages, productivity gains go *de facto* to profits, which increases their share. As profits are less well spent than wages, the level of economic activity also falls. Employment suffers at both ends (supply and demand) from productivity gains. On the supply side, the volume of employment required for a given level of output falls; on the demand side, the effect on the wage/profit distribution lowers the propensity to consume income. The search for a new institutionalized compromise in the context of zero-growth, in which wage earners seek to preserve a constant per capita income, thus leads to a surprising result: a fall in production and employment, a fall in the wage share and an increase in the profit share. Surprising, but, all in all, understandable. As we have seen, the mass of profits is also increasing, as the base effect - the fall in production - is more than offset by the rate effect - the rise in the margin rate. As a result, the returne on capital increases!

A partial response to the decline in employment can once again come from a reduction in working hours. If annual working time is reduced at a rate that is the inverse of productivity gains $l_t = l_0 e^{-\gamma t}$), employment and therefore wages and output can remain constant:

$$W = \widehat{w}^* N = \frac{\widehat{w}^* A}{(1 - c_\Pi d) l_0 \, \pi_0 + c_\Pi d \widehat{w}^* - c_w \, \widehat{w}^*} \qquad (28)$$

The problem of distributing and preserving employment and production in a stationary state would be solved, but not that of the falling employment rate (and rising unemployment) in the event of population growth. The employment rate evolves as follows:

$$\frac{N_t}{PA_t} = \frac{A \, e^{-nt}}{PA_0[(1 - c_\Pi d_2) l_t \, \pi_0 e^{\gamma t} + c_\Pi d \widehat{w}^* - c_w \, \widehat{w}^*]} \qquad (29)$$

A sharper reduction in working hours than previously, taking into account both productivity gains and demographic growth, could certainly help maintain the employment rate at its initial level. $(N_t/PA_t = N_0/PA_0)$, as we saw in the previous case. The rate of reduction in working hours required to achieve this can be deduced, after a little calculation, from equation (29), by replacing $(N_t/PA_t \ par \ N_0/PA_0)$:

$$l_t = \frac{A \ e^{-(\gamma + n)t}}{N_0 \pi_0 (1 - c_\Pi d_2)} + \frac{w^* e^{-\gamma t} \, (cw - c_\Pi d_2)}{\pi_0 (1 - c_\Pi d_2)} \qquad (30)$$

But this would once again raise the question of wage compensation for the reduction in working hours. This problem would arise for the part of the reduction in working hours that does not serve to counter the effect of productivity gains on employment (which part makes it possible to compensate the reduction in working hours thanks to those productivity gains). For the part that serves to make room in the volume of employment for new entrants (the growth in the active population) there is no *sui generis* source of compensation.

In a zero-growth regime with positive productivity gains, where employees seek to preserve their per-capita remuneration, the conflict is unsurprisingly concentrated between firms seeking to retain productivity gains in order to increase their profits, and employees who would like to use productivity gains to preserve employment, and therefore production, by reducing working hours. Unfortunately, productivity gains cannot be used twice: once to compensate in wage terms for the reduction in working hours, and once to compensate for the reduction in working hours that would be necessary to absorb the growth in the working population.

4. Wage/profit distribution adapts to guarantee an outlet for full-employment production

Since it is employment that ultimately proves to be the stumbling block to the sustainability of a zero-growth regime, it's worth asking what such a regime would look like if it were the objective of full employment (deemed cardinal) that were placed at the heart of the distribution compromise. Since wage-earners' incomes inevitably derive from their participation in production, the goal of full employment logically seems primary, worthy of being at the forefront of maxims aimed at making the absence of growth politically and socially sustainable. This is what we are studying in this section.

