Growth and distribution: a revised classical model

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Abstract. This paper discusses distribution and the historical phases of capitalism. It assumes that technical progress and growth are taking place, and, given that, its question is on the functional distribution of income between labor and capital, having as reference classical theory of distribution and Marx's falling tendency of the rate of profit. Based on the historical experience, it, first, inverts the model, making the rate of profit as the constant variable in the long run and the wage rate, as the residuum; second, it distinguishes three types of technical progress (capital-saving, neutral and capital-using) and applies it to the history of capitalism, having the UK and France as reference. Given these three types of technical progress, it distinguishes four phases of capitalist growth, where only the second is consistent with Marx prediction. The last phase, after World War II, should be, in principle, capital-saving, consistent with growth of wages above productivity. Instead, since the 1970s wages were kept stagnant in rich countries because of, first, the fact that the Information and Communication Technology Revolution proved to be highly capital using, opening room for a new wage of substitution of capital for labor; second, the new competition coming from developing countries; third, the emergence of the technobureaucratic or professional class; and, fourth, the new power of the neoliberal class coalition associating rentier capitalists and financiers.

Key words: growth, distribution, profit rate, wage rate, technical progress

JEL Classification: D3, O1, O3, 04, P1

Capitalist economic growth and the functional distribution of income were discussed by the classical economists, including Marx, but, whereas their explanation of growth as depending on investment and technical progress proved a durable theory, most economists abandoned it, because it is based in an assumption that proved not realistic – that the wage rate is essentially constant correspondingly to the historical cost of the reproduction of labor. This paper aims to restore the classical theory of distribution, but with a major change: it inverts the model theory, postulating that the rate of profit is constant in the long-term, and the wage rate, the residuum. Secondly, by introducing...
three types of technical progress and showing how it changed historically, it proposes that capitalist development has occurred in five historical phases (Industrial Revolution, Marx's Phase, Classical Capitalism, Fordism, and the Neoliberal Years), which can be reasonably explained by the model.

Although highly instable, marked by recurrent financial crises, technical progress and growth have been sustained since the capitalist and industrial revolution, whereas income distribution has not been so instable. On the contrary, it has been characterized by a relative stability, which, as I will argue in this paper, derives from the fact that the profit rate must remain satisfactory to business enterprises in the long-term, and that wages and particularly salaries don't need to just cover the social cost of reproduction of labor; they may increase above it, along with the increase of productivity or even more, depending on the dominant type of technical progress.

The model that I will present here is not oriented to the causes of economic growth, but, considering that growth is taking place, it returns to the classical concern with distribution. In the same way of the classical economists, I focus my analysis in the profit rate, not in the interest rate, but, differently of their more illustrious representatives (Smith, Ricardo and Marx), I do not believe that the rate of profit falls in the long-term. The classical economists related smartly growth and distribution, but privileging just one type of technical progress, although there are two others. Once the industrial and capitalist revolution takes place, and economic development gets started, the increase in labor productivity becomes ingrained in the economic process, and it is possible to analyze the main interrelated characteristics of the growth process. Specifically it is possible to connect historically the types of technological progress with the wage rate and the profit rate, and, so, with functional distribution of income. On the other hand, since economic development is essentially a historical process, it is possible to distinguish phases in this process, and define the stylized facts that characterize it.

I present in this paper a historical model – it is the outcome of the generalization of the regularities and tendencies observed in economic history. It has as reference the UK and France, which presented in a relatively ordered way the several phases of capitalist development. The model that I will present is classical because it deals with the classical concepts of labor and capital, and uses the classical approach to distribution of income, assuming one form of income as given or determinant and the other as residual. It is not a Keynesian model, not because I have critiques to it, but because I am not interested in discussing the causes of economic growth, which, for sure, depends on the investment rate, which depends on effective demand. I don't need to discuss demand because I am discussing distribution, not growth. This is a long-term model, where the effective demand may be assumed as neutral, although this is not always true. It is definitely not a neoclassical model for many reasons that can be summarized in one: because I reject the hypothetic-deductive method that neoclassical economists use – a method that is adequate for methodological sciences, not for substantive science like economics. The fact that the specifically neoclassical models (consistent with the general equilibrium) adopt an inadequate method (good for methodological sciences like mathematics and decision theory) explains why these models are just castles in the air.
This paper is divided in six short sections. In the first, I discuss why is more realistic to assume that the profit rate is constant in the long-term. In the second, I distinguish the three types of technical progress. In the third, I make the critique of the Okishio Theorem, which asserted to be irrational to choose a technique that will have as consequence the fall of the rate of profit. In the fourth, I make a brief discussion of the theoretical model that I am using, which is based in Marx's falling tendency of the rate of profit. In the fifth section, I present a periodization of capitalist development having the variables of the model, particularly the functional distribution of income, as criterion. And, in the sixth section, I make a short reference to the relation of the distribution model with the growth rate. I originally developed this model in a book published only in Portuguese. This paper summarizes the ideas in this book, except the ones relative to the last two phases of capitalist development – the one beginning between the 1930s, and the other, in 1979. In this last phase, my belief that technical progress was becoming capital-saving didn't prove true, and other factors (besides the types of technical progress) intervened in the functional distribution of income.

