GROWTH AND DISTRIBUTION:
A REVISED CLASSICAL MODEL

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Abstract. In order to understand economic growth and distribution one should not primarily look for models concerned with equilibrium, but for a classical model –a model in which the profit rate is the central variable. In capitalism, capital accumulation and growth depend on the profit rate, and the functional distribution of income is determined by it – together with the type of technical progress. In this paper the author presents a revised classical model of growth. It is revised because it inverts the classical model, making the rate of profit the constant in the long run, not for market reasons but because the capitalist system will build the necessary institutions to restore the profit rate whenever it falls; and because the wage rate is treated as the residuum, tending to grow with productivity. Given the existence of three types of technological progress (capital using or mechanization, neutral, and capital saving), the author shows how, in the process of economic growth the profit rate, the wage rate, and the functional distribution of income vary in the historical process of growth – a process in which it is possible to identify historical stylized stages.

Capitalist economic growth was well explained by the classical economists, in so far as they define economic growth as a process of systematic increase in income per capita through capital accumulation and incorporation of technical progress, focus in the profit rate and in the functional distribution of income between wages and profits, and give the required attention to the institutional aspects of the process. Yet, it was abandoned by most economists, probably because it is based in an assumption that proved not realistic – that the wage rate is constant or corresponds to the historical cost of labor reproduction. This paper aims to restore the classical model of growth by inverting the assumptions about the determinant and the residuum variable, and by introducing three types of technical progress.

The two basic growth models in modern economics – the Harrod-Domar model and the Solow model – adopt production functions establishing relations between capital, labor, technical progress, and economic growth. Although they apparently have as objective to

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discover the causes of economic growth, their original central concern is to build a model either consistent with the Keynesian assumption that no equilibrium is assured by the market, or with the neoclassical opposite assumption. Although this discussion may be interesting, it does not add new information to an obvious fact: although capitalist economic growth does not follow an equilibrium path, this does not mean that such equilibrium is of the razor's edge type. Although instable, growth has been sustained since the capitalist and industrial revolution as an outcome of market forces and state institutions. On the other hand, the Solow model is attractive to many economists because the production functions are an adequate tool for econometric research. Yet, growth models come almost invariably to the obvious conclusion that economic growth depends on a combination of savings and capital accumulation, education and incorporation of technical progress to production, adequate institutions, motivated and thriving entrepreneurs, competent state policies, etc.

The model that I will present here is not particularly concerned with the causes of economic growth, but, starting from the fact that growth is taking place, returns to the classical concern with distribution, and, so, with the long term tendencies of the rate of profit and of the wage rate. In the same way of the classical economists, I give a central role to the profit rate, but, differently of their more illustrious representatives (Smith, Ricardo and Marx), I do not accept that the rate of profit tends to fall in the long run. Through this approach, the classical economists related smartly growth and distribution, but, as I will argue in this paper, this was done by privileging just one type of technical progress although there are two others. Once the capitalist and national revolutions take place,[1] and economic development gets started, the increase in labor and overall 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 stages in this process, and define the stylized facts that characterize it.

In this paper I will present a classical revised model of growth and distribution. It is a classical model for two positive reasons – 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 –, and for two negative reasons: because, unlike the Keynesian model, it is not concerned with criticizing Say's law, and because, unlike neoclassical economics, it does not adopt a hypothetical-deductive method. It rather adopts a historical-deductive approach that generalizes out of historical experience – particularly form the new historical facts which are behind the economic and institutional change processes that make economic development to occur in stages of phases. It does need not to criticize Say's law and introduce demand in it because it is not interested in explaining cyclical crises, although it offers a basic explanation for the upturn of the long cycles or waves. It is a revised model because it starts from the inversion of the classical theory distribution. While in the classical model wages are the constant, and the profit rate, the residuum, in this model the profit rate is the constant (for economic and institutional reasons), and the wage rate, the residuum. After arguing for the reasonableness of this inversion in the

