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Profit share in income: is 1/3 a reference value?

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The distribution of income between the capital and the labor is considered as a major problem since Ricardo (1817). A value of about 1/3 for the profit share in income is often met and is a stylized fact for many growth models; however, significant variations are historically observed in an interval usually of 20 to 40% (Piketty, 2014).

This article proposes a theoretical explanation based on an endogenous and Keynesian growth model; the starting point is an idea of Kaldor (1972), economic growth being the result of a chain-reaction between increases in supply and demand. These increases are linked to the investments decided by the entrepreneurs and depend on the effective demand and on the marginal efficiency of the capital.

It is demonstrated that the steady states of this process have three main unexpected properties on the long term. Firstly, output growth rate is a linear function of employment growth rate and of net investment rate, the elasticities depending on the profit share in income and on the productivity of the capacity investment. Secondly, the "magic number" of 1/3 is theoretically justified when wage growth is independent of employment growth. Thirdly, a profit share in income higher than 1/3 leads to an economic slowdown.

The theoretical lessons are consistent with the stylized facts highlighted by economists and with the reality of the U.S. economy from 1961 to 2015. These results demonstrate the interest of this new way of research. The main macroeconomic implications lie in the importance of long-term aggregate demand and in the key role play in the growth process by the profit share in income.

Keywords: *distribution, profit share in income, effective demand, endogenous growth, United States.*

JEL codes *: D33, O40, O47, O51*

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1 INTRODUCTION

For a long time, the sharing of added value between the capital and the labor is an interrogation of the economists. The problem of income distribution has an important place in the economic thought of the great authors, from Adam Smith to Nicolas Kaldor, to David Ricardo or Karl Marx. For Ricardo (1817), "To determine the laws which regulate this distribution is the principal problem in Political Economy".

A distribution of income, 1/3 in favor of capital, 2/3 in favor of labor, was very often considered as a stylized fact, as evidenced by many historical works. In the first growth model of Cobb-Douglas (1928), the share of capital is a constant parameter of the model, evaluated at 30%. For the United States, there is an average share of 34% for the years 1909-1949 (Solow, 1957) [2] and 32.5% for the years 1958-1996 (Young, 2010). For a set of economies at different stages of development, the share of capital is also 34% on average around the year 1990 (Gollin, 2002)[3].

The most recent work (Piketty, 2014) confirms the existence since the 18th century of typical values: "we find that capital's share of income was on the order of 35-40 percent in both Britain and France in the late eighteenth century and throughout the nineteenth, before falling to 20-25 percent in the middle of the twentieth century and then rising again to 25-30 percent in the late twentieth and early twenty-first century" (Piketty, 2014, p. 201). Piketty notes also that capital's share of income increased in most of rich countries between 2000 and 2010 (Piketty, 2014, p. 222).

Thus, historically, an order of magnitude of 33% for the profit share in income is often met but significant variations exist in a range of 20 to 40%. So far, economic theory has proved unable to justify a value of 1/3 or other values (Askenazy and al., 2012).

Can we find a theoretical justification for this value of 1/3 for the share of capital that comes back in many statistics? Why can we meet other values?

In this article, we develop a new endogenous and Keynesian growth model and we demonstrate that the profit share in income plays a central role. The "magic value" of 1/3 corresponds to the case where the productivity gains are independent of the employment growth rate. In other words, the profit part of 1/3 is justified in an economy where the labor market functions perfectly, inducing the diffusion of productivity gains in all firms, regardless of their employment growth. The other values reflect the existence of a relationship between wage growth and employment growth; in other words, the labor market does not function properly in the allocation of wage gains.

The starting point of this new endogenous and Keynesian growth model is the vision of Kaldor for the process of economic growth process (1972). Kaldor carried out a series of studies seeking to characterize the process of economic growth (1956, 1961, and 1972), specifically the link between this process and the principle of effective demand, accumulation of capital, increasing returns and technical progress. 'Given that factor, the process of economic development can be looked upon as the resultant of a continued process of interaction–one could almost say, of a chain-reaction–between demand increases which have been induced by increases in supply, and increases in supply which have been evoked by increases in demand', concluded Kaldor (1972, p.1246).

[2] Annually the share varies between 31% and 40%.

[3] This 34% average concerns a set of 41 countries at different stages of development around 1990, the profit share in income varying from 20% to 35%.

This vision of a chain-reaction, neglected in subsequent work on economic growth, is the foundation of a new endogenous and Keynesian growth model we propose, building on the ideas of Schumpeter (1911, 1942), Keynes (1936), Palley (1996, 1997), Aghion-Howitt (1998), and Piketty (2014); the appendix 1 explains the main ideas taken into account.

In this growth process, entrepreneurs invest according to the effective demand and marginal efficiency of capital, either in capacity investments or in rationalization investments; they are also aiming at the competitiveness of the combination of investments. Job growth is the result of a balance between job creation linked to capacity investments and the job losses associated with rationalization investments.

The steady states of this process are determined. Three unexpected theoretical lessons then appear. Firstly, output growth rate is a linear function of employment growth rate and of net investment rate, the elasticities depending on the profit share in income and on the productivity of the capacity investment. Secondly, the "magic number" of 1/3 is theoretically justified when wage growth is independent of employment growth. Thirdly, a profit share in income higher than 1/3 leads to an economic slowdown. The theoretical lessons are consistent with the stylized facts highlighted by economists and with the reality of the U.S. economy from 1961 to 2015. These results demonstrate the interest of this new way of research.

In section 2, we develop the key elements of the growth process, modeled by an endogenous and Keynesian growth model of output and employment and by establishing "effective and competitive" equilibrium; then, we identify the steady states. In section 3, we show the three unexpected properties involving the profit share in income. In section 4, the major theoretical lessons are compared with the reality of the United States economy from 1961 to 2015. In section 5, this new growth model is the subject of a discussion showing consistency with the stylized facts highlighted by Verdoorn (1949, 1993), Okun (1962, 1970), Piketty (2014) and Ferri (2016). In section 6, the macroeconomic implications are drawn.

2 THE ENDOGENOUS AND KEYNESIAN GROWTH MODEL

The process of economic growth is the result of a chain-reaction between demand increases induced by increases in supply and increases in supply evoked by increases in demand. Each of these processes triggers the next, which is the characteristic of a chain-reaction. The latter can be boosted (economic boom) or stifled (stagnation or economic recession).

In the short term, entrepreneurs formulate rational expectations about fundamentals, taking into account a long-term view of the marginal efficiency of capital, reflecting confidence in the long-term state. They place themselves at the equilibrium of effective demand. At the same time, they make decisions to obtain the most competitive productive combinations, while taking into account the conditions prevailing in the different markets. For example, they have to decide the volume of capacity investment or rationalization investment, and the volume of jobs created or destroyed; they use simple criteria such as retaining projects with minimum total cost per unit of output, given the conditions in the labor market and the financial market.

Obviously, the expectations of entrepreneurs are rarely realized, given the great many uncertainties, their limited rationality and the unpredictable changes in many variables. However, entrepreneurs develop strategies to adapt to the new context by constantly seeking competitiveness and the balance between supply and demand.

2.1 ANTICIPATED INCREASES IN AGGREGATE SUPPLY AND DEMAND

We assume that at time t, the economy is in equilibrium from the point of view of supply Z, demand D and output Y. For entrepreneurs, investment I is then defined, as is the marginal efficiency of capital e_K, i.e. the expected long-term return on investment. Three types of investment are distinguished: capacity investment, rationalization investment and replacement investment. Capacity investment is used to "produce more", while rationalization investment is used to "produce differently".

We shall highlight the conditions of an equilibrium at time $t + dt$, taking into account the expectations formulated by entrepreneurs. To this end, the anticipated increases in aggregate supply and in aggregate demand will be determined, along with the equilibrium of effective demand. Competitive productive combinations will then be anticipated and sought after by entrepreneurs. This will highlight increases in output, employment and investment, in the "effective and competitive" equilibrium, as functions of the marginal efficiency of capital estimated by entrepreneurs. The growth process is modeled as a succession of effective and competitive equilibria.

First, we determine the expected increases in aggregate supply and aggregate demand over the interval $t + dt$.

2.1.1 Anticipated increase in aggregate supply

The anticipated increase in aggregate supply, represented by $\dot{Z}^a$, is the expected additional output volume corresponding to the employment increase of $\dot{L}^a$[4]:

$$\dot{Z}^a = \varphi(\dot{L}^a) \quad \text{with } Z(t) = D(t) = Y(t) \tag{1}$$

The marginal function of global supply rests on three founding hypotheses, which will be explained in turn.

