N° 5 septembre-octobre 2023 BIMESTRIELLE PP. 651-844

Revue d'économie politique

The 70th Congress of the French Economic Association

Lefebvre Dalloz
DALLOZ

Growth as a Chain Reaction: its Production Function, the Three Growth Regimes and the Advanced Economies

Alain Villemeur[1]

A new endogenous growth model has been developed, reconciling the ideas of Kaldor (economic growth as a chain-reaction), Schumpeter (creative destruction) and Keynes (effective demand); a new production function is obtained. From this growth model, it is shown that there are three growth regimes, with optima characterized by maximizing the return on rationalization investment or capacity investment. These lessons are consistent with the reality of 17 advanced economies (European, Anglo-Saxon, and Japanese) over the long period 1961-2018 for which we have precise data. These three growth regimes reflect economies during the post-war boom, highly job-creating Anglo-Saxon economies, but also economies that have performed poorly since the 2000s. The fundamentals are also consistent with the characteristics of the optima, thus reflecting the entrepreneurs' objective of maximizing the return on rationalization investment or capacity. Within each growth regime, increasing the profit share in income weakens GDP growth and productivity growth, while it can improve employment growth.

Advanced economies – Endogenous growth – Creative destruction – Effective demand – Return on investment

La croissance comme réaction en chaine : sa fonction de production, les trois régimes de croissance et les économies avancées

Un nouveau modèle de croissance endogène a été développé en réconciliant les idées de Kaldor (la croissance économique comme réaction en chaine), de Schumpeter (la destruction créatrice) et de Keynes (la demande effective) ; une nouvelle fonction de production est obtenue. A partir de ce modèle de croissance, il est démontré qu'il existe trois régimes de croissance, avec des optima caractérisés par la maximisation du retour sur l'investissement de rationalisation ou de capacité. Ces enseignements s'avèrent cohérents avec les réalités des 17 économies avancées (Européennes, Anglo-Saxonnes and Japonaise) sur la longue période 1961-2018 pour lesquelles nous disposons de données précises. Ces trois régimes de croissance reflètent des économies durant le boom économique d'après-guerre, des économies Anglo-Saxonnes très créatrices d'emplois mais aussi des économies aux faibles performances depuis les années 2000.

1. Alain Villemeur, Scientific Director of Chair "Demographic Transitions, Economic Transitions" (Paris-Dauphine University), Paris, France; villemeur@orange.fr. Author, with Jean-Hervé Lorenzi, of the recently published book « Global Theory of Growth and Distribution (2023).

Les fondamentaux sont également cohérents avec les caractéristiques des optima, reflétant ainsi l'objectif des entrepreneurs de maximiser le retour sur l'investissement de rationalisation ou sur l'investissement de capacité. Au sein de chaque régime de croissance, l'augmentation de la part du profit dans le revenu affaiblit la croissance du PIB et la croissance de la productivité, alors qu'elle peut améliorer la croissance de l'emploi.

Economies avancées – Croissance endogène – Destruction créatrice – Demande effective – Retour sur investissement

Codes JEL : D33, E23, E24, E25, O40

1. Introduction

A new endogenous growth model has been developed (Villemeur [2019] [34]; [2021] [35]), reconciling the ideas of Kaldor (economic growth as a chain-reaction), Schumpeter (creative destruction) and Keynes (effective demand); a new production function is obtained. This growth model based on these foundations has shown its potential interest and its consistency with data from the United States (U.S.) economy over the long period of prosperity 1961-2000; in particular, the new production function is consistent with the fundamentals of the U.S. economy. The importance of making a distinction between rationalization and capacity investment is highlighted.

Within this growth model (called "KSK growth model"), we demonstrate that there are three growth regimes, with their optima characterized by maximizing the return on rationalization investment or capacity investment.

Can we identify the three growth regimes of advanced economies over the long term? To answer this, we study the macroeconomic trajectories of 17 advanced economies, over a long period beginning from 1961, when we have accurate macroeconomic data for all these economies. The 17 advanced economies are the following: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Italy, Japan, Netherlands, Portugal, Spain, Sweden, United Kingdom, U.S.

We have theoretically shown that there are three growth regimes and three optima:

- the "Employment decline, constrained" regime, where the optimum is maximization (under constraint) of the return on rationalization investment;
- the "Employment growth, constrained" regime, where the optimum is maximization (under constraint) of the return on capacity investment;
- the "Employment growth, unconstrained" regime, where the optimum is maximization (without constraint) of the return on capacity investment.

Many European economies and Japan, with strong GDP and productivity growth during the post-war boom, are represented by the "Employment decline, constrained" regime or by the "Employment growth, constrained" regime, with a profit share of less than 1/3.

Since the year 2000, the advanced economies are generally represented by the first two growth regimes with a share of profit in income greater than 1/3 and with poorer macroeconomic performances.

Anglo-Saxon economies, such as Australia, Canada, and the United States, which are able to create many more jobs than other economies, are often represented by the "Employment growth, unconstrained" regime; then, the profit share in income is close to 1/3.

Each growth regime seems to reflect the decisions of entrepreneurs seeking to optimize the returns of investments, either of capacity investments or of rationalization investments. Within each growth regime, increasing the profit share in income weakens GDP growth or productivity growth, while it can improve labor market performance. It appears that profit share values are typically between 26% and 40%; a profit share above 40% is very detrimental to economic growth and can lead to depression in later periods.

In section 2, we recall the main lessons of the seminal endogenous growth model. In section 3, we extend the original growth model and we demonstrate the existence of three growth regimes and three optima, depending on the return on investments. In section 4, the fundamentals of 17 advanced economies since 1961 reveal these three growth regimes and an optimum for each growth regime. In section 5, this "KSK growth model" is discussed by showing its consistency with quantitative stylized facts highlighted by Ferri ([2016] [13]), Bhaduri and Marglin ([1990] [4]), Storm and Naastepad ([2017] [33]) and Piketty ([2014] [28]). In section 6, we present the stylized growth regimes consistent with the evolutions of the 17 advanced economies over the long period (1961-2018).

2. Growth process: the chain reaction and its production function

In this section, we recall the development of the new endogenous growth model and the main lessons (Villemeur [2019] [34]; [2021] [35]) in a succinct and synthetic way, in order to make the theoretical extensions that are then developed understandable.

2.1. The foundations of the KSK growth model

This new endogenous growth model starts from Kaldor's vision of the economic growth process (Kaldor [1972] [20]). Kaldor carried out a series of

studies aiming to characterize the process of economic growth ([1956] [18]; [1961] [19]; and [1972] [20]), specifically its relationships with the principle of effective demand, accumulation of capital, increasing returns and technical progress. He concluded the following: "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" (Kaldor [1972] [20]).