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[1] By 'capitalist and national revolutions' I mean the long period from the thirteenth to the nineteenth century that gave rise to capitalism and to the modern national states.

first section of the paper, in the second section I will present three types of technical progresses. In the third section I will shortly discuss the abstract relationships among the model's main variable. That will enable me to present in the fourth section four historical stages of capitalist development according to these variables, among which the determining one is the type of technical progress.[2]

Profit rate as a constant

To be simple, the model here presented assumes a closed economy, generalized competition, no state, one commodity, total and marginal output-capital relation equal, and just two agents: capitalists, receiving profits, R, and workers, wages, W. Income, Y, is the sum of wages and profits. Capitalists could be differentiated into entrepreneurs making a profit and *rentiers* receiving interests, but although I make the distinction in developing the argument, it is not necessary to the model. In the same vein, although I use the state and thus institutions in the argument, it may be ignored in the simpler version of the model. Expenditure is equal to income, and the sum of consumption, C, and investment, I. The functional distribution of income, is R/W = m,[3] 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, but for stylized facts which characterize growth, I can assume that the economy is growing, i.e., that income per capita and the productivity rate are increasing. Given the assumption that the labor force, L, in increasing at the same rate of 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 $\dot{y}/y = \hat{y}$). The wage rate is W/L = w; the variation of total wages is $dW/dt = \dot{W}$; the rate of growth of total wages, $\dot{W}/W = \hat{W}$; 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. 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 – Competitive Stage (1815/25 – 1875/95) –, in which it is falling from a high level, which prevailed during the 'industrial revolution', to a 'reasonable' level since then. 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, 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,

[3] Marx called this variable the surplus value rate, which he mostly assumed as constant.

predicted that the profit rate would decline in the long run. This prediction as well proved to be false. Since mid nineteenth century the profit rate remained basically constant, at a 'reasonable', 'satisfactory', or 'satisficing'[4] level, i.e., the level that capitalists require to borrow and invest, or that they invest from their retained profits. It varied strongly according to economic cycles, and responds to exogenous shocks, but in the long run it remained constant.

Why does it make sense to assume a constant rate of profit? Essentially it does because, on one hand, a satisfactory profit rate is a condition of existence or survival for the capitalist economic system; on the other, because there is not an economic alternative to capitalism. For some time it was thought that a command 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 *rentiers*. 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 asking permanently for higher wages, but they know that their wages cannot reduce the profit rate below a given level because this will endanger the capital accumulation and growth process.

Since classical economists believed that the productivity of labor would decline in the long run,[5] their bottom line was the wage rate. Yet, in so far as this prediction failed to be true, the alternative bottom line is the profit rate to be constant. 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 does 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 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 crisis or a threat of crisis, which will only be overcome if the profit rate is reestablished. Since economic agents need that the economy works, they either take the required policy and institutional measures to

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[4] 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 'satisficiing' are synonymous. See also, Simon (1957).

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

reduce the wage rate or to increase aggregate demand, or they wait that the market system processes the crisis and reestablishes the profit rate.[6]

In Marx's falling tendency of the rate of profit theory, the possibility that the counter-tendencies would effectively neutralize such tendency was considered as a possibility. In the theory that I am presenting, the long term constancy of the rate of profit is based on the institutional defense of the rate of profit by the capitalist class and government. Even if there was an economic alternative to capitalism, this defense would be fierce on the part of capitalists. 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, till a certain extent, assure the way out of the cyclical crisis, governments are supposed to provide the institutional reforms and policies that will assure that this outcome is achieved, and, in doing so, it will keep the long run rate of profit at a reasonable 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 activities with higher valued added. Yet, the process of labor productivity increase will be accompanied by changes in the productivity of capital, or the output-capital relation, Y/K (which Marx called technical composition of capital).[7] Given the fact that, concomitantly with labor productivity increase, 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 ($Y_2/K_2 < Y_1/K_1$, where i indicates time), technical progress will be capital-using, or we will have 'mechanization'. If the product-capital relation 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, income will be increasing at a smaller rate than capital:

$$\frac{\dot{Y}}{Y} < \frac{\dot{K}}{K} \qquad ou \qquad \hat{Y} < \hat{K} \quad .$$

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[6] 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.