- *The additional supply, as a function of capacity investment:* the additional supply $\dot{Z}^a$ is determined by the capacity investment $x^a I_n$ where I_n is the net investment volume[5]:

  $$\dot{Z}^a = Ax^a I_n \quad with \quad A = constant \qquad 0 \leq x^a \leq 1 \tag{2}$$

  $x^a I_n$ is the volume of investment that will be engaged in additional output; it will be referred to as "capacity investment". The complementary investment $(1 - x^a)I_n$ will be referred to as "rationalization investment".

  A is the "Productivity of capacity investment" (PCI), i.e. the productivity per unit of capacity investment. Henceforth, it is assumed to be constant. The PCI reflects the productivity of the investments used in the growth of output.

  x^a is the share of the net investment volume involved in additional output: it will be referred to as the "Ratio of capacity investment" (RCI), in this case the anticipated one. Any increase of x^a results in an increase in capacity of output. The RCI reflects the ability of the economy to invest in output growth.

- *Job creation, with increasing returns:* entrepreneurs create jobs according to the additional supply, the elasticity of "supply to jobs created" being variable:

  $$\frac{L_c^a}{L} = e_c^a \frac{\dot{Z}^a}{Z} \qquad e_c^a < 1 \tag{3}$$

[4] The index *a* indicates the anticipated (or *ex ante*) character of the variable.

[5] The difference between the (gross) investment volume and the net investment volume is due to the replacement investment volume.

L_c^a is the job creation associated with capacity investment. The jobs created are more productive, given the existence of increasing returns; hence an elasticity of less than 1. The creation of jobs, expected by entrepreneurs, is thus:

$$L_c^a = e_c^a A x^a \frac{I_n}{Y} L \qquad e_c^a < 1 \tag{4}$$

- *Destruction of jobs with capital-labor substitution*: entrepreneurs destroy jobs on the basis of the "supply shortfall" $A(1-x^a)I_n$, the elasticity of "supply shortfall to jobs destroyed" being variable:

$$\frac{L_d^a}{L} = e_d^a \frac{A(1-x^a)I_n}{Y} \qquad L_d^a = e_d^a A(1-x^a)\frac{I_n}{Y} L \tag{5}$$

The expected increase in employment is therefore:

$$\dot{L}^a = [(e_c^a + e_d^a)x^a - e_d^a]Ai_nL \qquad -e_d^a Ai_nL \le \dot{L}^a \le e_c^a Ai_nL \qquad i_n = \frac{I_n}{Y} \tag{6}$$

The increase in employment depends on net investment rate, and expected values for RCI and elasticities. The marginal global supply function is then written:

$$\dot{Z}^a = \varphi(\dot{L}^a) = \frac{Y}{(e_c^a + e_d^a)L}\dot{L}^a + \frac{e_d^a A\, i_n Y}{(e_c^a + e_d^a)} \tag{7}$$
$$0 \le \dot{Z}^a \le AI_n \qquad -e_d^a Ai_nL \le \dot{L}^a \le e_c^a Ai_nL$$

The marginal function of aggregate supply is a linear (increasing) function of the increase in employment and is represented in Figure 1.

2.1.2 Anticipated increase in aggregate demand

The increase in aggregate demand, represented by $\dot{D}^a$, is the additional product that entrepreneurs hope to derive from the additional employment $\dot{L}^a$:

$$\dot{D}^a = f(\dot{L}^a) \tag{8}$$

The additional demand $\dot{D}^a$ is composed of the additional volumes that entrepreneurs and consumers should spend on consumption and investment, taking into account the expected increase in employment. The marginal propensity to consume is taken as $p_{\dot{C}}$. Whence:

$$\dot{D}^a = p_{\dot{C}}\dot{Z}^a + \dot{I}^a \tag{9}$$

2.2 THE PRINCIPLE OF EFFECTIVE DEMAND

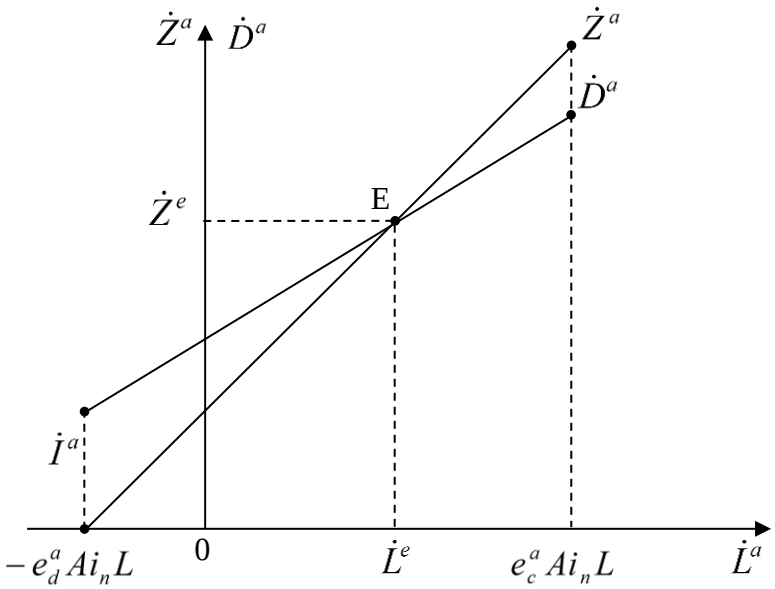

Figure 1 Increases in aggregate supply $\dot{Z}^a$ and in aggregate demand $\dot{D}^a$

The increase in aggregate demand is then written:

$$\dot{D}^a = f(\dot{L}^a) = p_{\dot{C}} \frac{Y}{(e_c^a + e_d^a)L} \dot{L}^a + p_{\dot{C}} \frac{e_d^a A i_n Y}{(e_c^a + e_d^a)} + \dot{I}^a \quad (10)$$

The marginal function of aggregate demand is a linear (increasing) function of the increase in employment and is represented in Figure 1.

"Additional effective demand" $\dot{D}^e$ is defined as the expected increase in demand at the point of intersection of increases in aggregate supply and demand, with an increase in the volume of employment $\dot{L}^e$. At the point of intersection, the anticipated profit is maximal. It can then be written:

$$\dot{D}^e = \dot{Z}^e = \dot{Y}^e \quad (11)$$

The aggregate demand curve (see Figure 1) is also a straight line that necessarily intersects the aggregate supply curve (point E). Point E, called "effective equilibrium", represents the new equilibrium anticipated by entrepreneurs:

$$\dot{Y}^e = A x^e i_n Y \qquad \dot{L}^e = (e_c^a + e_d^a) x^e A i_n L - e_d^a A i_n L \qquad x^e = \frac{\dot{I}^a}{(1 - p_{\dot{C}}) A i_n Y} \quad (12)$$

This balance imposes interdependencies between variables. For example, if entrepreneurs decide on an increase on investment and anticipate a particular marginal propensity to consume, this balance determines the RCI.

2.3 THE PRINCIPLE OF COMPETITIVE SUPPLY

At the equilibrium point of additional effective demand, entrepreneurs are looking for the most competitive productive combinations, that is to say those that both minimize the risk of loss of competitiveness against competing firms and ensure the return on investments. This leads them to determine the RCI and the elasticities according to the marginal efficiency of capital. To this end, entrepreneurs take into account three constraints: total cost per unit of output, short-term return and return independent of strategies.

2.3.1 The constraint of total cost per unit of output

Entrepreneurs minimize the expected total cost per unit of output[6] under a condition linked to the marginal efficiency of capital:

$$\frac{cost^e}{\dot{Y}^e} = \frac{\omega L_c^e + e_K x^e I_n}{A x^e I_n} \quad \textit{subject to} \quad \frac{\omega L_c^e}{x^e I_n} = \frac{C_1}{e_K} \quad x^e \neq 0 \quad e_K > 0 \quad (13)$$

The expected total cost of output $(cost^e)$ includes the cost of increasing employment and the cost of capacity investment. Minimization of the total cost per unit of output will be done under a condition, the cost of job creation per unit of capacity investment being inversely proportional to the marginal efficiency of capital. This condition reflects the risk that competitors will arise over the long term, this risk being all the stronger as the marginal efficiency of capital is greater; it aims to minimize the risk of loss of competitiveness in the long term.