The question is: how would an economy function in which employment is in some way "forced", in order to hire all the people who want to work? The working population grows in step with population growth ($PA_t = PA_0 e^{nt}$), labour productivity is assumed to be constant or increasing at a constant rate ($(PQ_t)/lN = \pi_0 e^{\gamma t}$) and full employment is assumed to be achieved ($N = PA$). This is tantamount to assuming that production is determined by supply conditions (i.e. population growth and productivity gains):

$$PQ_t = l_t \pi_0 e^{\gamma t} PA_0 e^{nt} = PQ_0 e^{(n+\gamma)t} \quad (31)$$

For such a thing to be conceivable, we need to think that aggregate demand always "mechanically" adapts to supply conditions, so that production can always be sold. If we believe that propensities to consume have no reason to be affected by changing supply conditions, the only thing that can adjust to guarantee outlets is the distribution of income.

The opportunity (effective demand) constraint is :

$$PQ = A + c_w W + c_\Pi d\Pi \quad (32)$$

We wonder what is the wage/profit distribution necessary to meet this market constraint (wathever PQ is). Assuming that profits are necessarily equal to the value of production offered (as if it had already been sold) minus wages, and replacing W by $(PQ - \Pi_{gross})$ in the previous equation, we obtain, after rearrangement : :

$$\Pi_{gross} = \frac{A - PQ\,(1 - c_w)}{c_w - c_\pi\,\mathrm{d}} \quad (33)$$

The amount of wages is easily deduced by calculating $W = PQ - \Pi_{gross}$:

$$W = \frac{PQ\,(1 - c_\pi \mathrm{d}) - \mathrm{A}}{c_w - c_\pi\,\mathrm{d}} \quad (34)$$

Since profit level is determined by zero-growth conditions (gross investment is equal to the depreciation required to keep the stock of productive capital constant), the profit-share (Π/PQ) and the wage-share (W/PQ) compatible with full employment are fully determined.

$$\frac{\Pi_{gross}}{PQ} = \frac{A}{PQ(c_w - c_\pi\,\mathrm{d})} - \frac{1 - c_w}{c_w - c_\pi\,\mathrm{d}} \quad (35)$$

In dynamic terms:

$$\frac{\Pi_{gross}^t}{PQ_t} = \frac{A}{(c_w - c_\pi\,\mathrm{d})PQ_0 e^{(n+\gamma)t}} - \frac{1 - c_w}{c_w - c_\pi\,\mathrm{d}} \quad (36)$$

The wage share comes immediately:

$$\frac{W_t}{PQ_t} = 1 - \frac{A}{(c_w - c_\pi\,\mathrm{d})PQ_0 e^{(n+\gamma)t}} + \frac{1 - c_w}{c_w - c_\pi\,\mathrm{d}} \quad (37)$$

To complete the picture, the wage per head evolves as follows:

$$\widehat{w}_t = (l_t\ \pi_0 e^{\gamma t})\left\{1 - \frac{A}{(c_w - \ c_\pi\ \mathrm{d})PQ_0 e^{(n+\gamma)t}} + \frac{1 - c_w}{c_w - \ c_\pi\ \mathrm{d}}\right\} \quad (38)$$

Just for curiosity's sake, we can also calculate the amount of net profit $\left(\Pi_{net} = \Pi_{gross} - A\right)$:

$$\Pi_{net} = \frac{(A - pQ)(1 - c_w) + \ c_\pi \mathrm{d}\ \mathrm{A}}{c_w - \ c_\pi\ \mathrm{d}} \quad (39)$$

The way in which this sort of "supply-driven, demand-validated" economy works can be summarized - and hopefully made comprehensible - as follows. If there were no population growth $(n = 0)$ nor productivity gains $(\gamma = 0)$, output would be constant, as would the stock of productive capital (the latter is constant by assumption, since accumulation is zero). In this zero-growth regime, with the imperative of full employment, income distribution is supposed to adjust so that demand always absorbs full-employment production. We might call this a sort of "guarantee of outlets" à la Kaldor (1956). To provide this guarantee, wages must be high enough to ensure that employee consumption (wages are better spent than profits) sustains a multiplier effect of autonomous expenditure (depreciation here) equal to the output that must be sold. Once this has been achieved (by what miracle, we should ask ourselves), the share of profits and wages in the product is stable. And wage per head is constant.