[7] In this paper I used the concept of output-capital relation, 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 relation, because when one says that this ratio is increasing, this means that capital productivity in increasing.

In the case of neutral technical progress, where $Y_2/K_2 = Y_1/K_1$, income will be increasing at the same rate as capital:

$$\frac{\dot{Y}}{Y} = \frac{\dot{K}}{K} \qquad ou \qquad \hat{Y} = \hat{K}$$

In the case of capital-saving technical progress, where $Y_2/K_2 > Y_1/K_1$, income will be increasing at a higher rate than capital:

$$\frac{\dot{Y}}{Y} > \frac{\dot{K}}{K} \qquad ou \qquad \hat{Y} > \hat{K}$$

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? Capital-using technical progress 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 is taking place. Whenever the costs involved in buying and operating a machine (and the respective production process) are smaller than the use of man-power, it will be rational for the capitalist to invest in this machine. As the business enterprise substitute capital for labor, the production costs will be reduced and the total productivity of labor will increase. 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 the more efficient machine, which replaces one kind 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.[8] Despite the fact that, in this decision process, the productions costs decreased for the business enterprises as different kinds of labor were successively replaced by different kinds of machines with decreasing productivity, each new machine replacing different kinds of labor will reduce, the overall output-capital relation 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 labor that was possible for a highly efficient machine, the tractor. Now, the second machine available which is economical or just became economical (i.e., reduces costs to the entrepreneur) is a harvesting machine. All farmers will have to buy or rent it, but, as they hold a lower output-capital ratio, the total output-capital ratio of the economy will fall, despite the fact that their costs were reduced. It is true that, in a given moment, a new machine replacing a type of labor which had not yet been mechanized, which is not less but relatively more efficient than the ones which had previously replaced other forms of labor, may be invented and made available to business enterprises. 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 the inventions and specially innovations (the actual adoption of the invention)

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[8] This curve is similar 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.

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 relation will be declining.

When the output-capital relation is decreasing, we will see that the profit rate will be decreasing. With this argument, we can understand something that appeared irrational: firms to adopt capital-using techniques which eventually will reduce instead of increase its profit rate. This was the question posed by the Okishio theorem (1961, 1967) challenging the possibility of a falling tendency for the rate of profit. Yet, as I argued, the business enterprise is acting rationally when it adopts the new technique or machine which is capital-using but efficient. It will have no alternative but to adopt it. Its strategy will be just a defensive one – a strategy to keep it competitive given the fact that the other firms will also the capital-using but cost reducing technique. The fact that, once all business enterprises replaced manpower for a given relatively (to the previous ones) less efficient machine, the resulting output-capital ratio for the whole industry and the average rate of profit will be smaller, is out of the control of each individual firm. This is a perverse but rational effect of mechanization or the adoption of capital using technical progress.[9]

While capital-using technical progress or mechanization involves the substitution of capital for different activities performed by labor, 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, increasing the output-capital relation. While in the case of mechanization the business enterprise had no other alternative than to invest in increasingly less efficient machines, in this case, it again will not have other alternative but in investing 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 machine performing the same operation, while new machines in the previous case are machines performing new operations and thus replacing new types of labor. New machines will only appear in the market as they bring some innovation and lower costs, but there is a major difference between new machines performing new 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.

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

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[9] A critique of the Okishio theorem similar to that was developed also by Anwar Shaik (1978), at the same time that I was developing this one.

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 it is the case of the Harrod-Domar and the Solow models, assume neutral technical progress. In the relatively short run (medium run) periods in which such models usually used, such assumption is reasonable and simplifies the model. In the present model, however, principally concerned with distribution in the long run, across the several historical stages or phases of economic development, to renounce such assumption is essential.