This vision of a chain reaction, neglected in subsequent economic growth literature, is the foundation of a new endogenous growth model also built on many economists' ideas (Appendix 1). The role of entrepreneurs is at the heart of this growth model and its main foundations are as follows:

— The entrepreneurs are the source of creative destruction through investments to "produce more" or "produce differently" (Schumpeter [1911] [30]; [1942] [31]).

— The entrepreneurs make decisions on output and employment by anticipating the supply-demand balance ("principle of effective demand"), accounting for a long-term forecast of the marginal return on capital ("marginal efficiency of capital") according to Keynes ([1936] [22]).

— The increasing returns are at work (Young [1928] [36]) and must be combined with the principle of effective demand (Palley [1996] [26]; [1997] [27]).

— The growth process is based on an AK-type endogenous growth model (Romer1986 [29]; Aghion & Howitt [1998] [1]).

However, capital K does not integrate "human capital" as many models of endogenous growth do. Piketty ([2014] [28]) notes that after long-term analysis of changes in the capital/income ratio and capital/labor sharing, there is no evidence that "human capital" has altered these developments. In this new growth model, technical progress is included in the labor and capital factors. Human capital favors creating new ideas and the diffusion of innovations (Nelson and Phelps [1966] [24]).

There are three types of investment (volume I):

- Replacement investment: with replacement investment, entrepreneurs maintain output and jobs. The volume of the replacement investment is δI, δ being the proportion of replacement. The volume of net investment is $(1-\delta)I$.
- Capacity investment: through capacity investment, entrepreneurs create jobs and produce more, with increasing returns. The share of the net investment volume committed to additional production and employment is x; it is referred to as the "Ratio of capacity investment" (Rci). The volume of capacity investment is $x(1-\delta)I$.
- Rationalization investment: by using rationalization investment, entrepreneurs destroy jobs and maintain the same production. The volume of the "rationalization investment" is $(1-x)(1-\delta)I$.

Economic growth results from a chain reaction between demand escalations, induced by increases in supply and supply escalations, evoked by increases in demand. Each process triggers the next, which is characteristic of a chain reaction; the subsequent process can be boosted (economic boom) or stifled (stagnation or economic recession).

In the short term, entrepreneurs formulate 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 decide to obtain the most competitive productive combinations, while considering the conditions prevailing in the different markets. For example, they must 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, considering labor and financial market conditions.

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 (output, employment, investment, technologies, wage, profit…) to adapt to the new context by constantly seeking competitiveness and the balance between supply and demand. For example, for the next period, entrepreneurs must decide on the expected increase in output and the expected increase in employment. They have to choose between different technologies, some creating jobs, others destroying jobs. They must also be sure of the competitiveness of future productive combinations.

The methodology is as follows: the chain reaction is modeled for the short term, then we determine the steady states (Barro & Sala-I-Martin [1995] [3]), over the long term, assuming that the expectations of the entrepreneurs are satisfied in reality and that the long-term growth is balanced.

Two main lessons are highlighted. First, in the new production function, the output growth rate is a linear function of employment growth rate and of net investment rate; the elasticities depend on the profit share in income and on the productivity of the capacity investment. Second, the number of 1/3 for the profit share in income is theoretically justified when wage growth is independent of employment growth. The main hypothesis and the main stages of the demonstration are presented in Appendix 2.

2.2. The new production function

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

$$g_Y = \frac{1-\propto}{2\propto} g_L + \frac{A}{2} i_n \qquad 0 < \propto < 1/2 \qquad g_Y > 0 \qquad -\frac{\propto}{1-\propto} A i_n < g_L \leq \frac{\propto}{1-\propto} A i_n \qquad [1]$$

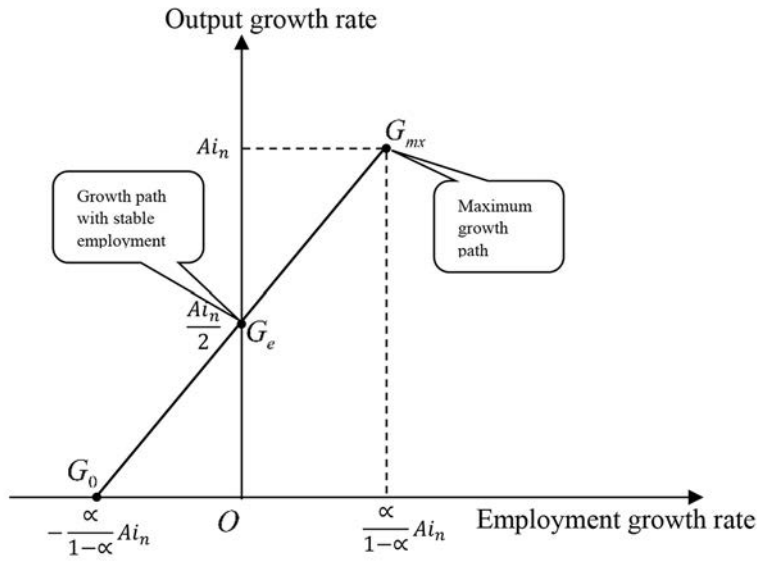
The growth rates of production and employment are symbolized by g_Y and g_L; $\propto$ and i_n are the profit share in income and the net investment rate respectively. A is the "Productivity of the capacity investment" (Pci), *i.e.*, the productivity per unit volume of capacity investment; it is assumed to be constant in the time. The Pci reflects the productivity of the investments used in the growth of production.

This linear relationship is the result of two basic equations for the output growth rate and for the employment growth rate:

$$g_Y = Axi_n \qquad g_L = \frac{\propto A}{1-\propto}(2x-1)i_n \qquad 0 < x \leq 1 \qquad [2]$$

To establish this linear equation, we assume that the profit share in income and the net investment rate are constant over time. In this production function, the output-employment coefficient $(1-\propto/2\propto)$ is always greater than the same coefficient $(1-\propto)$ in the classic Cobb-Douglas production function (Cobb & Douglas [1928] [7]); another difference is found in the determinant of the net investment rate instead of the capital growth rate.

Figure 1. The relationship between output and employment growth rates



The Pci and the net investment rate are exogenous data. The first reflects the speed of technical progress made possible by the techniques used and the institutions that accompany them. It therefore does not reflect the level of technical progress; a technologically lagging economy could be charac-

terized by a higher Pci than the leading economy. The second depends on monetary conditions, which are not discussed here.

In general, the greater the share of investments made in additional production capacity, the greater the growth. In other words, the more entrepreneurs manage to engage in increasing returns, the higher the growth.