Starting from this stationary state, it's easy to understand that the dynamics of an economy organized in this way would quickly give rise to tensions, and even contradictions. If there were population growth, with or without gains in labor productivity, production would have to grow at a constant rate $(n + \gamma)$ to ensure full employment. The share of profits would tend to fall, while the share of wages would increase to raise aggregate demand permanently to the right level. Wages per head would also rise, even in the absence of productivity gains. Clearly, in terms of economic and financial sustainability, in an economy that remained profit-driven, this could not go on *ad aeternam*. But the second contradiction would certainly be the following: the volume of production would increase continuously (at the rate $(n + \gamma)$), while capital accumulation is assumed to come to a halt. One of two things would happen: either the factors labor and capital are complementary, and then production capacities would quickly be saturated, making it *de facto* impossible to increase production and hire additional labor; or the factors are substitutable, and then hiring additional workers (for a given stock of capital), while conceivable, would not make it possible to maintain the aforementioned productivity gains over time. This is perhaps an interesting case to explore in greater depth: that of a regime guaranteeing full employment (without any increase in productive capital), at the cost of a slowdown in productivity gains, or even a drop in productivity. We won't do so here.

The third and most obvious contradiction arises from the fact that the above scenario assumes a continuous increase in production. Yet, from the point of view of ecological and social sustainability, what we're aiming for is not just full employment, but full employment without growth. And "without growth" cannot be understood solely as "without growth in the stock of productive capital". What counts, in terms of predation and degradation of nature, is obviously the level of production. How can we reconcile the two objectives?

Zero growth with full employment can only be achieved, in the case of demographic growth and persistent productivity gains (however small the sum of the two may be), by reducing working hours to compensate for both $(l_t = l_0 e^{(\gamma+n)t})$. Production would thus be stabilized - that's the aim - and respective shares of profits and wages needed to guarantee production outlets would themselves be stabilized. The reduction in the annual working time would therefore be only partially compensated: to the extent of the productivity gains that make it necessary. But for the part made necessary by the objective of making room in the workforce for new arrivals, it could not be compensated.

The merit of this thought experiment is that it shows, more clearly than the two previously studied regimes, that demographic growth is more formidable for the political and social sustainability of an economy than the persistence of productivity gains. The latter can find a useful "outlet" in the reduction of working hours, for which they can provide compensation (they make it possible to work less while consuming as much). Demographic growth, on the other hand, requires a reduction in working hours without wage compensation, i.e. a reduction in per capita wages in proportion to the increase in the working population. The latter requires not only "job sharing", but also income sharing.

The main drawback of this thought experiment is that it assumes that the economy is capable of adapting income distribution according to the demand required to absorb full-employment production. This is a very complicated matter if production has to keep pace with productivity gains and the working population to guarantee full employment. Since autonomous spending is supposed to stop growing $(A = \delta K = cte)$, all the effort required to sustain demand must come, in this case, from increasing the wage share, to boost the Keynesian multiplier. How can this be organized? And is it conceivable that this shift could take place without radically overturning the economic order, based on the quest for profit? On the other hand, the distributional adjustment required to sell off production is easier to achieve if full employment is achieved by reducing working hours, for a stagnant population - all that's needed then is to maintain the *status quo* in the functional distribution of income. At the same time, production stagnation is also more congruent with ecological constraints, which push in this direction, than growth.

5. Financial stustainability of a zero-growth regime.

Even if this is not the main focus of this article - which concentrates on the social sustainability of a zero-growth regime - it is still worth shedding some light on the financial sustainability of such a regime, within the framework of the hypotheses we have retained here. The main problem threatening financial stability when there is no longer any net accumulation of productive capital is that society's real wealth is given once and for all. Under these conditions, if agents wish to continue enriching themselves by saving (generally households, both rentiers and wage earners), this will force other agents (companies or the State) to go into debt to the same extent. The result would be a continuous build-up of financial imbalances, leading to a deterioration in the debt-to-equity ratio of certain institutional sectors - especially companies, if the State sets itself the rule of balancing public accounts - and/or the endless issue of new shares by companies.