The abstract relationships

Given these three forms of technical progress, or the variation of the output-capital ratio, we will 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:

(1)   R/K= R/Y / K/Y

Let us suppose, first, that the functional distribution of income between profits and wages is constant: R/Y→. 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↓), the profit rate will be declining, R/K↓; if technical progress is neutral (constant output-capital ratio, Y/K→), the profit rate will be constant, R/K→; and if technical progress is capital-saving (increasing output-capital ratio, Y/K↑), the profit rate will be increasing, R/K↑.

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 remains, 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.

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

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:

$$\frac{d}{dt}\left(Y\!\!\Big/\!\!K\right) = \frac{Y}{K}\left(\frac{\dot{Y}}{Y} - \frac{\dot{K}}{K}\right) \qquad\qquad \frac{d}{dt}\left(R\!\!\Big/\!\!W\right) = \frac{R}{W}\left(\frac{\dot{R}}{R} - \frac{\dot{W}}{W}\right)$$

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

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:

$$\frac{\dot{W}}{W} = \frac{\dot{R}}{R} + \left(\frac{\dot{Y}}{Y} - \frac{\dot{K}}{K}\right)\frac{Y}{W} \gtreqless 0$$

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:

$$(3) \frac{W}{Y}\frac{\dot{W}}{W} = \frac{\dot{Y}}{Y} - \frac{R}{Y}\frac{\dot{K}}{K} \gtreqless 0$$

From equation (3) we deduce that, if technical progress is neutral or capital-saving, total wages increase because 0 < 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.

When technical progress is capital-using, on the other hand, equation (3) gives us an ambiguous result. If capital grows at a higher rate than output, the right hand side of equation

(3) can 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 concentrating functional distribution, the wage rate may or may not be decreasing, depending on the rate of growth of income per capita, which influences R/Y. In the summary analysis that I will do of the historical stages of capitalist growth, the fall in the output-capital relation only takes place in the two first stages. In the first stage, the Industrial Revolution, in which mechanization is assumed, this ambiguity will remain. In order to keep the rate of profit constant, the wage rate probably fell, at least in terms of real income and standard of living. In the Competitive Stage, however, stage, the ambiguity will disappear despite mechanization, because I drop the assumption that the rate of profit was constant, because I assume that it was exceptionally high during the industrial revolution, and let it fall for the period. This allows the wage rate to remain approximately constant and the functional distribution of income to concentrate, as probably happened in this period.[10]

1. **Table 1: Types of technical progress, the wage rate and the functional distribution of income, given a constant profit rate.**

	If technical progress is	the wage rate will be	& functional distribution will be:
Capital-using	$Y/K\downarrow$	$W/L?$	$R/W\uparrow$
Neutral	$Y/K\rightarrow$	$W/L\uparrow$	$R/W\rightarrow$
Capital-saving	$Y/K\uparrow$	$W/L\uparrow$	$R/W\downarrow$

Historical stages

In the previous section I presented a model relating the main economic variables describing capitalist economic growth and distribution. Yet, economic development is a historical process that emerges with capitalism – a process that is not linear but subjected to major changes that tend to concentrate in given moments shaping 'revolutions', like the industrial revolution, the second industrial revolution, etc., and given rise to new stages or patterns of economic growth. As we abstract and simplify economic relations, we can do the same with economic history, and think capitalist growth 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 generalize, having as basis first industrial countries – England, France and United States – I believe that we can distinguish just four stages and a long transition:

Industrial Revolution	1750 – 1815
Competitive Stage	1815 – 1870
Classical Stage	1870 – 1945

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[10] In Bresser-Pereira (1986), I also called the period Competitive Stage as the 'Marxian period', because it corresponded to the time Marx lived, and was the only moment in which the rate of profit was falling.