**Profit rate as a constant**

The model here presented assumes a closed economy, generalized competition, no state, one commodity, total and marginal output-capital ratio equal, and just two agents: capitalists, receiving profits, R, and workers, receiving wages, W. Income, Y, is the sum of wages and profits. Capitalists could be differentiated into entrepreneurs making profit and *rentiers* receiving interests. This distinction is necessary to the model only in the last phase. In the same vein, although I use the state in the argument, it may be ignored in the simpler version of the model. Expenditure is equal to income, and to the sum of consumption, C, and investment, I. The functional distribution of income or plus value rate is $R/W = m$, and the profit rate is $R/K = r$, where $R$ are total profits, and $K$ is the stock of capital.

Economic growth is defined by the increase of productivity and of income per capita. Since I am not looking for the causes of economic growth, I will simply assume that the economy is growing, i.e., that the productivity rate and income per capita are increasing. Given the assumption that the labor force, $L$, is increasing at the same rate as population, $N$, the productivity rate, $Y/L = y$, and the increase of income per capita, $Y/N = n$ are equal. The variation of $y$ through time is $dy/dt = \dot{y}$, (and the rate of growth of income per capita, $y$, is $\dot{y}/y = \ddot{y}$). The wage rate is $W/L = w$; the variation of total wages is $dW/dt = \dot{W}$; the rate of growth of total wages, $\dot{W}/W = \dot{\dot{W}}$; the wage rate, $W/L = w$; the variation of the wage rate, $dw/dt = \dot{w}$.

The model does not describe any specific capitalist economy, but has as reference the first developed national states, particularly Britain and France. In the model, as in Kaldor (1956) and in Sraffa (1960), the long-term profit rate is assumed to be constant, except in one specific historical phase – the Marx’s Competitive Phase (1815/25 – 1875/95) –, in which it falls from a high level, which prevailed during the Industrial Revolution, to a satisfactory level since then, except in the crises, when it falls below this level. The
classical model of Smith, Ricardo and Marx assumed the wage rate constant, corresponding to the cost of reproducing of the labor force. This cost could change historically since it is a social cost, but this assumption is inconsistent with the extent that the real wage rate increased in the more developed countries since mid nineteenth century. On the other hand, the classical economists, using different arguments but all involving a fall in productivity, predicted that the profit rate would decline in the long run. This prediction also proved to be false. Since mid nineteenth century, the profit rate remained basically constant, at a “reasonable”, “satisfactory”, or “satisficing” level, i.e., the level that business enterprises require to borrow and invest. It varies strongly according to economic cycles, and responds to exogenous shocks, but in the long run it remains constant.

Why does it make sense to assume a constant rate of profit? Essentially because, on one hand, a satisfactory profit rate is a condition for the existence or survival of the capitalist economic system; thus, since it is not available a better economic alternative to capitalism, the profit rate will have to remain at a satisfactory level. For some time it was thought that a command or statist economy could be the alternative, but even whilst this belief was alive it was a distant belief. Given this lack of alternative, capitalist societies will have to preserve the profit rate. The capitalist system can only survive if a reasonable profit rate is assured to active capitalists or entrepreneurs – a rate reasonably above the interest rate received by rentier capitalists. On the other hand, although capitalist economies and societies are characterized by instability and conflict, they are, in the realm of each national state, a cooperative undertaking. The existence of nation-states presupposes a broad political agreement. Capitalists fight for profits, but they know that a reasonable wage rate is essential for political stability and a sustained aggregate demand. Correspondingly, workers are permanently asking for higher wages, but they know that their wages cannot reduce the profit rate below a given level without endangering the capital accumulation, the growth process, and employment.

Since classical economists believed that the productivity of labor would decline in the long run, their bottom line was the wage rate. Yet, in so far as this prediction failed, the alternative bottom line is the profit rate. While the constant wage rate proved a false prediction, and a third alternative – an increasing profit rate in the long run – makes no sense in a competitive economy, wages increasing in real terms in the long run and workers participating from the economic surplus do make sense. When an economy, in its cyclical process of growth, experiments high and sustained rates of growth, the wage rate will tend to increase. Theoretically the wage rate may increase up to the moment in which the economy achieves an hypothetical stage of abundance, i.e., up to the point that people have the full freedom to chose between income and leisure, and overwhelmingly decide for the later. In practical or historical terms, the average wage rate will increase till the bottom line represented by a satisfactory profit rate. From this point on, a profit squeeze process will materialize, and the economy will be experiencing fall in the investment rate and crisis, which will only be overcome if the profit rate is restored. Since economic agents and politicians need that the economy works, they either take the required policies or institutional reforms to reduce the wage rate, or, if there is room for that, they search to increase aggregate demand without increasing wages, or they wait
that the market system processes the crisis, reduce wages, and reestablishes the profit rate. The second – the Keynesian alternative – is obviously superior, but it will only be viable if there is a clear insufficiency of demand and unemployment, and if the expansive macroeconomic policy will be reverted as soon as it is possible.

When Marx developed the theory of the falling tendency of the rate of profit, he considered the possibility of countertendencies. In the model that I am presenting, the long-term constancy of the rate of profit, assured either by policy, or by technical progress not capital-using, is this countertendency in practice. Even if there were an economic alternative to capitalism, this capitalist would defend fiercely the working of this countertendency. Since there is not such alternative, capitalist eventually obtain the cooperation of the other social classes in the institutional process of protecting the rate of profit and the process of capital accumulation. Besides the market mechanisms that, to a certain extent, assure the way out of the cyclical crisis, governments are supposed to provide the institutional reforms and policies that will assure this outcome, and, in doing so, it will keep the long run rate of profit at a satisfactory level, consistent with investment and growth.