Here, we examine only the case studied in section 2, in the view that the substance of the remarks we can make about it would not be different for the other two cases. Remember that in this regime of zero accumulation, the compromise governing the wage relationship is based on the idea that employees and companies manage to defend the *status quo* in terms of income sharing:

$$\frac{\Pi_{gross}}{PQ} = \alpha \quad (1)$$

The financing capacity of wage-earning households (CF_{W}) is equal to their savings, since households do not invest. This gives, in effective demand equilibrium :

$$CF_W = (1 - c_w)(1 - \alpha)PQ^* \quad (40)$$

The financing capacity of rentier households (CF_π), meanwhile, is :

$$CF_\pi = (1 - c_\pi)d\alpha PQ^* \quad (41)$$

The fact that savings are generated "in the public", i.e. beyond the profits made by companies, forces them to finance part of their gross investments $(I_{gross} = A)$ on external resources. Companies' financing requirements (BF_{ent}) is :

$$BF_{ent} = \Pi_{gross} - A - DIV \quad (42)$$

Hence, after two lines of calculation (which we'll skip):

$$BF_{ent} = \alpha(1 - d)PQ^* - A \quad (43)$$

The need for external financing from the part of firms arises each period, increasing the company's liabilities, without any parallel increase in the value of its assets (the stock of productive capital is constant). This situation is unsustainable in the long term, given that the securities issued by companies to meet this financing requirement are accompanied by an income paid to their holders: either interest in the case of bonds, or dividends in the case of shares. These revenues are destined to account for an ever-increasing share of gross profits. This situation is not unthinkable... up to a point. In our model, where we have neglected debt financing and interest payments, the accumulation of corporate financing needs from period to period would lead to a continuous issuance of shares. The proportion of profits devoted to dividend payments (d) would therefore "logically" increase. This would initially have a favorable effect on the level of equilibrium economic activity (PQ^*) and profits, thanks to the reinforcement of the Widow's Jar mechanism (we can refer to equations (3) and (5) to convince ourselves of this). But this adjustment mode will have reached its limit when $d = 1$, i.e. when all gross profits are distributed to shareholders. From that point onwards, the entire financing of amortization investments will have to be financed by share issues... which sets the definitive pace for growth in the stock of shares in circulation, with no counterpart in terms of capital stock, additional profits, nor additional dividends. What could this contradiction lead to?

Unless we consider a Ponzi-type dynamic, where companies would issue even more shares to pay dividends, savers (rentiers and employees alike) will have to make do with a constant mass of dividends, for an ever-increasing volume of shares. We can assume that the price of shares on secondary markets would fall in proportion to the dilution of companies' financial capital, if the return required by shareholders, at the equilibrium of the secondary market, remains constant. This is perhaps the path that would be taken to resolve this contradiction between an economy without growth and the persistence of a desire for enrichment through savings. Finally, households could continue to save as they wish, but they would be condemned to see the market value of their savings stagnate. This quickly outlined scenario – which gives off a whiff of the second paradox of savings – could ultimately justify the fact that households, considered as a whole, no longer seek to generate net savings… this quest being a wasted effort. It would support those who pose this requirement to the principle of a zero-growth economy.

Conclusion

The intention of this paper was to study the long-term consequences of a zero-growth regime on the evolution of employment and unemployment, based on the assumptions that can be made concerning the evolution of the active population, labor productivity and working hours. These consequences were examined through three scenarios, corresponding to three different types of institutionalized compromises that can be envisaged in terms of income distribution and employment management in a world without growth, a world in which the actors would have accommodated their objectives with this perspective of a stagnation of production capacities in the long term. The first scenario corresponds to an assumption of fixed wage-profit distribution, manifesting a sort of *status quo* at the level of the bargaining power of employees and employers; the second scenario presents a behavior of employees who, faced with zero growth, demand and manage to maintain a constant wage per capita; the third corresponds to a scenario where the distribution of income adapts to be compatible with full employment (Kaldor scenario), which would be the shared objective of employees and companies (and perhaps politicians too).