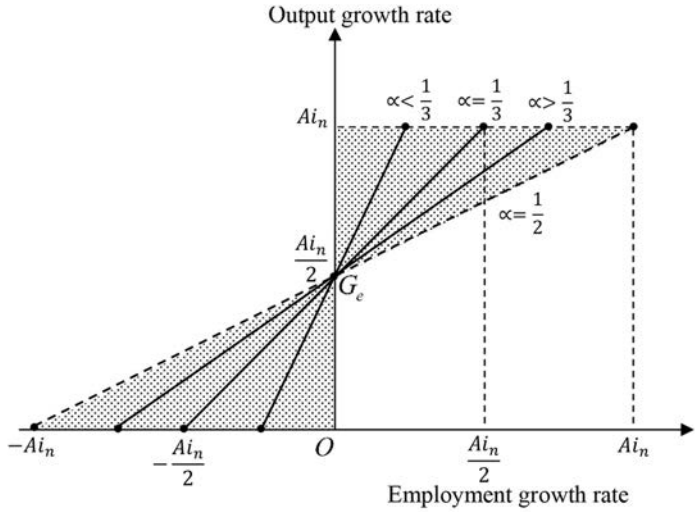
For a given profit share in income $\propto$, the set of steady states is represented by the segment $G_0\,G_{mx}$ of Figure 1. G_{mx} represents the maximum long-term growth path: the growth rates of output and employment are then maximum, with all new productive combinations being engaged in increasing returns. G_e represents the growth path with stable employment, the Rci being equal to 1/2. Over the long term, a cycle of economic growth, for example with production and employment growth rates evolving around average values, will be represented in a stylized way by trajectories located on the segment $G_0\,G_{mx}$.

Now we will deepen the role of the profit share in the production function and show that the value of 1/3 plays an important role.

2.3. The influence of the profit share in income and the value of 1/3

Figure 2 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. Note that the output-employment coefficient is 1 for a profit share in income of 1/3.

Figure 2. Possible linear relationships



Is the economy wage-led or profit-led? The possibility that growth regimes could be either wage-led or profit-led was first opened by Blecker ([1989] [6], Bhaduri and Marglin ([1990] [4]) and Marglin and Bhaduri ([1990] [23]). In Figure 2, consider a given positive employment growth rate, of course less then Ai_n, all things equal otherwise. 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 theoretically, most of them are wage-led economies.

What is the influence of profit share in income on output and on labor productivity if there is a constraint on employment, through the equation (2). Suppose the economy encounters constraints on employment growth, for example due to full employment or due to an inefficient labor market with a limited number of skilled people, where n is the bounded job growth rate:

$$n = \frac{\propto A}{1 - \propto} \, (2x - 1) i_n \qquad [3]$$

The output growth rate and the productivity growth rates are:

$$g_Y = n \frac{(1 - \propto) x}{\propto (2x - 1)} \qquad g_{Y/L} = n \frac{\propto + x (1 - 3\propto)}{\propto (2x - 1)} \qquad [4]$$

The output growth rate and the productivity growth rate decrease when the profit share increases.

What is the influence of the profit share in income on employment growth? If there is no constraint in the labor market, the employment growth rate increases. It can be noted that the evolution of output, productivity and employment can be very different, according to the constraints on the labor market.

Let now the labor productivity growth rate or the wage growth rate in relation to the employment growth rate be written from equations (1) and (2):

$$g_{Y/L} = g_\omega = g_Y - g_L = \frac{1 - 3\propto}{2\propto} g_L + \frac{A}{2} i_n = \frac{\propto + x (1 - 3\propto)}{1 - \propto} A i_n \qquad [5]$$

The number of 1/3 appears in equation (5). For this profit share, wage growth is independent of both employment growth and Rci. Thus, the wage gains in firms where employment is growing strongly will be equal to those observed in firms which are growing weakly.

This growth model offers an explanation for this number of 1/3. 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.

3. The three theoretical growth regimes and the regulation by return on investments

The initial growth model is now extended and we demonstrate the existence of three growth regimes and their three optima.

3.1. The returns on investments

The returns on capacity and rationalization investments play a key role in regulating economic growth. We define the return on capacity investment, the return on rationalization investment and the return on investments, respectively as the profit per unit of capacity investment[2], the profit per unit of rationalization investment and the profit per unit of investment. The return on capacity investment is assessed as the following:

$$r_{ci} = \frac{\dot{Y} - \omega L_c - \dot{\omega} L}{x I_n} = \frac{\propto \dot{Y} - \omega (L_c - \dot{L})}{x I_n} \quad with \quad \dot{\omega} L = (1 - \propto) \dot{Y} - \omega \dot{L} \qquad [6]$$

The job creation associated with capacity investment L_c (Villemeur [2019] [34]; [2021] [35]) is:

$$L_c = \frac{\propto}{1 - \propto} A x^2 \frac{I_n}{Y} L \qquad [7]$$

Finally, the return on capacity investment is:

$$r_{ci} = \propto A \frac{-x^2 + 3x - 1}{x} \qquad [8]$$

The return on rationalization investment and the return on investments[3] are:

$$r_{ri} = \propto A (1 - x) \qquad r = \propto A x \qquad [9]$$

Figure 3 shows these returns as function of the Rci. The return on capacity investment will influence the decisions of entrepreneurs. This return is positive for a Rci between $(3 - \sqrt{5})/2$ (*i.e.*, 38.2%) and 262%; the maximum is

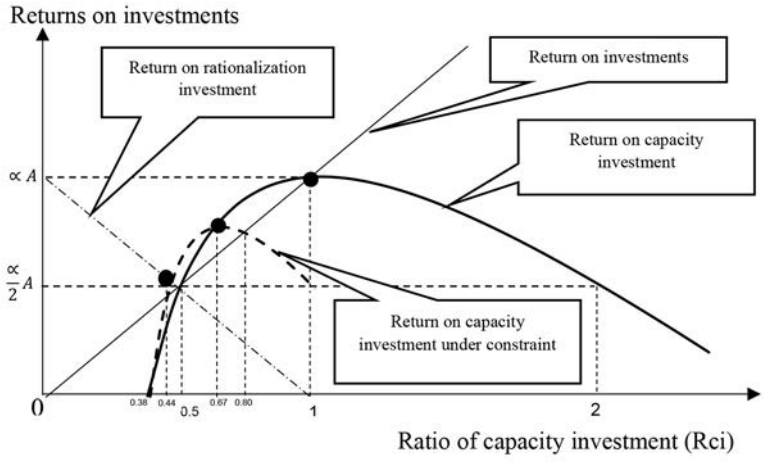
2. It is assumed that the entrepreneur increases wages, while maintaining profit share in income constant.

3. The return on investments is also the average of the others returns weighted by x and by $(1 - x)$.

for a Rci of 100%, all the investments being capacity investments. However, when the Rci becomes greater than one, entrepreneurs have an incentive to reduce capacity investments, which limits the economic boom[4].