**Types of technical progress**

Technical progress is defined by the increase of the productivity of labor. There is technical progress when productivity is increasing, or, in other words, when workers are being able to increase their average value added. Thus, technical progress involves not only the introduction of new methods of production and new products, but also the transference of labor from activities with lower to higher valued added per capita. Yet, the process of increase labor productivity will be accompanied by changes in the productivity of capital, or the output-capital ratio, Y/K (which Marx called technical composition of capital). Given the fact that, concomitantly with the increase of labor productivity, the capital productivity may decrease, remain constant, or increase, we have three types of technical progress, which are defined by the behavior of the productivity of capital. If the productivity of capital is decreasing (Y2/K2 < Y1/K1, where i indicates time), technical progress will be capital-using – we will have “mechanization”. If the output-capital ratio is constant, technical progress will be neutral. And if the productivity of capital is increasing, technical progress will be capital-saving.

In the case of capital-using technical progress – when the productivity of capital is decreasing – output or GDP will be increasing at a smaller rate than the stock of capital:

\[
\frac{\hat{Y}}{Y} < \frac{\hat{K}}{K} \quad \text{ou} \quad \hat{Y} < \hat{K}.
\]

In the case of neutral technical progress, where Y2/K2 = Y1/K1, income will be increasing at the same rate as capital:

\[
\frac{\hat{Y}}{Y} = \frac{\hat{K}}{K} \quad \text{ou} \quad \hat{Y} = \hat{K}.
\]
In the case of capital-saving technical progress – when the productivity of capital is increasing – the total output rate will be higher than capital, and we have increasing returns:

\[
\frac{\dot{Y}}{Y} > \frac{\dot{K}}{K} \quad \text{or} \quad \dot{Y} > \dot{K}
\]

Capital using technology, which involves the fall of the output-capital ratio, is typical of the early stages of industrialization and capital formation, when mechanization or the successive substitution of different machines for different forms of labor takes place. On the other side, capital saving technical progress, which also may be called modernization, derives from the substitution of new machines for old ones of the same type (i.e., which replace the same kind of labor, or performs the same kind of operation that a previous one performed). It is only the type or model of the machine that changes, since it replaces the same type of labor. The new model, however, is cheaper, or more efficient. In this second case, technical progress, besides saving labor, saves capital itself by increasing the output-capital ratio. While in the case of mechanization the only alternative to business enterprise was to invest in increasingly less efficient machines, in this case, it again will not have other alternative but to invest in increasingly more productive or less expensive machines – machines that are able to turn out a larger output (with the same quality) per unit of capital. New machines, in this case, are new in relation to other models of machines performing the same operation, while in the previous case are new machines performing new operations and thus replacing new types of labor. New machines appear in the market when they bring some innovation and lower costs, but there is a major difference between new machines performing operations which were previously manual, and new machines replacing old machines. In one case we have capital-saving technical progress, in the other, capital-using technical progress.

**Overcoming the Okishio Theorem**

How can we have, out of rational investment decisions, a situation in which technical progress involves a decreasing output-capital ratio? Or, in other words, which is the microfoundation for the choice of a capital-using technique? Nobuo Okishio (1961, 1967) argued that this behavior would be irrational. Actually, it is not. Whenever the costs involved in buying and operating a new machine (and the respective production process) is smaller than the use of man power, it will be rational for the capitalist to invest in this machine. As the business enterprise substitutes capital for labor, the production costs will be reduced, the productivity of labor will increase, and the capitalist who first introduced the new machine will make an extra profit. Yet, the machines available have different productivities, and replace different types of labor. If we suppose that the business enterprises face a decreasing investment opportunities curve, having, in the vertical, the cost reduction achieved, and in the horizontal axes, the respective machines and correspondent production processes available, the business enterprises will, first, invest in a more efficient machine, that replaces one type of labor; second, they will buy
the second best machine, which replaces a different type of labor; and so on, up to the point where breakeven is achieved. Despite the fact that, in this decision process, the production costs decreases for the business enterprises as different kinds of labor are successively replaced by different kinds of machines with decreasing productivity, each new machine replacing different kinds of labor will reduce the overall output-capital ratio, or the productivity of capital will decrease.

Take, for instance, the choice of techniques in an economy that has only agricultural production, and that replaced all possible labor for a highly efficient machine, the tractor. Then, another new machine reduces costs to the entrepreneur – a harvesting machine. All farmers will have to buy it, but as they hold a lower output-capital ratio, after the substitution is completed the total output-capital ratio of the economy will fall, despite the fact that their costs were reduced.

There is also the possibility of a new machine that replaces a different type of labor that had not yet been mechanized, and more efficient that the ones previously bought to replace other forms of labor. In this case, in which our cost-machines curve does not hold, mechanization will not cause the fall of the productivity of capital. Yet, this situation will be rather the exception than the rule. The tendency is that innovations (the actual adoption of the invention) take place in sequence in such a way that the first innovations involve high output-capital ratios and the following, increasingly smaller ones. In this case, technical progress will be necessarily capital-using, the output-capital ratio will be declining.

When the output-capital ratio is decreasing, we will see that the profit rate will be decreasing. With this argument, we can understand something that appeared irrational: firms adopting capital-using techniques that, eventually, will reduce instead of increase its profit rate. The Okishio Theorem challenged the possibility of a falling tendency for the rate of profit. Yet, as I argued, the business enterprise acts rationally and remains competitive when adopts the new technique or machine that is capital-using but efficient. This is a defensive strategy to keep the firm competitive, given the fact that the other firms will also adopt the capital-using but cost reducing technique. Once all business enterprises replace manpower for a relatively (to the previous ones) less efficient machine (but more efficient than direct labor), the resulting output-capital ratio for the whole industry will fall and the average rate of profit will be smaller. This is a non-predicted consequence, out of the control of each individual firm; it is a perverse but rational effect of mechanization or the adoption of capital using technical progress.