The minimization formula is equivalent to $Min\{(1-\propto)e_c^a A + e_K\}$ under the condition $C_1^{'} = e_c^a e_K$, given the relationship $\omega L = (1-\propto)Y$ where $\propto$ is the profit share in income at time *t*. The solution is easily obtained by the substitution of the condition into the function to be minimized:

$$f(e_c^a, e_K) = (1-\propto)e_c^a A + e_K = (1-\propto)e_c^a A + \frac{C_1'}{e_c^a} \quad (14)$$

[6] We consider the additional cost per unit of additional output.

$$\frac{\partial f}{\partial e_c^a} = (1-\propto)A - \frac{C_1'}{(e_c^a)^2} = 0 \quad \frac{\partial^2 f}{\partial (e_c^a)^2} > 0 \tag{15}$$

The minimum[7] is such that:

$$e_c^a = \frac{e_K}{(1-\propto)A} \qquad 0 <\propto< 1 \qquad e_c^a < 1 \tag{16}$$

This elasticity is completely defined; it is a function of the marginal efficiency of capital and of the profit share in income.

2.3.2 The constraint of short-term return on capital

Entrepreneurs aim to obtain, in the short term, an investment return equal to the expected return, i.e. the marginal efficiency of capital e_K:

$$\frac{\propto \dot{Y}^e}{I_n} = e_K \quad \Rightarrow \quad x^e = \frac{e_K}{\propto A} \qquad x^e \leq 1 \quad \Rightarrow \quad e_K \leq \propto A \tag{17}$$

As a result, the RCI is a function of the marginal efficiency of capital. The existence of conditions on the elasticity (equation 16) induces a condition on the profit share, which must be less than 1/2:

$$x^e = \frac{1-\propto}{\propto} e_c^a \qquad x^e = 1 \;\; and \;\; e_c^a < 1 \quad \Rightarrow \quad 0 <\propto< 1/2 \tag{18}$$

2.3.3 The constraint of return on capital independent of strategies

The return on investment depends on the expected increase in employment, assuming that profit share in income and wages are constant over time:

$$\frac{\propto \dot{Y}^e}{I_n} = \frac{\propto}{1-\propto} \frac{\omega \dot{L}^e}{I_n} = \propto A[(e_c^a + e_d^a)x^e - e_d^a] \tag{19}$$

In a stylized way, two strategies are possible: either a change in the RCI or a change in the elasticities. Both strategies must be equivalent in terms of return so that companies remain profitable whatever strategy is chosen. From equation (19), we obtain:

$$(e_c^a + e_d^a)dx^e = x^e de_c^a + x^e de_d^a - de_d^a \quad \Rightarrow \quad e_c^a + e_d^a = x^e \frac{de_c^a}{dx^e} + (x^e - 1)\frac{de_d^a}{dx^e} \tag{20}$$

Taking into account equation (18), one obtains:

$$\frac{\propto}{(1-\propto)} x^e + e_d^a = \frac{\propto}{(1-\propto)} x^e + (x^e - 1)\frac{de_d^a}{dx^e} \quad \Rightarrow \quad e_d^a + (1 - x^e)\frac{de_d^a}{dx^e} = 0 \tag{21}$$

$$e_d^a = u(1 - x^e) \qquad u = constant \tag{22}$$

As a result, the optimum shape of the elasticity related to jobs destroyed is a decreasing function of the RCI. In addition, entrepreneurs expect the same return on capital associated with pure rationalization investment (RCI equal to 0) and pure capacity investment (RCI equal to 1). The expected profit for pure rationalization investment is equal to the reduction in the wage bill, in view of the loss of jobs and stagnation of wages. Whence:

$$(1-\propto)uA = \propto A \qquad \Rightarrow \qquad e_d^a = \frac{\propto}{(1-\propto)}(1 - x^e) = \frac{\propto A - e_K}{(1-\propto)A} \tag{23}$$

Ultimately, the elasticity related to jobs destroyed is a function of the marginal efficiency of capital and of the profit share in income[8].

[7] The solution can also be obtained by writing as equal the two terms of the sum to be minimized.
[8] The sum of the two elasticities is a constant.

2.4 EFFECTIVE AND COMPETITIVE EQUILIBRIUM

The "effective and competitive" equilibrium is defined as that of the effective demand anticipated by the entrepreneurs and supported by a competitive supply. The RCI and the elasticities are now functions of the marginal efficiency of capital. Entrepreneurs, after having defined the marginal efficiency e_K, are able to determine the increase in output $\dot{Y}^{ec}$, the increase in employment $\dot{L}^{ec}$ and the increase in investment $\dot{I}^{ec}$:

$$\dot{Y}^{ec} = \frac{e_K}{\propto} i_n Y \qquad \dot{L}^{ec} = \frac{2e_K - \propto A}{1 - \propto} i_n L \qquad \dot{I}^{ec} = (1 - p_{\dot{C}}) \frac{e_K}{\propto} i_n Y \tag{24}$$

The result is that the effective and competitive equilibrium is uniquely defined and that the growth rates of output, employment and investment at equilibrium are expressed in terms of the marginal efficiency of capital:

$$\frac{\dot{Y}^{ec}}{Y} = \frac{e_K}{\propto} i_n \qquad \frac{\dot{L}^{ec}}{L} = \frac{2e_K - \propto A}{1 - \propto} i_n \qquad \frac{\dot{I}^{ec}}{I} = \frac{(1 - p_{\dot{C}})}{(1 - p_C)} \frac{e_K}{\propto} i_n \tag{25}$$

where p_C is the mean propensity to consume. These equations are valid for a non-zero marginal efficiency of capital. On the other hand[9]:

$$e_K = 0 \qquad x^{ec} = 0 \qquad \dot{Y}^{ec} = 0 \qquad \dot{L}^{ec} = -\frac{\propto A}{1 - \propto} i_n L \qquad \dot{I}^{ec} = 0 \tag{26}$$

At the effective and competitive equilibrium, a remarkable linear equation links the output growth rate, the employment growth rate and the net investment rate:

$$\frac{\dot{Y}^{ec}}{Y^{ec}} = \frac{1 - \propto}{2 \propto} \frac{\dot{L}^{ec}}{L^{ec}} + \frac{A}{2} i_n \tag{27}$$

Thus, the output growth rate is a linear function of both the employment growth rate and the net investment rate, the coefficients being a function of the profit share in income and of the PCI respectively. This equation is independent of the RCI, which makes it a relationship independent of the economic cycle.

We will now make a simplifying hypothesis, generally observed in reality over a certain period: the mean propensity to consume p_C and the proportion of replacement investment δ are assumed to be constant, which makes it possible to write:

$$p_C = p_{\dot{C}} = constant \qquad I_n = (1 - \delta) I = (1 - \delta)(1 - p_C) Y \tag{28}$$

As a result, the net investment rate is also constant[10]:

$$i_n = \frac{I_n}{Y} = (1 - \delta)(1 - p_C) = constant \tag{29}$$

The fundamental equations become:

$$\frac{\dot{Y}^{ec}}{Y} = \frac{\dot{I}^{ec}}{I} = \frac{e_K}{\propto} i_n \qquad \frac{\dot{L}^{ec}}{L} = \frac{2e_K - \propto A}{1 - \propto} i_n \tag{30}$$

2.5 THE STEADY STATES

The process of economic growth is modeled by a succession of effective and competitive equilibria anticipated by entrepreneurs. In order to identify the stationary states of this process in the long term, we assume that the expectations of entrepreneurs are satisfied in reality and that long-run growth is balanced[11]. It is shown here that, in the long term, the stationary states

[9] It is not possible to minimize the expected total cost per unit of output.

[10] This assumption is sometimes considered as a stylized fact; see for example De Long and Summers (1991) or Levine and Renelt (1992).

[11] Following the line of studies by Harrod (1939, 1948), Domar (1947), and Aghion-Howitt (1998).

are steady states, the growth rates of output and employment being constant over time. Three remarkable insights are deduced.

The expected values of the fundamental variables meet the reality:

$$\dot{Y}^{ec} = \dot{Y} \qquad \dot{L}^{ec} = \dot{L} \qquad x^{ec} = x \qquad \dot{I}_n^{ec} = \dot{I}_n \tag{31}$$

By definition (see Equation 16), the marginal efficiency of capital is equal to the marginal return on capital q:

$$e_K = \propto Ax = \frac{\propto \dot{Y}}{I_n} = q \tag{32}$$

It is now assumed that growth is balanced: the growth rate of output is equal to that of capital ("guaranteed" growth rate). In other words, the mean productivity of capital is constant over time. Whence:

$$\frac{\dot{Y}}{Y} = \frac{\dot{K}}{K} \Leftrightarrow \frac{Y}{K} = \frac{\dot{Y}}{\dot{K}} = constant = \frac{q}{\propto} = Ax \tag{33}$$

For steady states, the RCI is constant along with the marginal return on capital, the return on capital r and the capital/income ratio:

$$x = constant \qquad r = \propto \frac{Y}{K} = \propto Ax = q = constant \qquad \beta = \frac{K}{Y} = \frac{1}{Ax} = constant \tag{34}$$

Ultimately, output and employment growth rates, as well as the capital/income ratio and return on capital over the long term, depend on one variable, the RCI, taking values between 0 and 1. Hence, the growth rates in output, employment and investment will be symbolized by g_Y, g_L, g_I.