The return on capacity investment is greater than the return on investments when the Rci is greater than 50% and less than 100%. Entrepreneurs are therefore encouraged to invest in new production capacities for such values of Rci. If there is no constraint on the different markets (labor market, financial market, or technology market), they will increase the Rci up to the value of 1, in order to reach the maximum return on capacity investment. However, entrepreneurs may have to choose between more or less productivity for capacity investments and less or more volume of capacity investments when there are several technological choices; thus, they will try to maintain the capital productivity.

Figure 3. Returns on investments and the three optima



When the Rci is less than 50%, the return on rationalization investment is greater than the return on investments; thus, an incentive to invest in rationalization exists. However, entrepreneurs try to maintain a positive return on capacity investment.

Theoretically, three optima exist, depending on the decisions of the entrepreneurs facing different economic situations:

— Maximization of the return on capacity investment, unconstrained

4. When the Rci exceeds 200%, entrepreneurs are discouraged by such low returns and thus rapidly reduce their capacity investments. The value of 200% for the Rci appears as the short-term limit for the economic cycle.

In this case the optimum is for $x = 1$ (Rci of 100%), all investments being capacity investments. This optimum characterizes maximum unconstrained growth.

$$Max \left\{ \propto A \frac{-x^2 + 3x - 1}{x} \right\} \quad \Rightarrow \quad x = 1 \qquad [10]$$

— Maximization of the return on capacity investment, under the constraint of the capital productivity

Entrepreneur seek to maximize the return on capacity investment under the constraint of the capital productivity (Ax). In this case the maximization is the following:

$$Max \left\{ \propto A \frac{-x^2 + 3x - 1}{x} \right\} under\ the\ constraint \quad Ax = constant \Rightarrow x = 2/3 \qquad [11]$$

It is easy to show that the maximum is for $x = 2/3$ (Rci of 66.7%). The return on capacity investment under constraint is:

$$r_{ci/C} = \frac{2}{3} \propto A \frac{-x^2 + 3x - 1}{x^2} \qquad [12]$$

This return is also greater than the return on investments from the value 0.441 to the value 0.795 for x:

$$r_{ci/C} \geq r \qquad r = \propto Ax \qquad \Rightarrow \qquad 0.441 \leq x \leq 0.795 \qquad [13]$$

Thus, there is an incentive to invest in capacity investment (under constraint) for x above the value of 0.44 and up to the value of 0.80. Above this last value, we can assume that the first optimization is better for the entrepreneurs if there is no more constraints for capacity investments.

— Maximization of the return on rationalization investment, the constrained return on capacity investment being higher than the return on investments:

$$Max \propto A\,(1 - x)\ under\ the\ constraint\ r_{ci/C} \geq r \quad \Rightarrow \quad x = 0.441 \qquad [14]$$

This constraint preserves the return of capacity investment (under constraint) in order to revive the economy in the future.

3.2. The three growth regimes

Several conclusions can be drawn from these considerations. Sustainable growth regimes are such that the Rci are between 38.2% and 100%, with entrepreneurs having an incentive to return to this range if they venture

outside this range. Inside the sustainable range, growth regimes should focus around 3 optima:

- Optimum 1: the maximum return of rationalization investment under constraint (Rci equal to 44,1%); this optimum is relevant for the Rci range [38.2%; 50%] which defines the "Employment decline, constrained" regime.
- Optimum 2: the maximum return of capacity investment under constraint (Rci equal to 66.7%); this optimum is relevant for the Rci range [50%; 79.5%] which defines the "Employment growth, constrained" regime.
- Optimum 3: the maximum return of capacity investment, without constraint (Rci equal to 100%); this optimum is relevant for the Rci range [79.5%; 100%] which defines the "Employment growth, unconstrained" regime.

The Table 1 resumes the properties of the three growth regimes and their optima. In summary, the theory predicts that the ratio of capacity investment must be within the range [38.2%; 100%] and that Rci values should cluster around 44%, 67% and 100%, reflecting entrepreneurs maximizing return on rationalization or capacity investment under different conditions.

Within the framework of the "Employment decline, constrained" regime, entrepreneurs seek to maximize the return on rationalization investment, while preserving the return on capacity investment to avoid a negative return. Thus, for this growth regime, it can be assumed that the trajectories of the economies will be influenced by this constrained maximization linked to the rationalization investment. The Rci becomes greater than 38.2% and lower than 50%. The values of the Rci should be concentrated around 44.1%.

Table 1. The three growth regimes and the three optima

Rci	*0*	*38.2%*	*44.1%*	*50%*	*66.7%*	*79.5%*	*100%*	
Optima			*Optimum 1* Maximum return on rationalization investment (constrained)		*Optimum 2* Maximum return on capacity investment (constrained)		*Optimum 3* Maximum return on capacity investment (unconstrained)	
Growth regimes	unsustainable		Employment decline, constrained		Employment growth, constrained		Employment growth, unconstrained	unsustainable

Within the framework of the "Employment growth, constrained" regime, entrepreneurs seek to maximize the return on capacity investment, the priority being the productivity growth and not the employment growth. Thus, for this growth regime, it can be assumed that the trajectories of the economies will be influenced by this constrained maximization linked to the capacity investment. The Rci becomes greater than 50% and lower than 79.5%, the limit for the incentive with the return on capacity investment under constraint. The values of the Rci should be concentrated around 66.7% (2/3).

Within the framework of the "Employment growth, unconstrained" regime, entrepreneurs seek to maximize the return on capacity investment without constraint, the priority being employment. Thus, for this growth regime, it can be assumed that the trajectories of the economies will be influenced by this unconstrained maximization linked to the capacity investment. The Rci becomes greater than 79.5% and lower than 100%, the limit for the incentive with the return on capacity investment without constraint. The values of the Rci should be concentrated around 100% or just below.

4. The 17 advanced economies and the KSK growth model

In this section, we show the consistency of the theorical developments with the fundamentals of the 17 advanced economies since 1961, precise annual data being available from large databases on GDP growth, on employment growth (in hours worked) and on the gross investment rate, as well as profit share in income (see Appendix 3).

Advanced economies show wide variations in economic fundamentals, especially in profit share over the long period 1961-2018. To be in the theoretical conditions of steady states with limited variations in the profit share, it is necessary to define relevant periods. Also, we have generally considered five characteristic periods, delimited by major crises. The reference periodization, that of the United States, is as follows:

— 1961-1973: the oil crisis of 1973 put an end to a period of strong economic growth, with a recession in 1974.

— 1974-1991: crises follow one another, those of the two oil crises (1973, 1979) and the financial crisis of 1990-1991. The period ended with a year of recession and 1992 marked the return of real growth.

— 1992-2000: Strong economic growth is back, driven by the emergence and rapid diffusion of information and communication technologies. The bursting of the stock market (Internet) bubble in 2000 ended this period with a significant slowdown in 2001.

— 2001-2007: economic growth slows down sharply and the great financial crisis of 2008 put an end to this period (recession in 2008).