In the case of neutral technical progress, there is not a specific form of substitution of capital for labor, or the need of reasoning in terms of microfoundations. This sort of technical progress just exists in so far as the two previous processes – mechanization and modernization – compensate one another. At every moment we will have new types of labor being replaced by new types of machines, and old machines being replaced by new models of the same machines (“same” just in so far it replaces the same type of labor). In the first case, technical progress will be capital-using, in the second, capital-saving. If the negative effect of the first is compensated by the positive of the second,
technical progress will be neutral. Most growth models concerned with equilibrium (or lack of it) and with the determinants of the rate of growth, as the case of the Harrod-Domar and the Solow models, assume neutral technical progress. In the relatively short or medium-term periods in which such models are usually used, such assumption is reasonable and simplifies the model. In the present model, however, principally concerned with distribution in the long-term, across several historical stages or phases of economic development, to abandon such assumption is essential.

The abstract relationships

Given these three forms of technical progress, or the variation of the output-capital ratio, we have different behaviors of the other central economic variables: the profit rate, the wage rate, and the functional distribution of income. These variables are related among themselves following a simple identity:

\[ R/K = R/Y / K/Y \]

Let us suppose, first, that the functional distribution of income between profits and wages is constant: \( R/Y \rightarrow \). In this case, and just having in mind that an increasing capital-output ratio means a decreasing output-capital ratio, it is easy to see, from identity (1), that, if technical progress is capital-using (declining output-capital ratio, \( Y/K \downarrow \)), the profit rate will be declining, \( R/K \downarrow \); if technical progress is neutral (constant output-capital ratio, \( Y/K \rightarrow \)), the profit rate will be constant, \( R/K \rightarrow \); and if technical progress is capital-saving (increasing output-capital ratio, \( Y/K \uparrow \)), the profit rate will be increasing, \( R/K \uparrow \).

Thus, we cannot speak of a general tendency of the rate of profit to fall, increase, or remain constant just out of (1). Depending on the type of prevailing technical progress, and given a constant functional distribution of income, the rate of profit will correspondingly fall, remain constant, or increase. If, instead, we assume that the constant variable in the long run is the profit rate, as I already argued, and that economic growth is taking place, which will be functional distribution of income and the wage rate for each type of technical progress?

To answer this question, I start by taking the time derivative of equation (1), setting it to zero, and substituting \( R+W \) for \( Y \).

\[ \frac{d}{dt} \left( \frac{R}{K} \right) = \frac{d}{dt} \left[ \frac{R}{(R+W)} \right] = 0 \]

Computing the derivatives and doing some algebraic manipulations we have the following equation:
\[
(2) \frac{\dot{R}}{R} = \frac{\dot{W}}{W} = -\left(\frac{\dot{Y}}{Y} - \frac{\dot{K}}{K}\right) \frac{Y}{W}
\]

The left hand side of the equation (2) has the same sign as the rate of change of the functional distribution of income \( R/W \) and the right hand side has the opposite sign to the rate of change of \( Y/K \), since:

\[
\frac{d}{dt} \left( \frac{Y}{K} \right) = \frac{Y}{K} \left( \frac{\dot{Y}}{Y} - \frac{\dot{K}}{K} \right) \quad \text{and} \quad \frac{d}{dt} \left( \frac{R}{W} \right) = \frac{R}{W} \left( \frac{\dot{R}}{R} - \frac{\dot{W}}{W} \right)
\]

Therefore, equation (2) tells us that if technical progress is capital-using, or \( Y/K \downarrow \), the functional distribution of income will concentrate, so that \( R/W \uparrow \). If technical progress is neutral, the functional distribution of income will remain unchanged, and if technical progress is capital-saving, or \( Y/K \uparrow \), it must be that \( R/W \downarrow \).

Now, to understand what happens to the wage rate, let us assume that the population is constant. In a more complete version of the model, population is increasing at a constant rate. Yet, to simplify the equations and show more clearly the relations between the variables, we assume that population is constant, and then the wage rate, \( W/L \), will depend only on the change of \( W \). We now re-write equation (2) to analyze how \( W \) varies:

\[
\frac{\dot{W}}{W} = \frac{\dot{R}}{R} + \left( \frac{\dot{Y}}{Y} - \frac{\dot{K}}{K} \right) \frac{Y}{W} \geq 0
\]

Because the profit rate is assumed to be constant, we can substitute the rate of growth of capital for the rate of growth of profits in the above equation, which after some algebraic manipulations yields:

\[
(3) \frac{W \dot{W}}{Y W} = \frac{\dot{Y}}{Y} - \frac{R \dot{K}}{Y K} \geq 0
\]

From equation (3) we deduce that, if technical progress is neutral or capital-saving, total wages increase because \( 0 < \frac{R}{Y} < 1 \) for positive wages and profits, which makes the right hand side of equation (3) positive when the rate of growth of output is equal to or higher than the rate of growth of capital. Given the assumption of a constant population, when technical progress is neutral or capital-saving, the wage rate will also increase.
On the other hand, when technical progress is capital-using, equation (3) gives us an ambiguous result. If capital grows at a higher rate than output, the right hand side of equation (3) will be either positive or negative, depending on the magnitude of R/Y. Table 1 summarizes these results. In the case of capital-using technical progress or mechanization, which involves a concentrated functional distribution, the wage rate may be decreasing, depending on the rate of growth of income per capita, which influences R/Y. In the summary analysis of the historical stages of capitalist growth, the fall in the output-capital ratio only takes place in the two first stages. In the first stage, the Industrial Revolution, in which mechanization is assumed, this ambiguity is present. In order to keep the rate of profit constant, the wage rate probably fell. In the second phase, if the profit rate that falls, because the wage rate reached the subsistence level and cannot fall more. In this phase the ambiguity disappears despite mechanization, because I dropped the assumption that the rate of profit was constant and assumed that it was falling, because it was exceptionally high during the Industrial Revolution. This allows the wage rate to remain approximately constant and inequality to increase, as probably happened in this period.