Thus, the stationary states are characterized by the following equations:

$$g_Y = g_I = Axi_n \qquad g_L = \frac{\propto A}{1-\propto}(2x-1)i_n \qquad \beta = \frac{K}{Y} = \frac{1}{Ax} \qquad r = q = \propto Ax \tag{35}$$

$$0 < x \leq 1 \qquad 0 < \propto < 1/2$$

For these stationary states, the growth rates of output and employment are constant over time; these are therefore steady states. The main fundamentals in the steady states are expressed simply by the PCI, the net investment rate, the RCI, and the profit share in income.

In general, the greater the share of investment engaged in additional output capacities, the stronger the growth and return on capital. In other words, the more successful entrepreneurs become in increasing returns, the higher the growth rate and the return on capital. The search for maximum return by entrepreneurs encourages them to increase the RCI. So, the RCI reflects the growth regime of the economy.

The PCI and the net investment rate are exogenous data. The first reflects the speed of technical progress allowed by the techniques used and the institutions that accompany them. It does not therefore reflect the level of technical progress; a lagging economy could be characterized by a higher PCI than an advanced one. Net investment rate depends in particular on monetary conditions, which are not discussed here.

3 THE PROFIT SHARE IN INCOME

The profit share in income plays an important role in this growth model and the "magic number" of 1/3 has a theoretical justification.

3.1 A LINEAR RELATIONSHIP BETWEEN OUTPUT, EMPLOYMENT AND INVESTMENT DEPENDING ON THE PROFIT SHARE

The first salient insight lies in the long-run linear output-employment-investment relationship that the steady states verify:

$$g_Y = \frac{1-\propto}{2\propto} g_L + \frac{A}{2} i_n \qquad 0 < \propto < 1/2 \qquad g_Y > 0 \qquad -\frac{\propto}{1-\propto} A i_n < g_L \leq \frac{\propto}{1-\propto} A i_n \quad (36)$$

We have seen that this equation is valid when the rate of investment varies (see Equation (27)), which makes it possible to talk more generally about a relationship between output, employment and investment. However, here we will consider an output-employment relationship when the net investment rate is considered constant.

For a given profit share in income $\propto$, the set of steady states is represented by the segment $G_0 G_{mx}$ of Figure 2. G_{mx} represents the maximum long-term growth path: the growth rates o f output and employment are then maximal, with all new productive combinations being engaged in increasing returns. G_e represents the growth path with stable employment, the RCI being equal to 1/2.

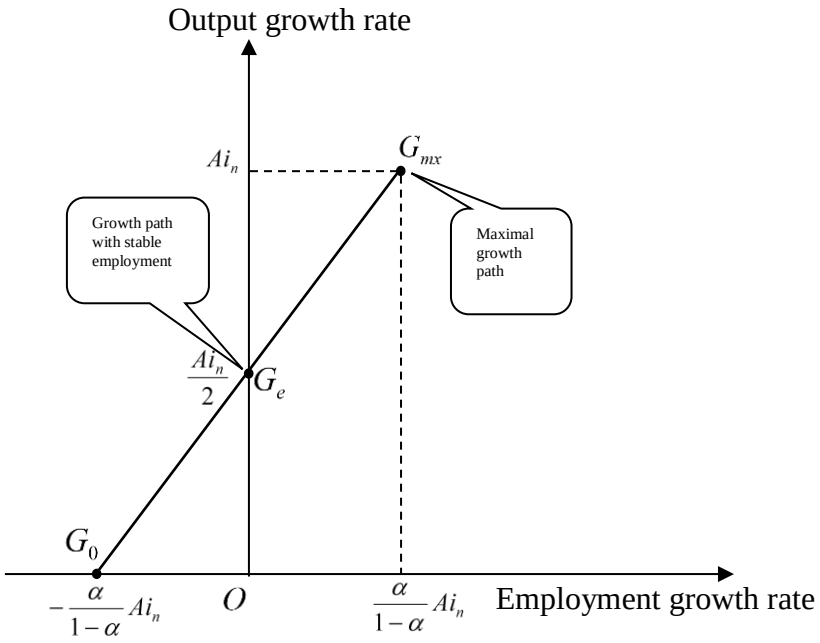

Figure 2 The linear relationship between output and employment

Figure 3 represents the zone defined by the set of line segments $G_0 G_{mx}$ when the profit share in income varies, but is at most equal to 1/2. Is the economy wage-led or profit-led? The possibility that demand-led regimes could be either wage-led or ptofit-led was first opened by Blecker (1989), Bhaduri and Marglin (1990) and Marglin and Bhaduri (1990).

In the figure 3, consider a given positive employment growth rate, of course less then Ai_n. We can see that a decrease in the profit share leads to an increase in the output growth rate; thus, the economy is wage-led. On the opposite side, if the employment growth rate is negative, the economy is profit-led. Usually, the economies have a positive employment growth rate on the long term; so, most of them are wage-led economies.

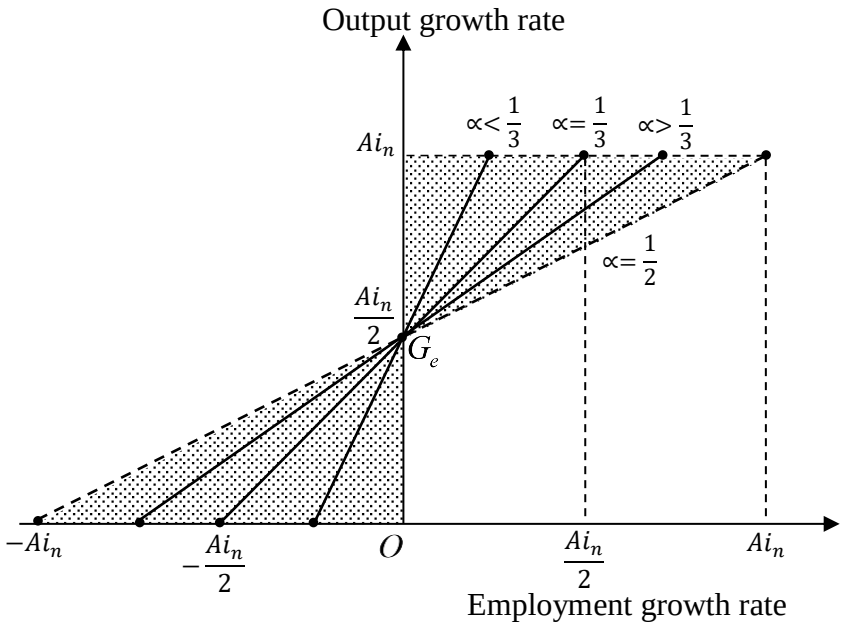

Figure 3 Possible linear relationships

3.2 THE MAGIC NUMBER OF 1/3 AND ITS ROLE

First of all, we show the existence of the "magic number" of 1/3 for the profit share in income in a special economic case and then we study the other cases.

3.2.1 The "magic number" of 1/3 for the profit share in income

Let the productivity growth rate or the wage growth rate in relation to the employment growth rate be written[12]:

$$g_{Y/L} = g_w = g_Y - g_L = \frac{1 - 3 \propto}{2 \propto} g_L + \frac{A}{2} i_n = -g_L + xAi_n \tag{37}$$

The "magic number" of 1/3 apppears in equation (37). For a profit share in income of 1/3, wage growth is independent of both employment growth and the RCI. In other words, the wage gains in firms where employment grow strongly will be equal to those found in firms that grow weakly.

This growth model offers an explanation for this "magic number". If the labor market operates in a perfectly homogeneous manner for the diffusion of wage gains, a wage standard is imposed on all firms and wage gains are independent of employment growth. In this case, the profit share in income must be exactly 1/3. The profit share in income of 1/3 characterizes a distribution that we will describe as "neutral", that is to say a distribution that does not distort the growth of the wages according to growth of employment.

What happens if the labor market is subject to rigidities for the dissemination of wage gains? When there is a distortion of wage gains for or against firms that grow strongly, the profit share in income has a value other than 1/3.

When the profit share in income is less than 1/3, wage gains grow at the same time as employment, making firms that create jobs very attractive. We can then assume that, in the long term, this property induces economic dynamism (an increase of the RCI) and finally a decrease in the capital/income ratio.

[12] From eqaution (36).

3.2.2 The profit share above 1/3 and the economic slowdown

When the profit share in income is greater than 1/3, wage gains decline when employment increases, which does not make companies that create jobs attractive. Entrepreneurs' expectations in terms of job creation may then not be met. This property could lead, in the long term, to an economic slowdown (a decrease in the RCI) and finally an increase in the capital/income ratio.