Transition ('Golden Age')   1945 – 1970
Knowledge Stage   1970 – …

This is not the moment to review and argue for these historical phases or stages.[11] The Industrial Revolution is a well known process. It is the moment in which the capitalist revolution, which began with the Commercial Revolution, comes to an end. It is the moment when, in Rostow's terms (1960), the 'take-off' takes place. In the Commercial Revolution, primitive accumulation – the initial accumulation of capital through the use of some form of violence – created the conditions for the subsequent generalization of wage labor and the competitive appropriation of surplus through profits (Marx, 1867: I,24). With the Industrial Revolution – a concentrated process of industrialization involving positive externalities or spillovers, and, consequently, high profit rates –, capitalist development becomes self-sustained in so far as the reinvestment of profits to keep pace of technological progress becomes a condition of survival of the business enterprises.

In this search for stylized facts, the Industrial Revolution, which I broadly located for Britain between 1750 and 1815, will be characterized by a high and constant profit rate, while technical progress will be dominantly capital-using. This is consistent with a declining wage rate, and with the concentration of the functional distribution of income. 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 is rising fast, despite the concentration of income, the wage rate may be stagnant or even increasing. Thus, in this phase, we have:

Industrial Revolution	$Y/K\downarrow$	$R/K\rightarrow$	$W/L?$	$R/W\uparrow$

The following phase is the Competitive Stage. It is the phase in which 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 describe by the classical liberal economists. Technical progress remains capital-using since mechanization continues intense overcoming the modernization process. Thus, we have decreasing returns. Yet, contrarily to the classical economists' prediction, the wage rate does not fall but probably remains constant. This is possible because the Competitive Stage is the only phase in which the profit rate probably decreases – something that is possible if we assume that it was very high during the Industrial Revolution. This decrease leaves ambiguous the functional distribution of income, which probably continue 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.

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[11] I attempted to do that in Bresser-Pereira, 1986.

Competitive Stage	Y/K↓	R/K↓	W/L→	R/W↑

By the second part of the nineteenth century, around 1870, we have major changes which bring the Classical Stage, the stage 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 in so far as 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 turns possible what, in the late 1940s, the 'Prebisch's these on the uneven distribution of the productivity gains between developed and developing countries is 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 oligopolist, 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 moment. 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.

Classical Stage	Y/K→	R/K→	W/L↑	R/W→

Finally, after World War II, we see, first, the definitive rise and affluence of the professional middle class or technobureaucratic class, and, in a second moment, globalization. I refer to this phase as the Knowledge Stage because technical, organizational and communicative knowledge become the strategic factor of production. The system remains capitalist, but the power and income of the individuals possessing one of these three types of knowledge (or, still better, a combination of them) increase in relation to the power of inactive or *rentier* capitalists. Yet, despite the fact that the managerial elites replace in large extent the capitalist class in controlling the large business organizations, the market logic of capitalism remains unchanged. Or the changes are not big enough to legitimize expressions like post-capitalism. The economy continues to be essentially market coordinated; the profit motive continues to be central, and capital accumulation with the incorporation of technical progress remains in the core of the growth process. Technical progress remains neutral, although we can already notice a clear tendency for capital-savings technologies to dominate, particularly in the realm of information technology. Yet, three central new facts give rise to the

Knowledge Stage: the definitive emergence of the professional or technical middle class, the technology of information revolution, and globalization. These new facts cause a major change in the capitalist system: capital ceases gradually to be the strategic factor of production, as it is replaced by technical and organizational knowledge (Galbraith, 1967; Bresser-Pereira, 1972, 1981).The new middle class, or professional middle class, receiving salaries not wages,[12] now share power and income with the capitalist class, to which the most successful managers soon join as they become rich.