1. Table 1: Consequences of technical progress over the wage rate and distribution, given a constant profit rate.

<table>
<thead>
<tr>
<th></th>
<th>If technical progress is</th>
<th>...the wage rate will be</th>
<th>&amp; distribution will be:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital-using</td>
<td>Y/K↓</td>
<td>W/L?</td>
<td>R/W↑</td>
</tr>
<tr>
<td>Neutral</td>
<td>Y/K→</td>
<td>W/L↑</td>
<td>R/W→</td>
</tr>
<tr>
<td>Capital-saving</td>
<td>Y/K↑</td>
<td>W/L↑</td>
<td>R/W↓</td>
</tr>
</tbody>
</table>

**Historical phases**

In the previous section I presented a model relating the main economic variables that describe capitalist economic growth and distribution. Yet, economic development is a historical process that emerges with capitalism – a process that is not linear but subject to major changes that tend to concentrate in given moments, shaping “revolutions” such as the industrial revolution, the second industrial revolution, etc., and given rise to new phases, or stages or patterns of economic growth. As we simplify economic relations, we can do the same with economic history, and think in terms of historical phases or stages of capitalist growth. I know that historical growth processes are extremely complex and vary from country to country. Yet, in an effort to generalize, and having as basis the first industrial countries – England, France and United States – I distinguish in Table 2 only four stages and one crisis or transition. There were other crises or transitions, but I only distinguish one, recent, because my attention is more focused in the later phases.
2. Table 2: Phases of Capitalism since the Industrial Revolution

<table>
<thead>
<tr>
<th>Phases</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Revolution</td>
<td>1750 – 1815</td>
</tr>
<tr>
<td>Marx's Phase</td>
<td>1815 – 1870</td>
</tr>
<tr>
<td>Classical Phase</td>
<td>1870 – 1929</td>
</tr>
<tr>
<td>Fordism</td>
<td>1930 – 1965</td>
</tr>
<tr>
<td>Crisis (transition)</td>
<td>1966 – 1978</td>
</tr>
<tr>
<td>Neoliberal Years</td>
<td>1979 – 2008</td>
</tr>
</tbody>
</table>

**Industrial Revolution.** The Industrial Revolution is the moment when the capitalist revolution, which began with the Commercial Revolution, and was followed by the formation of the nation-state, came to a close in England. In Rostow’s terms (1960), it is when the *takeoff* takes place. The Commercial Revolution and the primitive accumulation (the initial accumulation of capital through the use of some form of violence) happened in the framework of mercantilist capitalism – the first historical form of developmental state and of developmental capitalism - and created the conditions for the subsequent generalization of wage labor and the competitive appropriation of surplus through profits (Marx, 1867: I, 24). The Industrial Revolution, which also takes place in the context of mercantilism, was a concentrated process of industrialization involving positive externalities or spillovers, and, consequently, high profit rates. After it, capitalist development becomes self-sustained in so far as the reinvestment of profits becomes a condition of survival of the business enterprises to keep pace of technological progress.

In this search for stylized facts, the Industrial Revolution, which I broadly located for Britain between 1750 and 1815, was characterized by a high and constant profit rate, while technical progress was dominantly capital-using, or, in other words, the output-capital ratio or the productivity of capital was falling. This is consistent with a declining wage rate, and with the increase of inequality. The wage rate may be declining because it is assumed that workers, immediately before the Industrial Revolution, had a higher standard of living; the first moment of industrialization represented for them proletarization or pauperization. Yet, if income per capita was rising fast, despite the increase of inequality, the wage rate was constant or even increasing. Thus, in this phase, we have:

<table>
<thead>
<tr>
<th>Industrial Revolution (1750-1815)</th>
<th>Productivity of capital</th>
<th>Profit rate</th>
<th>Wages</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y/K↓</td>
<td>R/K→</td>
<td>W/L?</td>
<td>R/W↑</td>
<td></td>
</tr>
</tbody>
</table>

**Marx’s Phase.** The following phase is the Marx’s Phase that could also be name the Competitive Phase. In this period economic liberalism or competitive capitalism is
dominant. The transition from pre-capitalism was completed. The economy is characterized by a large number of small and medium sized family enterprises. It is essentially competitive, since the gigantic business enterprises are not yet present. The economic system corresponds to the one predicted and described by the classical liberal economists and particularly by Marx, because it is the period when the profit rate falls. Technical progress remains capital-using since mechanization continues intense overcoming the modernization process. Thus, we have decreasing returns. Yet, the wage rate does not fall but remains constant since it was at the subsistence level. The profit rate may decrease without harming investment because we assume that it was very high during the Industrial Revolution. This decrease leaves ambiguous the functional distribution of income, which probably continues to concentrate, but much less than in the previous phase, and may even have remained constant, depending on the rate of growth of the income per capita.