— 2008-2018: economic growth resumes after the Great Recession of 2008-2009, but on a weaker trend than in previous periods.

The periodizations used are presented in appendix 4 for each economy. Of course, they may differ from that of the U.S., with the limits for each period subject to change by one or two years[5]. Only Australia does not experience any recession in 2008 or 2009 but a notable slowdown. Three economies

5. For example, after the 1973 oil shock, a recession or slowdown may occur in 1975 or 1976, a return to notable economic growth in the 1990s may occur in 1993 or 1994.

(Spain, Greece, Japan) are characterized by only four periods, the crisis of 2001 not having really affected them, the third period ending with the Great Recession of 2008-2009.

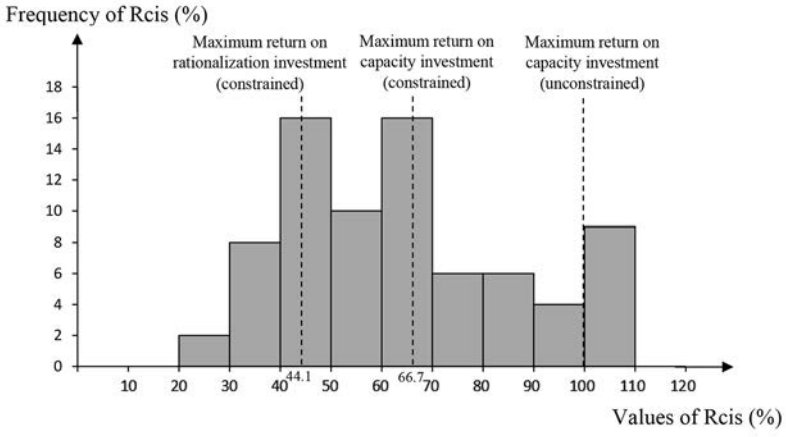
Based on these data (GDP growth rate, employment growth rate, net investment rate, profit share in income), the theory presented makes it possible to calculate the mean values of Rci and Pci (Appendix 2), whose equations are recalled below:

$$x = \frac{\propto g_Y}{2\propto g_Y - (1-\propto) g_L} \qquad A = \frac{2\propto g_Y - (1-\propto) g_L}{\propto i_n} \qquad [15]$$

4.1. The identification of the three optima

Can we identify the three optima by examining the characteristics of the 77 economic trajectories[6] selected for the 17 advanced economies? Figure 3 is the Rci histogram.

Figure 4. Histogram of Rci values for 17 advanced economies (1961-2018)



6. We have identified 82 trajectories (see Appendix 4); are not considered 2 trajectories where the output growth rates are negative (Greece and Italy 2008-2018) and 3 trajectories where the Ric is well above 1, the labor market being very unbalanced (Italy 2001-2007, Spain 1994-2008, United Kingdom 2008-2018).

We note the existence of three concentrations of values, corresponding to the three optima:

— The first is on the range [40%-50%]; it seems to reflect the optimum 1, *i.e.*, the maximum return on rationalization investment under constraint (Rci of 44.1%) inside the "Employment decline, constrained" regime.

— The second is on the range [60%-70%]; it seems to reflect the optimum 2, *i.e.*, the maximum return on capacity investment growth under constraint (Rci of 66.7%) inside the "Employment growth, constrained" regime.

— The third is on the range [100%-110%]: it seems to reflect the optimum 3, *i.e.*, the maximum of the unconstrained return on capacity investment (Rci of 100%) inside the "Employment growth, unconstrained" regime. It can be assumed that most entrepreneurs react after reaching the optimum 3, due to optimistic behavior.

These ranges concentrate 53% of the values. Thus, 47% of the trajectories are in intermediate trajectories, reflecting a mix of trajectories with different objectives.

4.2. The identification of the three growth regimes

All Rci values are between 20% and 110%, and 77% are within the range of sustainable growth regimes ([38.2%; 100%]).

Some trajectories are outside this range: do we see the return inside the range during the following trajectory? We can identify 12 trajectories outside the theoretical range; for 10 trajectories, the Rci returned to the range during the following period, for the remaining 2 trajectories, this is the case after 2 periods. Thus, all the trajectories outside the theoretical range are followed by trajectories inside the range, after a maximum of 2 periods. This fact seems to reflect the existence of incentives for entrepreneurs to return to sustainable growth regimes.

Table 2. The three growth regimes (17 advanced economies since 1961)

Growth regimes (average values in %)[7]	*GDP growth rate*	*Employment growth rate*	*Productivity growth rate*	*Net investment rate*	*Profit share in income*	*Rci*	*Pci*
Employment decline, constrained (Rci < 50% and profit share < 1/3)	3.55	– 0.61	4.16	17.7	30.2	40.7	47.4
Employment decline, constrained (Rci < 50% and profit share > 1/3)	1.54	– 0.29	1.83	15.4	36.6	39.2	23.0
Employment growth, constrained (50% < Rci < 79.5% and profit share < 1/3)	4.71	0.51	4.20	18.7	29.4	59.8	42.8
Employment growth, constrained (50% < Rci < 79.5% and profit share > 1/3)	2.57	0.73	1.84	15.3	37.6	65.7	26.3
Employment growth, unconstrained (Rci < 79.5% and profit share < 1/3)	3.14	1.35	1.79	16.4	32.0	95.5	21.0
Employment growth, unconstrained (Rci > 79.5% and profit share > 1/3)	2.85	1.51	1.34	16.5	36.1	96.1	18.0

Can we identify the three growth regimes and test the theoretical properties that were explained previously? The 77 trajectories are distributed among the various growth regimes according the theoretical Table 1. The results are presented in Table 2; for each of the three growth regimes, we considered the cases where the profit share is lower or higher than 1/3.

The properties brought to light in the different regimes are as follows:

— "Employment decline, constrained" regime: productivity gains are important while rationalization investments very largely dominate. The profit shares are divided between those less than 1/3 (58%) and those greater than 1/3 (42%). 65% of the Rci values are between 38.2% and 50%. The average values of Rci are 40.7% and 39.2%, compared to 44.1%.

— "Employment growth, constrained" regime: productivity grows faster than employment while capacity investment dominates. The profit shares are divided between those less than 1/3 (36%) and those greater than 1/3 (64%). The average values of Rci are 59.8% and 65.7%, compared to 66.7%.

7. For each growth regime in the Table 2, the number of trajectories considered are respectively 15, 11, 9, 23, 7, 12.

— "Employment growth, unconstrained" regime: employment grows rapidly while capacity investment largely dominates. The Rci values are between 79.2% and 109.9%, which is consistent with the predicted theoretical values. The average values of Rci are 95.5% and 96.1%, compared to 100%.