This property is illustrated by Figure 4 which represents the evolution of the wage growth rate as a function of employment growth rate when the profit share is less than 1/3 or more than 1/3. The wage rigidity, i.e. the wage growh rate is constant, leads to a negative employment growth rate when the profit share becomes higher than 1/3; thus, the output growth rate decreases.

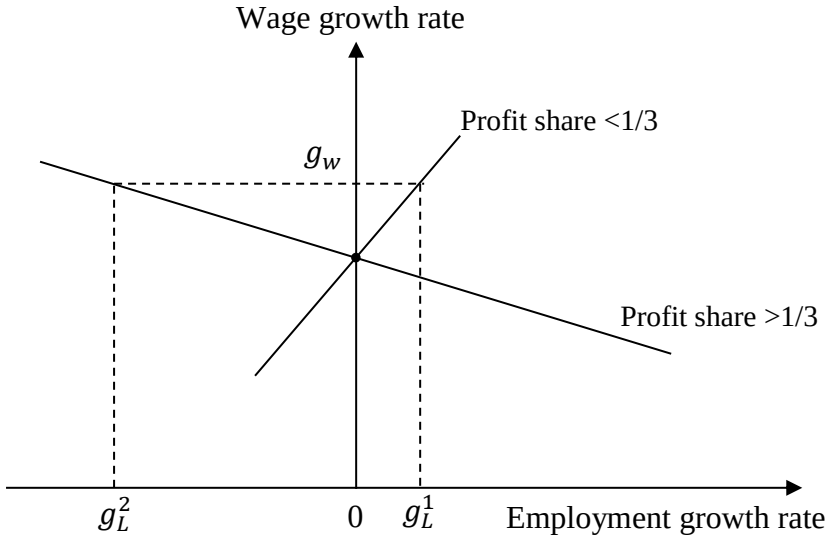

Figure 4 The economic slowdown when the profit share is above 1/3

3.2.3 A high-performing economy in the long term with 1/3 for the profit share

We can now illustrate the lessons of this new model for a high-performing economy characterized by the maximal output growth rate or the maximal return on capital (RCI de 1), the full employment and the maximal employment growth rate (profit share of 1/3), assuming the labor force growth rate *n* and the capital/income ratio β. Hence, for a high-performing economy:

$$x = 1 \qquad \Rightarrow \qquad g_Y = Ai_n \qquad \beta = \frac{K}{Y} = \frac{1}{A} \tag{38}$$

$$\propto = \frac{1}{3} \qquad g_L = n \qquad \Rightarrow \qquad g_L = n = \frac{A}{2}\, i_n \qquad i_n = 2n\beta \tag{39}$$

Table 1 presents the theoretical lessons. The output growth rate is the double of the labor force growth rate, the profit share in income is 1/3 (the neutral distribution) and the net investment rate depends only on the labor force growth rate and on the capital/income ratio.

Hypotheses	Theoretical lessons
Maximum output growth rate: $x = 1$ Full employment: $g_L = n$ Maximum employment growth rate: n Labor force growth rate: n Capital/income ratio: β	$g_Y = 2g_L = 2n$ $\propto = 1/3 \quad i_n = 2n\beta$ $g_Y = g_L + n$

Table 1 - A high-performing economy in the long term

Thus, the macroeconomic performances of a high-performing economy are determined solely by the labor force growth rate, the capital/income ratio and the proportion of replacement investment.

4 THE U.S. ECONOMY AND THE PROFIT SHARE IN INCOME

Could this growth model explain the trajectories of the U.S. economy, the largest advanced economy? To answer this question, the U.S. economy has been considered since the 1960s because precise data are available on the growth rates of GDP and employment, on rate of investment and on profit share in income.

The period 1961-2000 appears very favorable for a detailed comparison between the theoretical model and reality, given the regular and high growth observed as a trend, while rate of investment and profit share in income were relatively constant. Nearly full employment is encountered at the beginning and at the end of the period, which makes it possible to consider that the functioning of the labor market has been satisfactory, thus allowing the employment growth rate to adjust to the population growth rate. The profit share varied moderately, while being very close to the value of the theory of 1/3 characterizing a neutral distribution; moreover, the capital/income ratio varies very little over this period.

The period 2001-2015 will be examined later, given the occurrence of two crises, that of 2001 and that of 2008, called another Great Recession; over the decade, economic growth has declined markedly and full employment is no longer assured.

4.1 A HIGH-PERFORMING ECONOMY ON 1961-2000

For the period 1961-2000, precise annual data (see Appendix 2) on GDP and employment growth (in hours worked) and the gross investment rate, as well as the profit share in income[13] are available. Table 2 presents the mean annual values.

Empirical fundamentals for the United States economy	1961-2000
• GDP growth rate (g_Y^*)	3.61 %
• Employment growth rate (g_L^*)	1.64 %
• Net investment rate (i_n^*)	15.5%
• Profit share in income $(\propto^*)$	34.0%

Table 2 - Fundamentals of the United States economy (1961-2000)

[13] The data are from the World Bank (World Development Indicators-WDI-August 2016) for the GDP growth rate and the gross investment rate, from the Groningen Center for the growth rate of total hours worked (The conference Board and Groningen Growth and Development Center, Total Economy Database, August 2016, http://www.ggdc.net). Data on the profit share in income from 1961 to 2000 is taken from the European Commission (Annual macro-economic database – AMECO – May 2017). In the absence of net investment in databases, it is assumed that the proportion of replacement investment is typically 30%.

Based on these data, the theory presented makes it possible to calculate the mean values of the PCI and the RCI, whose equations are recalled below:

$$A = \frac{2 \propto^* g_Y^* - (1 - \propto^*) g_L^*}{\propto^* i_n^*} \qquad x = \frac{\propto^* g_L^*}{2 \propto^* g_Y^* - (1 - \propto^*) g_L^*} \tag{40}$$

Table 3 presents the PCI and RCI characterizing this economy over the period 1961-2000.

United States growth model: parameters	1961-2000
• Productivity of capacity investment (PCI)	0.260
• Ratio of capacity investment (RCI)	89.7%

Table 3 - Characteristics of the growth model of the United States economy (1961-2000)

A first striking result is the following: with an RCI of 89.7%, the average fundamentals of the economy are characteristic of the maximum growth path. In other words, the economy is, on average over the broad period 1961-2000, positioned on the path of maximum growth of output and employment, with a distribution very close to the neutral distribution of 1/3.

Are wage gains independent of employment growth, as the theory shows? For the period 1961-2000, we find no correlation between labor productivity growth and employment growth. Several economists have also made this observation over a long period[14]. For example, Salter (1960, 1966) found that there was no correlation between labor productivity gains and employment growth[15] in his survey of 27 industrial sectors of the U.S. economy from 1923 to 1950. Hansen-Wright (1992) also find that there is no correlation between labor productivity and employment. Thus, as predicted by the growth model, this profit share in income close to 1/3 is clearly associated with an independence of wage gains in relation to the growth of employment.

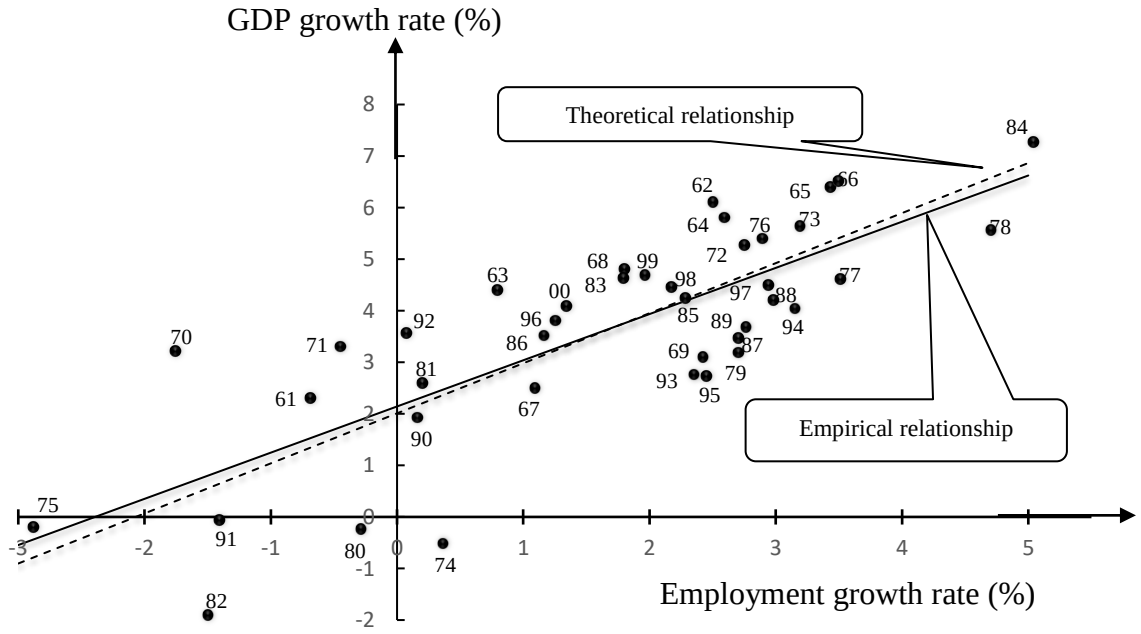

Figure 5 United Sates (1961-2000): the annual growth paths and the relationships

[14] It is also a conclusion of Keynes: 'Workers will not seek a much greater money-wage when employment improves.' (1936, p. 253).