Transition	$Y/K\rightarrow$	$R/K\downarrow$	$W/L\uparrow$	$R/W\downarrow$*

Between 1945 and 1970 economic growth is extraordinary. This was the Golden Age of capitalism (Glyn et al., 1988; Marglin, 1990), and, although I am including it in the new phase, it may also be viewed as a transition period. The profit rate keeps high, while wages and particularly salaries are increasing fast. Fast enough to cause, in the 1960s, a profit squeeze, and the fall in the rate of profit (Boddy and Crotty, 1975; Goldenstein, 1999). The neo-liberal ideological wave and the institutional market oriented reforms that began in the following decade are a reaction of the system to restore the satisfying profit rate – something that is achieved in the 1990s (Wolff, 2001; Brenner, 2002; Duménil and Lévy, 2002). Not considering these cyclical variations, technical progress remains basically neutral (although the information technology revolution points out toward a capital-saving type of technical progress),[13] the profit rate remains constant, and the distribution between profits and wages also remains basically constant in the Knowledge Stage. Yet, the internal distribution of wages between wages stricto sensu (the remuneration of the industrial and service working class) and salaries (the compensation of the professional middle class) changes decisively in favor of the latter. The personal concentration of income which starts around 1975 all over the world provides evidence of this fact. The figures about income distribution that are normally published by government agencies are figures about the personal (not the functional) distribution of income. The official statistic bodies that do such surveys usually do not clearly distinguish profits from wages *lato senso*, and definitely do not differentiate wages from salaries, just classifying the population according to percentage groups of income. The changes in the Gini coefficients derived from the tables reflect principally the distribution between salaries and wages, since profits are underestimated in this kind of statistic. In so far as the demand for technical labor increased strongly with the information technology revolution, while the demand for non-technical labor lagged behind, personal concentration of income was inevitable. On the other hand, as the top professional class assumed increasingly the direction of major business enterprises, and capitalists were increasingly reduced to the condition of *rentiers* or inactive capitalists, they accepted that the profit rate went down a bit

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[12] The professional middle class, that I also called technobureaucracy, and technicians' class (Bresser-Pereira, 1972, 1981), and Wright Mills (1951) called the 'new middle class', refers to professionals working in private, public non-state, and state organizations. Technical, organizational, and communications knowledge assure power in organizations and at society at large to the top strata of such social class.