<table>
<thead>
<tr>
<th>Marx's Phase (1816-1870)</th>
<th>Productivity of capital</th>
<th>Profit rate</th>
<th>Wages</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

**Classical Phase.** By the second part of the nineteenth century, around 1870, we have major changes which bring the Classical Phase, the stage when the capitalist growth gets fully consolidated: mass production techniques are introduced, the explosion motor replaces the steam motor, and electrical power is dominated and diffused (the Second Industrial Revolution). As a consequence, the economic system turns relatively less competitive, in so far as large business enterprises start dominating the scene, and workers get organized in unions. Both changes were interdependent: the higher level of workers’ organization was only possible in view of the relative oligopolization of markets. From this, follows a major consequence: workers became capable of retaining the productivity gains. Economic theory based on competition assumed that productivity increases would just lead to lower costs which would benefit all, including foreign consumers. The new workers’ organization capacity turned possible that, in the late 1940s, the Prebisch’s and Singer’s these on the uneven distribution of the productivity gains between developed and developing countries was formulated: while industrial countries which had organized labor were able to conserve productivity gains, disorganized workers producing primary products in developing countries were not, from that deriving the deterioration of the terms of exchange.

For our model, only the first aspect of the problem is important. With the Second Industrial Revolution, these characteristics are just enhanced. Markets are increasingly oligopolistic, but business enterprises remain competitive enough to keep centrally concerned with the incorporation of technical progress. In so far as mechanization and capital-savings technology compensate one another, the output-capital ratio is basically constant (as growth models usually assume), technical progress is neutral. From this moment on, workers would be able to augment their wages according to the productivity rate without threatening the profit rate. Capitalism achieves its classical
The great agreement between capitalists and workers, which would assure a relative social peace in developed industrial countries, begins. Technical progress is neutral, the profit rate is constant, and the functional distribution of income, constant; as a consequence, the wage rate increases with productivity.

<table>
<thead>
<tr>
<th>Classical Phase (1871-1929)</th>
<th>Productivity of capital</th>
<th>Profit rate</th>
<th>Wages</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y/K→</td>
<td>R/K→</td>
<td>W/L↑</td>
<td>R/W↑</td>
<td></td>
</tr>
</tbody>
</table>

**Fordism.** Since the 1929 financial crash and Franklin Delano Roosevelt’s bold reforms rejecting economic liberalism and bringing back capitalism to its developmental origins, we have the New Deal; after World War II – between 1945 and 1965, the Golden Years of Capitalism (Glyn et al., 1988; Marglin, 1990). Following the French Regulation School, we may call this whole phase, Fordism. In this phase we have an increase in the output-capital ratio or the productivity of capital, which explains the increasing wages, a satisfactory rate of profit, and moderate reduction of inequality. The period closes, after World War II, with the Western European catching up, and building the Welfare State.

During Fordism, the assumed constancy of the profit rate was consistent with wages rising faster than the productivity of labor. In fact, in the Fordist period the advanced economies experienced high rates of growth and financial stability, while inequality clearly diminished, not only due to the increase of the productivity of capital and to the augmented power of organized labor, but also due to indirect wages represented by the large social services of the Welfare State. Yet, since 1965 the good times for labor ended, and capitalism in the rich countries will be oriented to the reduction of wages.

This phase as well as the next one, the Neoliberal Years, should be, in principle, capital-saving, consistent with growth of wages above productivity. But since the 1970s, wages were pressed down and stagnant principally in the United States, where neoliberalism was more aggressive, because of first, the fact that the Information and Communication Technology Revolution proved to be highly capital using, opening room for a new wage of substitution of capital for labor, second, the new competition coming from developing countries, third, the emergence of the technobureaucratic or professional class, and, fourth, the new power of the neoliberal class coalition associating rentier capitalists and financiers.

<table>
<thead>
<tr>
<th>Fordism (1930-1965)</th>
<th>Productivity of capital</th>
<th>Profit rate</th>
<th>Wages</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y/K↑,→</td>
<td>R/K↑,→</td>
<td>W/L↑</td>
<td>R/W→</td>
<td></td>
</tr>
</tbody>
</table>

**Crisis.** In the crisis and transition years from Fordism to the Neoliberal Years (1966-78) the productivity of capital fell, wages continued to increase, and the profit rate fell sharply. According to Duménil and Lévy (1993: 299), the output-capital ratio starts...
falling in 1966; Thomas Piketty (2013: 309) concurs: the ratio output-capital or the productivity of private capital of rich countries falls sharply in the 1970s: “whereas private capital represents between 2 and 3.5 years of national income in the rich countries in 1970, it represents between 5.1 and 5.2 in 2010”. In consequence, the profit rate falls (Duménil et Lévy 1996: 214). It falls also because wages increase more than productivity, due to the power of the unions and the relative scarcity of labor (Boddy and Crotty 1975; Goldenstein 1999). Actually, when I was originally developing this model, in the late 1970s, I expected that after World War II technical progress had become modestly capital-saving; instead of primarily substituting machines for labor, business firms would then be mainly (but not exclusively) substituting less costly or more efficient machines or cheaper machines. Yet, this was not the dominant form of technical progress. The new information and communication technologies involved a new wave of substitution of capital for labor, which is initially capital-using, reducing the productivity of capital.