[15] Given the long-term consistency of the profit share in income, the wage growth rate is equal to the growth rate of labor productivity.

Figure 5 shows annual growth paths for the period 1961-2000. The mean growth path (1.64%, 3.61%) is located at the top and is surrounded by a cloud of growth paths. There are only 5 recessions and all the other annual paths have an annual output growth rate above 1.9%: this fact shows the effectiveness of policies to stimulate the economy after recessions. On the short term, growth can largely exceed the long-term maximum[16], but this growth is not sustainable.

What is the linear empirical relationship, using the annual data? What is the theoretical output-employment relationship when assuming that the net investment rate is constant? The theoretical relation is determined from the known values of profit share in income, PCI and net investment rate (see tables 2 and 3).

Empirical relationship[17] (1961-2000)		Theoretical relationship (1961-2000)	(41)
$g_Y = 0.90 g_L + 0.0214$	$R2 = 0.62$	$g_Y = 0.97 g_L + 0.0201$	

The empirical relationship is significant and the differences between the theoretical and empirical coefficients are of the order of 8%.

Figure 5 shows also the theoretical relationship and the empirical relationship. It illustrates the unbalanced nature of annual economic growth and the trajectory of the fundamentals winds around the steady states. This figure reflects that the instabilities are, in a way, channeled around the long-term relationship characterizing the steady states. This should be seen as the impact of adaptive strategies of entrepreneurs and the result of the competitive functioning of the different markets.

This finding of an output-employment coefficient of about one over a long period (equations 41) is consistent with the measurement made for different sectors and different historical periods. Indeed, Bernanke and Parkinson (1991), in the study of the evolution of output and employment in ten industries for the two periods 1924-1939 and 1955-1988, showed in the linear regressions a coefficient of employment of 1.07 and 0.96 respectively[18].

4.2 2001-2015: THE INSIGHTS

We have shown the good fit between the new growth model and the data for the 1961-2000 period of the U.S. economy. Is it still verified for the years 2001-2015? The increase of the profit share in income since 2001 and the Great Recession of 2008-2009 introduce a rupture in economic fundamentals, which leads us to consider two periods, 2001-2008 and 2009-2015.

Table 4 summarizes, for the three successive periods since 1961, the macroeconomic fundamentals[19] as well as the RCI, the PCI. The bursting of the stock market bubble in 2001-2002 resulted in lower GDP growth and a drop in employment growth; the GDP growth rate drops further after the Great Recession.

United-States	g_Y	g_L	i_n	$\propto$	RCI	PCI
1961-2000	3.61 %	1.64 %	15.5 %	34.0 %	89.7 %	0.260
2001-2008	2.10 %	0.14 %	15.4 %	36.3 %	53.0 %	0.257
2009-2015	1.40 %	0.39 %	13.2 %	38.7 %	64.3 %	0.165

Table 4 - United States from 1961 to 2015: comparison of the three periods

[16] The maximum long-term growth is 4.03 % (RCI=1).
[17] The standard errors linked to the coefficients are 0.12 and 0.003.
[18] In 72% of the cases, the coefficients for the different sectors are between 0.8 and 1.3 (based on quarterly observations).
[19] The same data bases are used (see 4.1).

Over these two periods, the profit share in income increases sharply and rapidly, by about 2.3 points for 2001-2008 and 4.7 points for 2009-2015 compared to the period of prosperity. The first lesson highlights, for the PCI, the continuity for 2001-2008 then its significant decline of the order of 36% after the Great Recession. The rupture introduced by the Great Recession is reflected in a brutal collapse of effective demand and, ultimately, that of the PCI, despite the massive stimulus policy implemented in 2009-2010.

The second lesson highlights the correlation between the trend decline in the GDP growth rate and the very rapid rise in the profit share in income. Recall that the theory emphasizes that a profit share greater than 1/3 may induce long-term slowing growth. The impact of such an increase should therefore be questioned, since the long period of prosperity between 1961 and 2000 had been characterized by a profit share that was almost constant and very close to the value of 1/3 of a neutral distribution. Effective demand is probably not strong enough, especially given the rises in profits and in household savings.

Annual GDP growth in the United States has slowed considerably since the 2000s and has not returned sustainably above 3%, whereas it was a long-term feature throughout the 20th century, apart from periods of great crisis, of course. The new growth model shows that an important reason lies in the share of profit in income, the recent period being associated with a significant value overrun of 1/3 while the long period of prosperity was associated with value of around 1/3.

The aggravating fact, especially since the beginning of this new century lies in the rapid rise of inequalities; in particular, high-income earners became more numerous at the same time as the gap with the average wage increased. These employees (managers) have a propensity to consume much lower than that of the average employee, which contributes to depress demand. This tends to further weaken long-term demand, pulling down economic growth. The same conclusion is drawn by Palley (2014) showing that growth slowed because income inequality increased owing to a wage-bill shift from worker to manager.

As a result, an annual long-term growth of more than 3% in average, is compromised by both the excessive share of profit in income and the rise in income inequality.

5 DISCUSSION AROUND THIS NEW GROWTH MODEL

5.1 AN ENDOGENOUS AND KEYNESIAN MODEL OF GROWTH

It was only with the development of the theory of aggregate demand theory by Keynes (1936) that the rule of aggregate demand in the growth process was clearly recognized. But Keynes was mainly interested in the short period theory of unemployment.

A recurring theme in alternative theories about economic growth is the role of long-term aggregate demand (Setterfield, 2010). Dutt (2010) reconciles supply and demand in long-term growth analysis and shows that "aggregate demand can have an effect on growth not only in the short term but also in the long term".

Our endogenous and Keynesian growth model is consistent with the ideas of Dutt and Setterfield because it shows the importance of long-term aggregate demand for two reasons. The first reason lies in the growth process, which is an infinite chain-reaction where the additional demand is always decisive. The second reason lies in the too high profit share in income, which reduces long-term demand and, consequently, the output growth rate.

In our growth model, the concept of aggregate demand was combined with the increasing returns advocated by Palley (1996, 1997). It is a key point which highlights the role of long-term demand in an endogenous model.

This new growth model rehabilitates rational expectations formulated by entrepreneurs, be it on output, employment, investment, wages, profits and, of course, on future return on investment. It thus highlights the chain-reaction constituted by successive increases in supply and demand, the chain-reaction being regulated by the marginal efficiency of capital.

Rationality is bounded, taking into account the complexity of the decisions to be made. Maximization of profit is obviously sought, but minimization of unit output cost, with a concern for long-term competitiveness, is an indispensable step, as Schumpeter had theorized.

The growth process is based on an *AK*-type endogenous growth model. However, capital *K* does not integrate "human capital" as do many models of endogenous growth. As Piketty (2014) notes, after long-term analysis of changes in the capital/income ratio and capital/labor sharing, there is no evidence of a "human capital" that should have altered these developments.

The *AK* model is combined with a process of creative destruction, as Aghion-Howitt (1998) have studied: however, it is assumed that creative destruction manifests itself through two types of investment (capacity and rationalization) and not through types of innovation.

In general, economic development is based on the material (including software) and social technologies implemented. Investments, of a material or software nature by definition, are accompanied by intangible investments (training, organization, etc.) which are not modeled here. However, the PCI seems to indirectly reflect the productive efficiency of these intangible investments and also that of the functioning of the labor market. The maximum long-term growth reflects the excellence of a growth regime that combines new technologies, social technologies, innovation processes and the satisfactory functioning of the labor market.

In order to take into account many dimensions of anticipation, the model has been simplified on many non-fundamental aspects in the initial analysis. For example, the capital evolution equation has been simplified by modeling the volume of replacement investments. Investments have been categorized into the three usual categories (capacity, rationalization and replacement), while the reality may be more complex, with alternative investments that can incorporate technical progress and improve capacity. In the interests of simplification, we did not consider the capacity utilization rate which is thus integrated into the RCI.