[13] Wolff (2001) shows that since the early 1980s the organic composition of capital is falling – a clear indication of this tendency for technical progress to turn capital-saving.
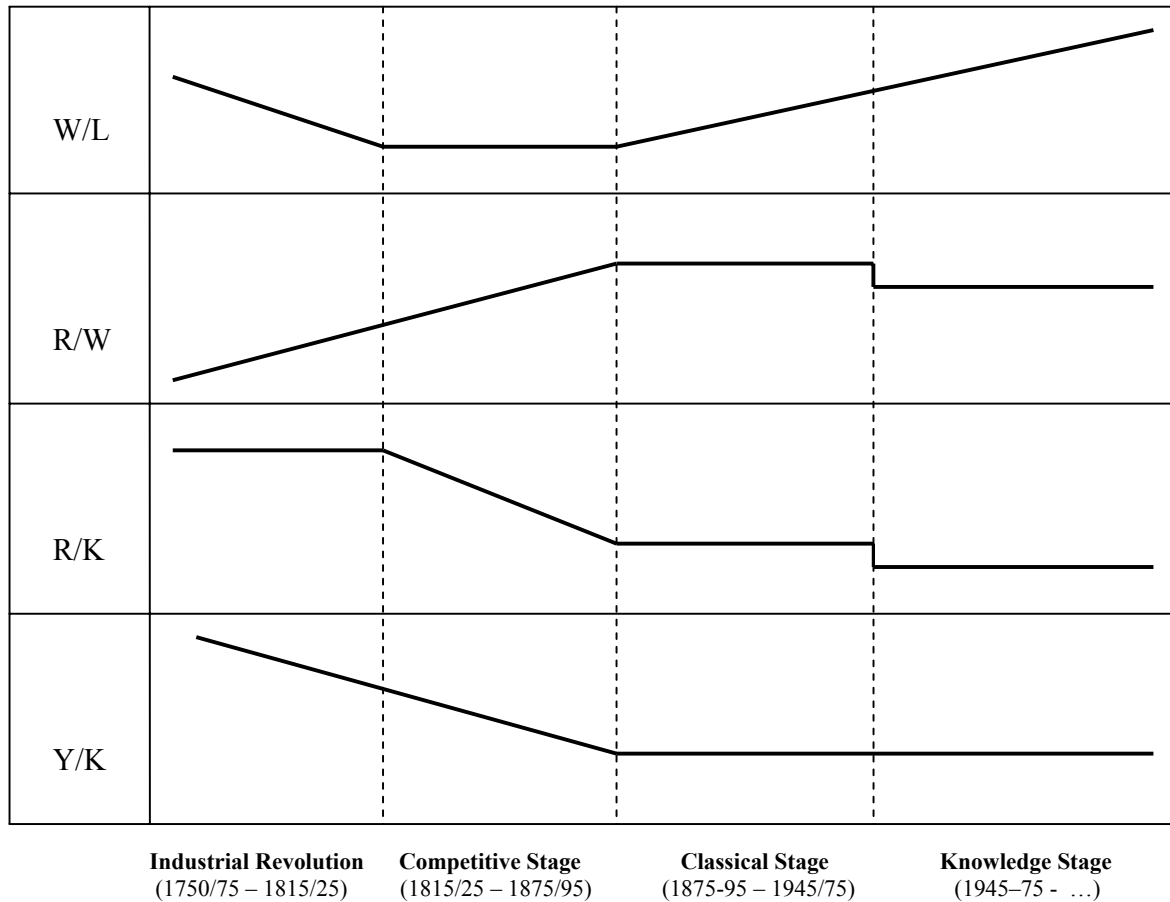
(the dent in Figure 1 reflecting this fall), to stabilize at a new constant lower level, the difference being appropriated by salaries, particularly by top executives' high salaries.

After the transition, the basic relations in the Knowledge Stage show the same trends that in the Classical Stage, since technical progress will continue to be defined by a constant output-capital ratio, while the profit rate and the functional distribution of income remain constant, and the wage rate increases again at the rate of increase in productivity.

Knowledge Stage	Y/K→	R/K→	W/L↑	R/W→

These relations can be seen in Figure 1, where we have the trends of the four variables, or the stylized economic facts for the four phases. Notice that the order of the variables is relatively arbitrary. Technical progress is capital-using in the first and second phase, neutral in the third and fourth. Not considering the 1945-75 transition, only for the Competitive Stage I dropped the assumption of a constant rate of profit, because in the previous phase the rate of profit was above satisfactory level. The functional distribution of income is increasing (concentrating) in the Industrial Revolution, constant in the remaining phases. The wage rate decreases in the Industrial Revolution, turns constant in the Liberal or Marxian phase, and starts to increase with productivity in the Classical Stage. It increases above that level in the transition to the Knowledge Stage, to take into consideration the sharp increase in the professional middle class' salaries, but after that it is supposed to grow with productivity increase.

2. Figure 1: Stylized economic facts in four historical stages

| | **Industrial Revolution**
(1750/75 – 1815/25) | **Competitive Stage**
(1815/25 – 1875/95) | **Classical Stage**
(1875-95 – 1945/75) | **Knowledge Stage**
(1945–75 - …) |

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, i.e., with distribution. This is only partially true. Each of the three forms of technical progress implies a rate 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 predominates capital-using techniques. 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. And, naturally, it is also dependent on the rate of capital accumulation. The intensity of technical progress depends on a large number of variables, as education, entrepreneurial capacity, labor and entrepreneurial motivation, rational allocation

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of resources, institutions adequate to growth, competent and growth oriented economic policies, etc. These are the microeconomic reforms, in which dynamic capitalist economies are supposed to be permanently involved.