<table>
<thead>
<tr>
<th>Crisis (transition)</th>
<th>Productivity of capital</th>
<th>Profit rate</th>
<th>Wages</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1966-1978)</td>
<td>Y/K↓</td>
<td>R/K↓</td>
<td>W/L↑</td>
<td>R/W↓</td>
</tr>
</tbody>
</table>

**Neoliberal Years of Capitalism.** From 1979 to 2008, we have the Neoliberal Years of Capitalism. This was the time when a reactionary ideology turns dominant among the economic elites in rich countries. The fundamental objective was to retrieve a satisfactory profit rate – something that was achieved in the 1990s (Wolff, 2001; Brenner, 2002; Duménil and Lévy, 2002) by reducing direct and indirect wages – reducing direct wages by flexibilizing the labor contracts, so reducing the costs that these contracts brought to business enterprises; and reducing indirect wages by reducing or eliminating the large social services that the state had undertaken since the end of World War II.

In the process of keeping wages stagnant or growing substantially less than productivity, notwithstanding technical progress was neutral (just didn’t turn capital-saving, as had happened in the Fordist period), four factors concurred. One that is directly related to our model: the capital-using consequence of the Information and Communication Technology Revolution, and the three other, independent: the fact that rich countries begin to confront with the competition of developing countries in the exports of manufactures since the 1970s, the brutal increase of the remuneration of the top executives of the big corporations and of the financiers, and the strength of the narrowness of the neoliberal class coalition.

The Information and Communication Technology Revolution, which begins immediately after the war and gained impulse since the 1966, brought back a capital-using technology which reduced the productivity of the capital or the output-capital ratio, while increasing the productivity of labor. Instead the process of economic growth become capital-saving, as I expected, because mechanization seemed exhausted, and the
time had come for the substitution of new and more efficient machines for old machines, we come back to strong process of substitution of capital for labor in so far as the new technologies proved to involve a fall in the productivity of capital.

<table>
<thead>
<tr>
<th>Neoliberal Years (1979-2008)</th>
<th>Productivity of capital</th>
<th>Profit rate</th>
<th>Wages</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y/K↓</td>
<td>R/K↑</td>
<td>W/L→</td>
<td>R/W↑</td>
<td></td>
</tr>
</tbody>
</table>

The capitalism that arises from the Second Industrial Revolution, which I call Classic Capitalism is not a pure or liberal capitalism, but a Technobureaucratic Capitalism, in so far that the technobureaucratic or professional class was already sharing power and privilege with the bourgeoisie since the rise of the big corporations and the relative separation of ownership from the control of these corporations. In the Fordist period, capital continued to be a fundamental source of power, but it had become so abundant, as the measures of the liquidity of the capitalist economies showed, that, as John K. Galbraith (1967) remarked, technical, organizational and communicative knowledge had already become the strategic factor of production. This new class is then a big new middle class benefiting from good salaries. But it will be only in the Neoliberal Years of Capitalism that its top stratum, now formed of the top executives of the multinational corporations and the financiers, will get associated politically to the rentier capitalists to form the neoliberal class coalition. Whereas this class coalition is very narrow, the class coalition of entrepreneur-capitalists, the middle class and the popular classes of the Fordist Phase was a broad class coalition. Whereas almost all players were sharing the fruits of development during Fordism, in the Neoliberal Years, only the rentier capitalists, the financiers who manage their wealth, and the top executives of the corporations are the winners; all others, “the rest”, are losers. This economic new reality behind this new political arrangement was financialization or finance-led capitalism (Guttmann 2008). Combining three major financial innovations (the creation of the Euro currency in the 1960s, because the London-based banks accepted to offer dollar-denominated time deposits and loans, the creation of a wholesale money markets, and the transformation of the great banks in the major actors in this Market) resulted in a brutal increase in the gains and in the functional participation in income of the financiers and, in a lesser extent, of the capitalist rentiers. Thus, one additional explanation for the relative stagnation of wages in rich countries since the mid 1960s (additionally to the reduction of the productivity of capital brought by the Information and Communication Technology Revolution and to the loss of power of organized labor), were the high salaries and bonus to the top technobureaucratic class.

In his extraordinary study of the inequalities in capitalism, Thomas Piketty (2013: 386, 498) underlies that the inequalities originated from the revenues of capital are bigger than the ones originating from labor: “whereas the revenues of labor of the top 10% receiving more revenues are around 25 to 30% of total revenues, the revenues of capital of the top 10% is always superior to 50%”. Yet, principally to explain the explosion of the inequality that took place in the US since the 1970s, he believes that the inequalities
of labor – specifically of the very high salaries – explains a substantial part of it. “The increase of the wage and salary inequalities in the US refers, more than anything else, to the very high salaries: the 1% of the highest remunerations, and still more, of the 0,1% highest... Concretely, remunerations around 100 000 dollars-200 000 dollars have increased only faster than the average, while the ones above 500 000 dollars (and in particular the remunerations of several millions of dollars) have literally exploded”.

The rate of growth

As I remarked in the beginning of the paper, these models do not deal with the factor that cause a higher or a smaller rate of growth, but with the behavior of the profit and the wage rate, and with the functional distribution between profits and wages, and, in the last section, also the salaries. Yet, it must be said that the three forms of technical progress imply rates of growth, in so far as the output-capital ratio measures the productivity of capital. Given the other variables constant, growth will be higher if technical progress is capital-saving than if it is neutral, and still higher if it is compared with a moment in which capital-using techniques predominate. This is one among several others reasons why catching up has proved so difficult for developing countries, where the productivity of capital – which is often falling because mechanization (capital-using technical progress) - prevails over modernization (capital-saving technical progress). Yet, the model does not say which will be this rate, because the increase in the labor productivity does not depend only on the type of technical progress, it also depends on the intensity of technical progress: periods of intense technical progress will tend obviously to show higher rates of growth than periods where innovation gets protracted. In macroeconomic terms, this intensity, on its hand, will depend, on the rate of capital accumulation; and in microeconomic terms, on a large number of variables, as education, entrepreneurial capacity, labor and entrepreneurial motivation, rational allocation of resources, institutions adequate to growth, and particularly a national development strategy.