These results show that the average values of Rci are very close inside each growth regime, regardless of the value of the profit share in income, lower or higher than 1/3. Let's take the example of the "Employment decline, constrained" regime: the fundamentals are very different if we take into account the value of the profit share. When the profit share is less than 1/3, the GDP and the productivity growth rates are higher; nevertheless, the Rci remains close to the optimum, which again seems to reflect the same optimization. The same observation is also made for the other growth regimes.

These results, based on the fundamentals of 17 advanced economies, confirm the existence of three growth regimes structured by the different cases of maximizing the return on investment. Each growth regime seems to reflect the decisions of entrepreneurs seeking to optimize the returns of investments, either of capacity investments or of rationalization investments. The value of the profit share, less or more than 1/3, is an important parameter influencing the macroeconomic fundamentals for the three growth regimes.

When comparing macroeconomic performance within each growth regime, it becomes clear that GDP and productivity growth decline as the profit share increases while employment growth increases. The best employment growth regime is obtained for the "Employment growth, unconstrained" regime.

5. Discussion about the KSK growth model and the lessons

The discussion focuses on the main characteristics of this "KSK growth model" as well as its consistency with several quantitative stylized facts.

5.1. A new endogenous growth model

This new endogenous growth model belongs to the out-equilibrium economics as defined by Amendola and Gaffard ([1998] [2]; p. 3): "Out of equilibrium, the supply and demand processes, of resources, and of commodities no longer match. They do not match at any given moment and they do not match over time". Thus, two main questions arise: who is the central actor in this growth process? What are the main forces to regulate the economy and ensure during certain periods the stability of the fundamentals?

As Schumpeter theorized, through creative destruction, the entrepreneur is the central actor in this new growth model, making major decisions regarding investments and employment. It is assumed that creative destruction manifests through both types of investment and not in innovation types as many endogenous growth models assume.

A recurring theme in alternative theories about economic growth is the role of long-term aggregate demand (Setterfield [2010] [32]). Dutt ([2010] [12]) 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". Similar to our growth model, others combine the ideas of Schumpeter and Keynes. Dosi *et al.* ([2010] [9]; [2017] [10]) presented a family of evolutionary agent-based models, the "$K+S$" formalism, which combines both "Keynesian" (demand-driven) and "Schumpeterian" (innovation-driven) mechanisms. The results suggest strong complementariness between Schumpeterian and Keynesian policies in ensuring that the economic system follows a path of sustained stable growth and employment. Unlike the $K+S$ formalism, our "KSK growth model" is based on an analytical formalism in which Kaldor's vision provides a framework based on the chain reaction between increases in demand and supply. In the steady states of this long-term process, we assume that the expectations of entrepreneurs are met in reality and that long-run growth is balanced[8]

Maximization of profit is obviously sought, but minimization of unit output cost, with a concern for long-term competitiveness, is an indispensable step, as theorized by Schumpeter. The three constraints for competitive supply are common sense for entrepreneurs, even if their rationality is limited; they can be considered as heuristics (Dosi *et al.* [2020] [11])[9] for determining the effective and competitive equilibrium.

5.2. The discussion around the stylized facts of Ferri

Ferri ([2016] [13]) has established four new stylized facts that are different from those identified by Kaldor ([1961] [19]) for the Golden age of capitalism and lately extended by Jones and Romer ([2010] [17]): an increasing capital share[10], an augmenting wealth-output ratio, an increasing inequality process, a volatile rate of growth.

Table 3 illustrates these new stylized facts, the 17 advanced economies being considered over the different periodizations from 1961 to 2018[11]. From

8. In line with the studies of Harrod ([1939] [15]; [1948] [16]) and Domar ([1947] [8]).
9. A heuristic is "a strategy that ignores part of the information, with the goal of making decisions more quickly, frugally and/or accurately than more complex methods" (Gigerenzer and Gaissmaier, [2011] [14]: p. 454).
10. Karabarvounis and Neiman ([2014] [21]) also established this stylized fact.
11. The reference periodization is that of the United States: for the other countries, we gather the closest periodizations. For economies with only 4 periods, the long periods are broken down into two periods.

the Golden age of capitalism until the last period (after the Great Recession), macroeconomic performances (GDP growth and productivity growth) are declining, while the average profit share in income is rising rapidly from 30.9% to 37.3%. The evolution of employment growth rates remains ambiguous when profit share in income reaches values of around 37%.

Table 3. Macroeconomic fundamentals (average in %) for each period

17 advanced economies	*GDP Growth rate*	*Employment growth rate*	*Productivity growth rate*	*Net investment rate*	*Profit share in income*
1961-1973	5.4	0.2	5.2	18.4	30.9
1974-1991	2.3	0.1	2.2	17.1	31.9
1992-2000	3.2	1.2	2.0	15.6	36.0
2001-2007	2.3	0.8	1.5	15.9	37.3
2008-2018	0.8	0.2	0.6	14.5	37.3

These stylized facts are consistent with the growth model developed in this article. The starting point is the increase in the profit share, which in the long run depresses GDP growth and productivity growth for economies with constraints on employment growth. The rapid slowdown in GDP leads to an increase in the wealth/output ratio. In all these conditions, of course, inequalities will increase.

It can also be noted that the highest profit shares in income are linked to Greece and Italy, with more than 40% over long periods (Appendix 4). These economies experienced a severe depression over the last period 2008-2018 (negative annual growth in GDP and employment) after the Great Recession of 2008. In addition, two other economies (Finland and Sweden) experienced a profit share above 40% over a period (respectively 2001-2008, 1994-2000); profit share decreases in the next period and then no depression occurs.

5.3. The Bhaduri-Storm paradox

The vast majority of empirical studies on the Bhaduri-Marglin model ([1990] [4]) find that major economies, including the United States and the European Union as a whole, have been broadly wage driven over the past few decades, while that the smaller or more open economies are profit-oriented, once foreign trade is taken into account (Onaran and Galanis [2012] [25]; Blecker [2014] [5]). Blecker paid more attention to the temporal dimension of this distinction; rising profits may be helpful in stimulating a recovery in the short term, but the economy is driven by wages in the long term.

Nevertheless, governments have operated since the 1980s in the neoclassical belief that full employment is possible by reducing the cost of labor and allowing low-wage flexible service jobs. "The strategy appeared to work as real wage restraint was associated with higher jobs growth" Storm and Naastepad ([2017] [33], p. 5) concluded. The paradox is this: how could this happen in wage-led economies?

In this "KSK growth model", an increase of the profit share leads to an increase in the employment growth rate according to equation (2), all other things being equal. Storm and Naastepad come to the same conclusion by showing that the key point is the slowdown in labor productivity growth. This fact is consistent with the lesson of this growth model that an increase in profit share can lower productivity growth and lead to more jobs.

5.4. The consistency with the quantitative stylized facts of Piketty

Piketty ([2014] [28]) described the major changes in the profit share in income over the very long term, with the profit share generally being between 20% and 40%. 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 growth model.