Economic growth depends on a fourth factor, in addition to the rate of capital accumulation, the type, and the intensity of technical progress: macroeconomic stability, which is expressed into stable prices, a moderate interest rate, a competitive exchange rate, and a reasonable degree of full employment. Since economic growth is the long term sum or the integral of short term GDP per capita growth rates, the growth achieved every year is important. In some moments, it is required to sacrifice the short term for the long term, and get involved in economic adjustment, but when a country does this, it expects that the growth rate through time will be higher. Full employment, on its hand, depends on competent macroeconomic policies managing the economic cycle.

What does this long term historical model of growth say in relation to administration of the business cycle and particularly of the long cycles? It says essentially one thing. When an economy faces some king of crisis, this means that the expected profit rate fell down, that investments were reduced. Thus, the solution will necessarily involve the restoration of the profit rate. We can have at least two types of crisis: a slowdown or normal recession, or a major and long term crisis. In the first case, restoring the rate of profit will involve monetary and fiscal policy. However, if the crisis involves a fall in the profit rate, as it happened in the United Sates in the 1970s, or is related to large foreign indebtedness and macroeconomic instability, as has been in most Latin American countries since 1980, the solution will probably involve institutional reforms and wage reduction. Thus, keeping the profit rate constant at a reasonable level is not just a long term sensible assumption; it also may indicate which should be the required long term institutional reforms and the macroeconomic policies that will recover the expected profit rate, stimulate investment, and resume economic growth.

Conclusion

The revised classical model of growth that I just presented is a historical model. Concomitantly, it is an abstract and general growth model, where the stylized facts about economic growth and distribution appear clearly. It assumes an investment function: capital accumulation depends on the expected rate of profit. It also assumes a production function: growth depends on investments, and on the type and intensity of technical progress. It also depends on full employment, since the production function defines the potential output; the actual product will also depend on effective demand, or on reducing the output hiatus.

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. Given the existence of three types of technological progress (capital using or mechanization, neutral, and capital saving), I show how – in the process of economic growth or increase of labor

productivity – 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, which are defined by the technical composition of capital or output-capital relation. 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). Technological progress will be capital-using if the increase in labor productivity entails the reduction of the output-capital ratio. It will be neutral, if economic growth takes place with a constant output-capital ratio; and it will be capital-saving if this ratio increases.

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 appear a tendency to the fall of the rate of profit (as it happen 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 Competitive Stage, from 1815 to around 1870; the Classical Stage, from 1890 to 1945/70; and the Knowledge Stage, from 1970 till presently. In the four phases, increase in labor productivity is taking place. The model does not discuss this rate. It assumes that it will depend on the rate of capital accumulation, the intensity of technological progress, and the effective use of capital and labor inputs. From the assumption historically verified that economic growth is happening, it looks for the stylized facts involved in this growth process. In the first stage (the industrial revolution), the only important supposition is that the profit rate is high. Given this assumption, in the second phase (competitive capitalism) the profit may decline without threatening to paralyze the process of capital accumulation. Technological progress is capital-using, and the functional distribution of income (or surplus value rate) is constant, as the wage rate is reduced to the cost of reproduction of the labor force level, and the rate of profit is declining. In the third period, the Classical Stage, we have a kind of long term steady state. Technical progress becomes neutral, the functional distribution of income between profits and wages is constant, the profit rate constant, and the wage rate increases with productivity. Finally, with technobureaucratic capitalism, technical progress is capital-saving. The functional distribution declines, as the profit rate remains constant, while wages (which now, given the rise of the professional middle class, includes salaries), increase at a higher rate of productivity. To be more precise, the wage rate *stricto senso* remains constant, but the salary rate increases substantially. On the

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other hand, given the fact that now the profit rate remunerates principally *rentiers* or inactive capitalists, and the entrepreneurial activity is also paid with high salaries received by top managers, the satisfactory profit rate (consistent with capital accumulation) is somewhat smaller than in the competitive and in the classical period, becoming again constant at this lower level.

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