Economic growth depends on a fourth factor, in addition to the rate of capital accumulation, the quality of the micro or supply variables, and the type and intensity of technical progress: price and financial stability, which is expressed into fiscal and exchange rate responsibility, or, in other words, into a moderate but positive public savings and into a current-account, which must show a surplus if the country faces the Dutch disease and dully neutralizes it. But the discussion of these themes is not in the scope of this paper.

Conclusion

The revised classical model of growth that I just presented is a historical model. It is an abstract and general growth model, where the stylized facts on how economic growth and particularly the functional distribution of income appear clearly. The model aims at being simple and general without losing a historical perspective. Thus, it assumes a closed economy, competition, and the existence of only two economic agents: capitalists
and workers. The state is present in the model not as an economic agent collecting taxes and providing economic transferences, but only defining the institutions required for markets to operate and the profit rate to be assured at a satisfying level. In the model, technological progress is defined by the increase of labor productivity (which corresponds to the increase of income per capita, if one assumes as constant the active/inactive labor force relation). It affirms the existence of three types of technological progress: capital-using or mechanization, which involves a falling output-capital ratio or a falling productivity capital; capital-saving technology, which involves an increasing output-capital ratio or an increasing productivity of capital; and a neutral technical progress, which results of the first and the second type neutralizing each other. I show how – in the process of economic growth – the profit rate, the wage rate, and the functional distribution of income between profits and wages vary in relation to these three types of technical progress.

Marx’s theory on the falling tendency of the rate of profit hypothesis is only valid if and while the capital-using technological progress was dominant. If technological progress is assumed to be neutral, the profit rate will remain constant, while the wage rate will increase according to the growth of labor productivity. In the moment that capital-saving technology becomes dominant the wage-rate could increase more than the productivity rate, while the profit rate would remain constant.

The assumption of a constant rate of profit is based on two other assumptions besides the fact that mechanization is dominant just in the early periods of capitalist development: that there is no alternative form of economic organization to capitalism, and that capital accumulation and growth depend on a satisfying profit rate. Thus, the profit rate plays a central role in the model. Whenever there is a tendency to the fall of the rate of profit (as it happened between the late 1960s and the 1980s), the economic and political system reacts in order to restore it.

From this model, and from basic factual knowledge on the history of modern capitalism, it is possible to derive the stylized facts of capitalist growth. Britain and, more generally, the countries that first completed the capitalist revolution are taken for reference. Economic growth turned out in four phases: the Industrial Revolution, from late eighteenth century to around 1915; the Marx’s or Competitive Phase, from 1815 to around 1870; the Classical Phase, from 1890 to 1929; Fordism, from 1930 to 1964; a Transition-Crisis Phase, from 1966 to 1978; the Neoliberal Years, from 1979 to 2008. Since the 2008 Global Financial Crisis, capitalism in rich countries is undergoing a moment of transition and indetermination.

References


By “industrial and capitalist revolution” I mean the long period from the thirteenth to the nineteenth century that gave rise to the modern national states and to capitalism.

See Bresser-Pereira (2007).

See Bresser-Pereira (1986). Recently I returned to the theme in Bresser-Pereira (2014).

Herbert A. Simon (1956[1979]: 20) created the expression “satisficing”, arguing that “evidently, organisms adapt well enough to ‘satisfice’; they do not, in general, ‘optimize’.” Here, the expressions “reasonable”, “satisfactory” and “satisficing” are synonymous.

Not all classical economists predicted the long run stagnation prospect, but this is clear in Ricardo, Malthus, and Marx.

Thus, in this assumption of a long-term constant profit rate is implicit a theory of the economic cycle, that I sketched in Bresser-Pereira (1986), but that goes off the point of this paper.

In this paper I used the concept of output-capital ratio, $Y/K$, which Marx called “technical composition of capital”, avoiding the use of the “organic composition of capital” concept which rather complicates than simplifies the argument. In the growth literature, capital-output relation is more often used, but I prefer its inverse, the output-capital ratio, because when one says that this ratio is increasing, this means that capital productivity is increasing.

This curve is similar to Keynes’ marginal efficiency of capital. The difference is that in the marginal efficiency of capital the vertical axis shows directly the expected rate of profit, while in the investment opportunities curve that I am suggesting we have the cost reductions related to the different techniques replacing different types of labor.

Anwar Shaikh (1978) made a critique of the Okishio Theorem similar to this one. We both were working independently, but he published his finding some years before.

Capitalism was born with mercantilism – a form of economic and political organization of capitalism where the state had a major role in coordinating the economic
system, by regulating the market and complementing it. The first industrial revolutions (UK, France and Belgium) took place in the historical context of mercantilism.

11 According to Duménil and Lévy (1993: 299), the output-capital ratio starts increasing in 1966, whereas for Thomas Piketty (2013: 309) it increases permanently since 1950; but in a previous page in his book Piketty (2013: 270) remarks that in the 1970s there was a sharp fall in the productivity of private capital of rich countries: “whereas private capital represents between 2 and 3.5 years of national income in the rich countries in 1970, it represents between 5.1 and 5.2 in 2010”.