5.2 THE CONSISTENCY WITH THE STYLIZED FACTS OF VERDOORN, OKUN AND FERRI

Many economists have identified stylized facts. We will focus on the stylized quantitative facts of Verdoorn (1949, 1993), Okun (1962, 1970) and more recently of Ferri (2016), the latter indicating a break with the arrival of the new millennium.

Is the linear theoretical relationship between output-employment-investment compatible with the empirical laws set forth by Verdoorn? Verdoorn's law (Verdoorn, 1949, 1993) estimates productivity elasticity relative to output to be close to 0.5; it is 0.484 according to Kaldor (1956). This has been the subject of numerous subsequent evaluations showing a wider spectrum of values; this elasticity "appears to be significantly different from both 0 and 1" (Boyer and Petit, 1981, p.1117)[20].

Our growth model provides an elasticity of 0.5 for an economy characterized by a maximum growth path and a neutral distribution, such as the U.S. economy (1961-2000), exactly the value found by Verdoorn and Kaldor.

[20] Values from 0.38 to 0.93 are found, for example, for the 1961-1973 period.

However, for economies characterized by other values of profit share in income or RCI, the elasticity could theoretically vary in practice from 0.5 to 1, which seems to be in line with the empirical reality.[21]

Okun's law (Okun, 1962, 1970) describes a linear relationship between the change in the unemployment rate and the GDP growth rate; below a certain threshold of economic growth, unemployment increases, above this threshold, it decreases, with constant elasticity. Okun's law is statistically valid for most countries, as confirmed by a study of 16 OECD countries (Lee, 2000). For example, Okun (1962) found this empirical relationship for the U.S. economy:

$$\dot{u} = -0.5(g_Y - 3\%) \tag{42}$$

For the period 1970-2008 (Blanchard and Cohen, 2009), the empirical relationship is:

$$\dot{u} = -0.41(g_Y - 3{,}1\%) \tag{43}$$

Our theoretical prediction of the variation of unemployment $\dot{u}$ for an economy characterized by a growth rate of the active population *n* and by a potential growth g_Y^p would be:

$$\dot{u} = n - g_L = n - \frac{2 \propto}{1-\propto} g_Y + \frac{\propto A i_n}{1-\propto} \tag{44}$$

$$\dot{u} = -\frac{2 \propto}{1-\propto}(g_Y - g_Y^p) \;\; with \;\; g_Y^p = \frac{1-\propto}{2 \propto} n + \frac{A}{2} i_n \tag{45}$$

The variation in unemployment is then theoretically a linear relation of the output growth rate, the elasticity depending only on the profit share in income. Always for the U.S. economy, for the period 1960-2000, the theoretically predicted relationship would be:

$$\dot{u} = -1.03(g_Y - 3.6\,\%) \tag{46}$$

For the same period, the empirical relationship[22] is:

$$\dot{u} = -0.38(g_Y - 3.5\,\%) \tag{47}$$

It is qualitatively consistent with Okun's empirical law. The main difference lies in the value of the elasticity, which is lower. Can we explain the difference? The discouraged worker effect is the main explanation (Long, 1953; Benati, 2001). When growth is lower than potential growth, the increase in unemployment is lower because some unemployed people are discouraged and leave the labor market; if not, some discouraged unemployed return to the labor market and the unemployed rate is higher than expected.

Ferri (2016) has established four new stylized facts that are different from those identified by Kaldor (1961) for the Golden age of capitalism and lately extended by Jones and Romer (2010): an increasing capital share[23], an augmenting wealth-output ratio, an increasing inequality process, a volatile rate of growth.

Those stylized facts are incompatible with the canonical ones. Nevertheless, our new Keynesian and endogenous model is consistent with those new facts. It has been demonstrated that an increasing capital share in income (above 1/3 for the U.S. economy since the 2000 years) induced a slowdown of the economy and an increase of the capital/income ratio. The long american period of prosperity with an average output growth rate of more than 3% per year is ended for the period 2001-2015. Of course, in those conditions, we can assume that the inequalities will increase.

[21] It is easy to demonstrate that the elasticity could increase from 0.5 to 1 (profit share of 0.25, RCI of 0.5).
[22] The unemployed rate is from Economics Outlook (OECD- June 2018).
[23] Karabarvounis and Neiman (2014) also established this stylized fact.

5.3 THE BHADURI-MARGLIN PARADOX

The vast majority of empirical studies on Bhaduri-Marglin model (1990)[24] finds that the larger economies, including the U.S. and the European Union as a whole, are wage-led overall during the last decades, while same smaller or more open economies are profit-led once foreign trade is taken into account (Onaran and Galanis, 2012; Blecker, 2014). Blecker has paid more attention to the time dimension of this distinction; rising profits may be helpful for stimulating a short-run recovery but the economy is wage-led in the long run.

Nevertheless, the governments operated since the 1980 years in the neoclassical belief that fuller employment is possible if one reduces the cost of labor and allows for low-wage flexible service jobs. "The strategy appeared to work as real wage restraint was associated with higher jobs growth" concluded Storm and Naastepad (2017, p.5). The paradox is the following: how could this happen in wage-led economies?

In our growth model, an increase of the profit share in income leads to an increase in employment growth rate according the equation (35), all parametrers being equal. Consequently, the productivity growth rate decrases as the profit share has no direct impact on output growth rate when the profit share is less than 1/3. Storm and Naastepad have the same conclusion as they demonstrate that the key point is the slowdown of labor productivity growth.

Thus, an increase in profit share in income, when it is less than 1/3, can depress the productivity growth and lead to more employment. Nevertheless, the profit share continuing to increase above 1/3 will induce destruction of jobs and will increase the unemployment rate if the active population grows.

5.4 A DISTRIBUTION CONSISTENT WITH PIKETTY DATA

The profit share in income could result from the confrontation between the power of shareholders seeking the best profit and the bargaining power of unions struggling to obtain the best wage increase. As we have seen, Piketty (2014) described the major changes in the profit share in income over the very long term.

Is this new growth model consistent with Piketty's data? According to Piketty, the fundamental law of capitalism is $r > g_Y$. Thus:

$$r = \propto Ax \qquad g_Y = Axi_n \qquad r > g_Y \qquad \Rightarrow \qquad \propto > i_n \tag{48}$$

Our growth model, combined with the Piketty law gives a framework for the profit share:

$$i_n < \propto < \frac{1}{2} \qquad \text{in the long term, for durable growth: } i_n < \propto \leq 1/3 \tag{49}$$

The profit share in income for countries such as the United Kingdom and France has been between 20% and 40% since 1770 for the United Kingdom and 1820 for France. Thus, it has never been greater than 50%, which is also an upper limit for this theory.

Profit share in income is greater than 1/3 between 1810 and 1870 for the United Kingdom, and between 1840 and 1870 for France[25], which corresponds essentially to the time of the first industrial revolution. It is also the period of Marx's analysis of industrial capitalism during which wages stagnate or even regress and profits increase. This seems to confirm the theoretical idea that a profit share in income above 1/3 may be detrimental to long-term economic growth.

[24] See Bhaduri and Marglin (1990); Marglin and Bhaduri (1990).

[25] The profit share in income exceeds 40% and reaches about 45% around 1850-1860 for the United Kingdom and France.

Since the 1880s, the profit share in income has almost never been significantly higher than 1/3. It is well below 30% from 1920 for the United Kingdom and 1940 for France. This also seems to confirm the theoretical idea that such a profit share is generally beneficial for long-term economic growth. The 20% lower limit for the United Kingdom or France (in the 1970s and 1980s), is also consistent with the theoretical limit, with a net investment rate of around 16%.

6 MACROECONOMIC IMPLICATIONS

The distribution of income between capital and labor has important macroeconomic implications. A profit share in income of 1/3 is the one that maximizes job creation, as did the U.S. economy from 1961 to 2000. In general, wage policy must encourage the diffusion of productivity gains, in all firms, which should stimulate the economy.

When the profit share becomes greater than 1/3, firms are encouraged to cut jobs in order to maintain a significant wage increase. The risk is then to weaken demand and thus to cause further job losses; as a result, the economic downturn occurs. Since the beginning of the 21st century, the U.S. economy illustrates this risk. The latest considerations underscore the need to stimulate long-term demand.

In addition, the endogenous and Keynesian growth model and its validation by the U.S. economy since the 1960s has implications which are very important for today's advanced economies.

The entrepreneurs make key decisions based on the effective demand principle and the competitive supply principle, regarding additional supply, job creation, job destruction, capacity investment, rationalization investment, or still wage increase. The decisions depend on the anticipation of many macroeconomic variables. The proper functioning of the different markets (products and services, labor or financial) is required so that the entrepreneurs can anticipate variables, in a relevant way.