The model used is relatively minimalist. It resembles the Keynesian short-term model more than the Post-Kaleckian growth model, which has become canonical for dealing with questions of growth and distribution. We assume that on average companies only invest in order to keep the stock of productive capital constant. The "investment function" therefore does not involve any reaction to the utilization rate of equipment and consequently does not induce an acceleration effect on the economy (investment becomes an autonomous expenditure again). As a result, only the multiplier remains as a driving force for the economy. We are practically sent back to the short-term equilibrium, determining the level of economic activity in each period, rather than the growth of this level of activity over time.

We have retained an equally minimalist institutional framework. There is no State, no relations with the rest of the world, and no financial sector. Companies invest only to replace worn-out or obsolete production capacities with "greener" capital goods, possibly leading to gains in labor productivity. Rentiers save part of their dividends and employees save part of their salaries. There is no autonomous consumption coming from credit or the wealth effect.

In scenario 1, the level of production is made completely stationary by a given autonomous demand (depreciation is given), a stable income share and propensities to consume wages and profits given. Therefore, if the renewal of the capital stock were to continue to generate productivity gains, unemployment could only increase (*a fortiori if* the active population continued to grow) and the gap widen between those who have a job (and continue to see their wages increase at the rate of productivity gains) and those who are unemployed. We have seen that this threat can be responded to by a continuous reduction in the annual working time, at the cost of a stagnation of the wage per capita (exchange of wage increases for free time), or even a decrease, if the active population continues to grow. In scenario 2, where employees manage to defend only the stability of their wage per capita, when productivity gains continue to exist, the latter go to increasing profits, while the need for labor is reduced. The distribution compromise seems very unfavourable to employees. Employment is decreasing and so is the share of wages. This also produces a recessive effect on the level of economic activity in equilibrium, which does not prevent profits from increasing (the rate effect dominates the base effect). However, if the bargaining power of employees is indeed that which has been assumed, they may succeed in imposing a reduction in working hours to defend employment, with wage compensation to preserve their wage per capita (this is the institutionalised compromise that prevails). In this case, productivity gains would go to wages and the wage-profit split would be constant. But if the working population continued to grow, the rate of reduction in working hours necessary to preserve employment, and the increase in the wage bill necessary in parallel to preserve the wage per capita, would cause the share of profits to continually fall. This would not be sustainable forever in a monetary production economy that would remain profit-oriented (even if it had given up accumulation). In scenario 3, where full employment is assumed as a principle, the distribution would have to adjust permanently to ensure the growth of outlets at the rate of productivity gains *plus* the rate of the working population. This would be a growing economy (in production and outlets) without capital accumulation. Which would quickly become unthinkable. Again, the ecological and social sustainability of the system could only be ensured by reducing working hours, at the rate of productivity gains and growth of the working population. Wages per head could be preserved to a certain extent (corresponding to the part of the reduction in working hours made necessary by productivity gains and offset by them), but not entirely. If wage compensation were to also concern the reduction in working time intended to absorb the growth of the working population, this would cause the share of profits to continually fall.

Despite the minimalist framework adopted here, it may have seemed that the theoretical treatment of the question required a thick level of mathematical formulation, leading to conclusions whose scope is difficult to grasp synthetically. As for the mathematical developments, if they take an important place, they remain at the service of a simple vision of economic processes: the equilibrium level of production is ultimately determined by effective demand, which depends solely on the relationship between autonomous expenditure and the different propensities to consume income, depending themselves on the rules of distribution. As for the conclusions, if we ignore the variations linked to the different institutional compromises studied, they can be summed up in a few things - which could perhaps be anticipated from the start: in an economy without growth, maintaining full employment proves to be a very difficult objective to achieve, because it is likely to put any social-political compromise on distribution under pressure. If productivity gains continue (even at a moderate pace), a reduction in working hours is essential. It is even more necessary if it is a question of absorbing the growth of the working population. But these two problems, which we may have to face simultaneously, are not equally formidable (from an economic point of view). Productivity gains, while being responsible for the reduction in the volume of working hours demanded, open up a solution: the reduction in the same proportions of working hours, compensated at the salary level thanks to these same productivity gains. This does not, in theory, exacerbate the conflict of distribution. It is quite different with regard to new arrivals. To make a place for them in employment, in zero growth, others must give up a share of their income. The problem could only ease on this side, at least in rich countries, if it were verified that the evolution of the active population depends partly on the long-term macroeconomic perspectives, and would accompany more or less well (downwards) the slowdown in growth.