Profit share in income is greater than 1/3 between 1810 and 1870 for the United Kingdom, and between 1840 and 1870 for France[12], 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. 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. After the Second World War, the profit share is generally less than 1/3 in advanced economies. It is especially after the 1990s that the profit share will generally rise above 1/3 as noted by Ferri ([2016] [13]) and as confirmed by our analysis for advanced countries since 1961.

As Piketty noted from historical analysis, the profit share has never exceeded 40% over long periods. This is also the case for the 17 advanced economies over the period 1961-2018; otherwise, economic depression results. These facts reinforce the question of the negative impact of very high profit share on economic performances.

12. The profit share exceeds 40% and reaches about 45% around 1850-1860 for the United Kingdom and France.

6. The three stylized growth regimes and the advanced economies

In summary, we characterize the three growth regimes, and the transitions between them.

6.1. The stylized fundamentals of the three growth regimes

We can now stylize (Table 4) the three growth regimes, their three optima (Rci values: 44%, 67%, 100%) and profit share in income (values lower or higher than 1/3). For the profit share in income, we considered values in the range [20%; 40%] for sustainable economic growth.

The analysis of the fundamentals of the 17 advanced economies is useful to highlight the characteristics of the parameters as the net investment rate (i_n) and the Pci (A). Thus, within each growth regime, the profit share, the Pci and the net investment rate are the main determinants of the GDP growth rate and the employment growth rate.

Table 4. The three sustainable growth regimes and the stylized fundamentals

Growth regimes[13]	*Profit share (in %)*	*GDP and employment growth (in %)*	*Parameters*[14] *range (in %)*	*Economies (annual GDP and employment growth, in %)*	
Employment decline, constrained	$20 < \propto \leq 33.3$	*Optimum 1* (return on rationalization investment, constrained) $g_Y = 0.44Ai_n$ $g_L = -0.12\frac{\propto}{(1-\propto)}Ai_n$	$i_n\,(17.7 \pm 1.7)$ $A\,(47.4 \pm 20.8)$	France Germany	1961-1974 (5.6; – 0.4) 1961-1973 (4.2; – 0.9)
	$33.3 < \propto \leq 40$		$i_n\,(15.4 \pm 2.0)$ $A\,(23.0 \pm 16.9)$	Japan Germany	1992-2007 (1.2; – 0.5) 1994-2000 (1.9; – 0.1)
Employment growth, constrained	$20 < \propto \leq 33.3$	*Optimum 2* (return on capacity investment, constrained) $g_Y = \frac{2}{3}Ai_n$ $g_L = \frac{\propto}{3(1-\propto)}Ai_n$	$i_n\,(18.7 \pm 2.7)$ $A\,(42.8 \pm 22.4)$	Spain Japan	1961-1974 (7.2; 0.5) 1974-1991 (4.4; 0.6)
	$33.3 \leq \propto \leq 40$		$i_n\,(15.2 \pm 1.4)$ $A\,(26.7 \pm 10.2)$	United Kingdom France	2001-2007 (2.8; 0.7) 2001-2008 (1.7; 0.6)
Employment growth, unconstrained	$20 < \propto \leq 33.3$	*Optimum 3* (return on capacity investment, unconstrained) $g_Y = Ai_n$ $g_L = \frac{\propto}{(1-\propto)}Ai_n$	$i_n\,(16.2 \pm 1.3)$ $A\,(24.1 \pm 10.1)$	Canada U.S.	1961-1974 (5.1; 1.8) 1961-1973 (4.3; 1.6)
	$33.3 \leq \propto \leq 40$		$i_n\,(16.8 \pm 2.1)$ $A\,(16.0 \pm 5.9)$	Canada U.S.	1993-2000 (3.4; 1.9) 1974-1991 (2.8; 1.5)

13. The three growth regimes contain about 34%, 42%, 25% of the trajectories respectively.
14. Mean and standard deviation.

The "Employment decline, constrained" regime reflects, when the profit share is less than 1/3, the European countries during the post-war boom, with strong GDP and productivity growth, and otherwise, the Japanese economy after the stock market bubble burst in 1991 and also the European economies with low GDP and productivity growth associated with periods of crisis.

The "Employment growth, constrained" regime reflects, when the profit share is less than 1/3, the Japanese economy and some European economies before the oil crisis, with high GDP and productivity growth, and otherwise, the European and the United States economies just after 2000 with weaker performances.

The "Employment growth, unconstrained" regime often reflects Anglo-Saxon economies (Australia, Canada, and United States) which are able to create far more jobs than other economies; the profit share in income is usually around 1/3. The net investment rate decreases significantly when the profit share in income exceeds 1/3 for the first two growth regimes. This is not the case for the "Employment growth, unconstrained" regime, with high employment growth associated with a stable net investment rate; nevertheless, as we have seen, if the profit share goes above around 37%, it seems that this growth regime is not sustainable.

The Pci reflects the speed of technical progress made possible by the techniques used and the institutions that accompany them. This is for example the case of France and Germany before the oil crisis (1973), compared to the United States economy. It can be noted that the Pci tends to decrease after the year 2000 and especially after the Great Recession 2008-2009.

6.2. Transitions between the three growth regimes

Over the long period from 1961 to 2018, we found that the transitions between the three growth regimes were many and varied. Can we highlight the determinants that would explain them?

It seems difficult to fully answer this question given the limits of the growth model that is developed, for example, by not taking monetary policies into account, which is certainly a major limit. Nevertheless, the first elements of an answer can be provided.

Let's not forget that the "Employment growth, unconstrained" regime is a particularly stable growth regime over the long term when the profit share is close to 1/3, as the Anglo-Saxon economies have been from 1961 to 2000, despite numerous oil shocks, financial crises and the emergence of new information and communication technologies. With the arrival of the new millennium and the crisis of 2000-2001, the transition is made to a regime of "Employment growth, constrained", with a rising share of profit while employment growth slowed sharply. After the great financial crisis of 2008-

2009, economies maintained this growth regime, but with economic performance still in decline.

The "Employment growth, constrained" regime, the most frequently encountered, appears relatively stable over the long term. This stability is linked to the existence of regulation by maximizing capacity investment around the 2/3 Rci value. Transitions to the unconstrained employment growth regime do exist, for example in Belgium, the Netherlands and Portugal, but they are few and short-lived, probably due to the constraints rapidly encountered on the labor market. It therefore seems that the best sustainable growth regime is difficult to achieve, as no catch-up economy has succeeded in establishing itself there over the long-term basis. This seems to reflect the importance of the institutions that underpin these regimes (labor market, innovation system, etc.).

This "Employment growth, constrained" regime seems to have been destabilized by the great financial crisis of 2008-2009, with many economies plunging into job destruction and quasi-stagnation, while seeing profit shares rise sharply. The increase in rationalization investments is a response to the emergence of financial and economic crises.