Our central premise is that both demand and supply factors play a role in the determination of long-run growth. In general terms, economic growth is determined by the chain interactions between increases in supply and demand, including in the long term, which leads to economic policies stimulating supply and demand in a coordinated way.

The better policy is to accelerate the chain-reaction between additional supply and demand. For example, when the additional supply induces new jobs well paid, the additional demand is higher. Also, when the additional demand is made of new innovating products produced domestically, the growth is accelerated. Of course, the domestic demand-led growth is a way of stimulating the chain-reaction.

The entrepreneurs are very sensitive to the state of confidence in the future that is reflected by the marginal efficiency of capital. A high level of confidence in the future favors the implementation of capacity investments, jobs creation and therefore economic growth, while a low level favors the implementation of rationalization investments, jobs destruction and therefore economic stagnation or recession. The public authorities must create this state of confidence in the future.

Of course, the finance sector plays an important role in the growth process. It can impact the marginal efficiency of capital as Keynes thought. In this growth model, it can also affect the choice of the entrepreneurs between the two kinds of investment, capacity or rationalization investments. Capacity investments are stimulated by the emergence of new products requiring new production capacities. Innovation is likely to maintain a strong increase in supply and demand if consumers like novelty. The U.S. economy illustrates over the long term this emphasis on innovation on the 1961-2000 period.

7 CONCLUSION

The value of 1/3 for the profit share in income, often encountered at different times in many economies, has a theoretical justification. This value is linked to a very flexible labor market where all firms have the same wage growth rate, regardless of employment growth. In other words, productivity gains are spreading perfectly in all firms. There is therefore a standard for the wage growth in all firms and so there is no correlation between the wage growth rate and the employment growth rate. This "magic number" is reached for the long period of prosperity of the U.S. economy from 1961 to 2000 where the profit share in income is on average 34%.

The demonstration is based on a new endogenous and Keynesian growth model. The process of economic growth must be seen as a chain-reaction between the supply and demand increases anticipated by entrepreneurs. This process leads entrepreneurs to take decisions about production, employment and investment, in accordance with the principles of the effective demand and of the competitive supply. This chain-reaction is regulated by the marginal efficiency of capital assessed by entrepreneurs.

Beyond the "magic number" of 1/3 for the profit share in income, there are two other major and unexpected insights. Firstly, output and employment growth rates and the net investment rate verify the following linear relationship:

$$g_Y = \frac{1-\propto}{2 \propto} g_L + \frac{A}{2} i_n$$

where $\propto$ is the profit share in income, i_n the net investment rate (or the net saving rate) and A the productivity of the capacity investment. This relationship is checked for the U.S. economy from 1961 to 2000.

Secondly, a profit share in income higher than 1/3 leads to an economic slowdown. This property is checked for the last period 2001-2015 of the U.S. economy; during this period, the profit share in income increased from 34.0% to 38.7%, while the mean annual growth decreased from 3.6% before 2000 to 1.8% over the last period.

All these results show the great interest of an endogenous and Keynesian model combining the effective demand principle and the competitive supply principle. These results are also consistent with quantitative stylized facts highlighted by many economists (Verdoorn, Okun, Bhaduri-Marglin and Piketty); they explain also some breakthrough facts characterizing the new millennium (Ferri).

The main macroeconomic implication is that aggregate demand has an effect on growth not only in the short term but also in the long-run. One way to stimulate growth is to speed up the chain-reaction between increases in supply and demand.

In view of these results, obtained using simplified modeling, this research path appears promising. The next step in this research project should be to study a wider spectrum of countries.

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APPENDIX 1: THE ORIGINS OF THE ENDOGENOUS AND KEYNESIAN GROWTH MODEL

For Keynes (1936), the entrepreneur makes decisions on output and employment by anticipating the supply-demand balance ("principle of effective demand"), taking into account a long-term forecast of the marginal return on capital ("marginal efficiency of capital"); the entrepreneur also seeks to minimize the risk of loss of competitiveness in the long term[26]. For Palley (1996, 1997), increasing returns must be combined with the principle of effective demand and accumulation of capital governed by investment.

For Schumpeter (1911, 1942), the entrepreneur is the source of creative destruction through investments to "produce more" or "produce differently"; the entrepreneur seeks to minimize the total cost per unit of output[27]. For Aghion-Howitt (1998), growth is an endogenous process compatible with creative destruction and whose steady state is sought.

For Piketty (2014), empirical examination of the distribution of wealth for more than two centuries shows that the return on capital is higher than the growth rate of the economy ($r > g$ described as the "fundamental law of capitalism"). There is also an interaction between the long-term profit share in income ($\propto$) and the capital/income ratio (β); furthermore, given the data, there is reason to doubt the existence of "human capital" as an output factor.

[26] 'The output from equipment produced to-day will have to compete, in the course of its life, with the output from equipment produced subsequently, perhaps at a lower labor cost, perhaps by an improved technique... Moreover, the entrepreneur's profit (in terms of money) from equipment, old or new, will be reduced, if all output comes to be produced more cheaply.' (Keynes, 1936: p. 141).

[27] 'Everyone agrees that private and socialist managements will introduce improvements if, with the new method of production, the total cost per unit of product is expected to be smaller than the prime cost per unit of product with the method actually in use.' (Schumpeter, 1942: p. 97).

These considerations are the basis of a model of a growth process based on entrepreneurs anticipating effective demand and competitive supply. Growth is endogenous and investments induce creative destruction. We define the principle of competitive supply, and then the "effective and competitive" equilibrium as the balance anticipated over a period by entrepreneurs who want to reach the balance of effective demand, while implementing competitive productive combinations. Thus, we combine the principle of effective demand and the principle of competitive supply in order to define "effective and competitive" equilibrium.

Obviously, "effective and competitive" equilibrium is never reached, without exception, and entrepreneurs must formulate a new equilibrium in the next period. We show that this growth process, consisting of a succession of effective and competitive equilibria sought by entrepreneurs, admits steady states in the long term, where expectations approach reality and growth is balanced.

APPENDIX 2: DATA ON U.S. ECONOMY (1961-2015)

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
g_Y	2.3	6.1	4.4	5.8	6.4	6.5	2.5	4.8	3.1	3.21	3.3	5.26	5.64	-0.52	-0.2	5.39	4.61	5.56	3.18	-0.25
g_L	-0.68	2.51	0.8	2.6	3.44	3.5	1.1	1.81	2.43	-1.75	-0.44	2.76	3.2	0.37	-2.87	2.9	3.52	4.71	2.71	-0.28
i	21.9	22.1	22.3	22.4	22.6	22.6	22.1	22	22.9	21.2	21.2	21.8	22.2	21.7	20.6	21.1	22.4	23.7	24.4	23.5
$\propto$	31.9	32.5	32.8	33.2	34.1	34 .2	33.4	32.9	31.8	30.9	31.9	32.2	32.5	31.9	33.4	34.1	34.2	34.5	34.4	33.5

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
g_Y	2.59	-1.91	4.63	7.26	4.24	3.51	3.46	4.2	3.68	1.92	-0.07	3.56	2.75	4.04	2.72	3.8	4.49	4.45	4.69	4.09
g_L	0.21	-1.49	1.8	5.05	2.29	1.17	2.71	2.99	2.77	0.17	-1.4	0.08	2.36	3.16	2.46	1.26	2.95	2.18	1.97	1.35
i	23.3	22.5	22.4	23.5	23.6	23.5	23	22.4	22	21.2	20.1	19.8	20	20.3	20.8	21.3	21.5	22.2	22.7	23
$\propto$	34.3	33.5	34.9	35.6	35.7	35.3	34.7	34.3	35.1	34.6	34.2	34.2	34.8	35.5	35.8	36.2	36.1	35.1	35.2	34.2

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
g_Y	0.98	1.79	2.81	3.79	3.35	2.67	1.78	-0.29	-2.78	2.53	1.60	2.22	1.49	2.43	2.43
g_L	-1.24	-1.26	-0.48	1.13	1.49	1.82	0.73	-1.03	-5.48	-0.02	1.55	1.73	1.24	1.89	2.09
i	22.4	21.4	21.5	22.0	22.8	22.9	22.1	21.0	18.6	18.0	18.3	19.0	19.1	19.5	19.6
$\propto$	34.4	35.4	36.0	36.4	37.4	37.3	37.0	36.8	37.7	38.7	38.8	38.8	39.3	39.1	38.6

Table - Annual GDP growth rate. annual employment growth rate. annual gross investment rate and annual profit shares in income for 1961-2015 (in %)