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Annexe 1.

In section 2, where employees and companies manage to defend the *status quo* in terms of income distribution, if we had assumed that it is net profit, rather than gross profit, which is distributed in the form of dividends $(DIV = d_2(\Pi_{gross} - A))$, gross profit would remain positive but net profit would become negative. Equations (4) and (5) would indeed transform in (4') and (5'):

$$\Pi_{gross} = \frac{\alpha A(1 - d_2 c_\pi)}{1 - \alpha d_2 c_\pi - (1-\alpha) c_w} \quad (4')$$

Since both the numerator and denominator are positive, the ratio is positive.

$$\Pi_{net} = \frac{A(1-\alpha)(c_w - 1)}{1 - \alpha d_2 c_\pi - (1-\alpha) c_w} \quad (5')$$

As in the general case $(c_w - 1) < 0$, the numerator is négative, while the denominateur is positive. The ratio is thus negative, unless $(c_w = 1)$, in which case net profit is zero.

Annexe 2.

In section 3, where employees defend a constant level of wages per head, if we had assumed that it is net profit, rather than gross profit, which is distributed in the form of dividends $(DIV = d_2(\Pi_{gross} - A))$, gross profit would remain positive but net profit would become negative. Equations (22) and (23) would indeed transform in (22') and (23'):

$$\Pi_{gross} = \frac{A(1 - d_2 c_\pi)(1 - \frac{\widehat{w}^*}{l\,\pi_0} e^{-\gamma t})}{1 - d_2 c_\pi \left(1 - \frac{\widehat{w}^*}{l\,\pi_0} e^{-\gamma t}\right) - c_w \left(1 - \frac{\widehat{w}^*}{l\,\pi_0} e^{-\gamma t}\right)} \quad (22')$$

Since both the numerator and denominator are positive, the ratio is positive.

$$\Pi_{net} = \frac{A(c_w - 1)\,(\frac{\widehat{w}^*}{l\,\pi_0} e^{-\gamma t})}{1 - d_2 c_\pi \left(1 - \frac{\widehat{w}^*}{l\,\pi_0} e^{-\gamma t}\right) - c_w \left(1 - \frac{\widehat{w}^*}{l\,\pi_0} e^{-\gamma t}\right)} \quad (23')$$

As in the general case $(c_w - 1) < 0$, the numerator is négative, while the denominateur is positive. The ratio is thus negative, unless $(c_w = 1)$, in which case net profit is zero.

Annexe 3.

We can verify that the derivative of profits in relation to the profit share is positive, when employees defend a constant level of wages per head (as it is the case in section 3). This is because the recessionary effect of an increase in the profit share on national income (which reduces profits through the base effect) is more than offset by the increase in the profit share (the rate effect).

Starting from equation (22) and replacing $(1 - \frac{\widehat{w}^*}{l\,\pi_0} e^{-\gamma t})$ by π, we have :

$$\Pi = \frac{A\pi}{1 - c_{\Pi} d\pi - c_w(1-\pi)}$$

Hence, the first derivative of Π in relation to π is :

$$\Pi' = \frac{A[1 - c_{\Pi} d\pi - c_w(1-\pi)] + A\pi(c_{\Pi} d - c_w)}{[1 - c_{\Pi} d\pi - c_w(1-\pi)]^2}$$

After simpilification it comes :

$$\Pi' = \frac{A(1 - c_w)}{[1 - c_{\Pi} d\pi - c_w(1-\pi)]^2}$$

Since both the numerator and denominator are positive, the derivative of profits in relation to the profit share is always positive.