The "Employment decline, constrained" regime reflects two very different realities. When the share of profit is less than 1/3, it characterizes many economies catching up with the US economy; there are then numerous transitions to the constrained employment growth mode, given the improvement in the labor market and the arrival of more numerous generations. When the profit share exceeds 1/3, it characterizes economies in crisis with mediocre economic performance, with rising profit shares exacerbating this trend towards stagnation; Italy and Greece represent these transitions towards the extreme form of severe depression, with profit shares exceeding 39-40%.

In the end, transitions between regimes are generally limited to close regimes, which again seems to reflect the importance of the institutions (*e.g.*, labor market, innovation regime, etc.) that govern these regimes.

7. Conclusion

A new endogenous growth model has been developed (Villemeur [2019] [34]; [2021] [35]), reconciling the ideas of Kaldor (economic growth as a chain-reaction), Schumpeter (creative destruction) and Keynes (effective demand); a new production function is obtained.

In this article, within this growth model (called "KSK growth model"), we theoretically demonstrate that there are three growth regimes, with their optima characterized by maximizing the return on investments, rationalization, or capacity.

The study of the fundamentals of 17 advanced economies and their 77 economic trajectories over the long period 1961-2018 confirms the existence of three growth regimes and their three optima:

- The "Employment decline, constrained" regime reflects a growth regime where creative destruction is mainly oriented towards the destruction of jobs. Rationalization investments are dominant and entrepreneurs seek to maximize the return on rationalization investment, under constraint; the specific value of the Ratio of capacity investment is therefore about 44%.
- The "Employment growth, constrained" regime reflects a growth regime where creative destruction is mainly oriented towards job creation in a limited way due to constraints. Capacity investments are dominant and entrepreneurs seek to maximize the return on capacity investments, under constraint; the specific value of the Ratio of capacity investment is therefore about 67% (or 2/3).
- The "Employment growth, unconstrained" regime reflects a growth regime where creative destruction is mainly oriented towards unconstrained job creation. Capacity investments are largely dominant and entrepreneurs seek to maximize the return on capacity investments; the specific value of the Ratio of capacity investment is therefore about 100%.

A main lesson emerges concerning the behavior of entrepreneurs: they seek to maximize the return on investment, either from rationalization investment or from capacity investment, sometimes under certain constraints. This overview confirms the interest of considering the two types of investment that determine the behavior of entrepreneurs.

Within each growth regime, the profit share in income is a key variable. As a trend, GDP and productivity growth are higher for a profit share of less than 1/3; the evolution is more complex for employment, the growth of employment increases when the profit share increases, but it starts to decrease for a profit share higher than about 37%. A profit share above 40% seems unsustainable in the long term.

In the long term, transitions between the three growth regimes are generally limited to close regimes, and the best sustainable growth regime is difficult to achieve from the other growth regimes. These facts seem to reflect the importance of the institutions (labor market, innovation regime, etc.) that govern these regimes.

The KSK growth model appears consistent with the reality of advanced economies and can highlight new well-verified lessons. Within each growth regime, the study of the trajectories show that the macroeconomic performances can be very diverse, even if the trajectories are under the influence of the same optimum. This fact reflects the probable influence of other parameters that are not considered in this growth model, such as the financial market.

In view of these results, obtained by simplified modelling, this new avenue of research appears promising in order to better understand the economic fundamentals of the most advanced countries and the role of profit share in economic growth.

Appendix 1: The origins of the growth model

This new endogenous growth model is in line with the great ideas of Kaldor, Schumpeter and Keynes, with the entrepreneur being the principal agent at the heart of the growth process.

This new endogenous growth model starts from Kaldor's vision of the economic growth process (Kaldor [1972] [20]) as a chain-reaction between increases in demand and increases in supply: "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"[15]. This process leads to an endless disequilibrium process.

For Schumpeter (Schumpeter [1911] [30]; [1942] [31]), the entrepreneur is the source of creative destruction through innovation and investments to "produce more" or "produce differently"[16]. In the first case, it is through capacity investments, in the second through rationalization investment; creative destruction also leads also to creating jobs or destroying jobs. For Schumpeter, the entrepreneurs seek to minimize the total cost per unit of output: "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"[17].

For Keynes (Keynes [1936] [22]), 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. "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"[18].

These main ideas 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 pro-

15. Kaldor, [1972] [20], quote page 1246.
16. Schumpeter, [1911] [30], quote page 121.
17. Schumpeter [1942] [31], quote page 97.
18. Keynes [1936] [22], quote page 141.

ductive 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: The KSK growth model and the production function

Entrepreneurs must take decisions about output, employment, and investment. They follow four successive steps:

- In the short term, entrepreneurs formulate expectations regarding anticipated increases in aggregate supply and demand.
- They place themselves at the equilibrium of effective demand.
- They decide to obtain the most competitive productive combinations.
- They define the effective and competitive equilibrium.

Then, for this growth process, we look for steady states over the long term. Now each step is presented.

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[19]. Remember that we consider three types of investment:

- capacity investment: through capacity investment, entrepreneurs create jobs and produce more, with increasing returns
- rationalization investment: by using rationalization investment, for the same production, entrepreneurs destroy jobs
- replacement investment: with replacement investment, entrepreneurs maintain output and jobs.

19. In this growth model, we assume that the marginal efficiency of capital is always positive.

Thus, for each type of capacity or rationalization investment, there is an increase in labor productivity.

We shall highlight the conditions of an equilibrium at time $t + dt$, considering 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 $t + dt$.

1.1. Anticipated increase in aggregate supply

The anticipated increase in aggregate supply, represented by $\dot{Z}^a$, is the expected additional supply volume[20] corresponding to the employment increase of $\dot{L}^a$:

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

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[21]:

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

$x^a I_n$ is the volume of investment that will be engaged in additional supply; 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 supply.

x^a is the share of the net investment volume involved in additional supply: 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

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

21. The difference between the (gross) investment volume and the net investment volume is due to the replacement investment volume. The proportion of replacement investment is δ; so, we can write $I_n = (1 - \delta)I$.

additional supply. The Rci reflects the ability of the economy to invest in supply growth.

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

$$\frac{L_c^a}{L} = e_c^a \frac{\dot{Z}^a}{Z} \qquad 0 \le e_c^a < 1 \qquad [3]$$

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:

$$L_c^a = e_c^a A x^a \frac{I_n}{Y} L \qquad [4]$$

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

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

$$e_d^a \ge 0$$

The expected increase in employment is therefore:

$$\dot{L}^a = [(e_c^a + e_d^a)x^a - e_d^a] A i_n L \qquad -e_d^a A i_n L \le \dot{L}^a \le e_c^a A i_n L \qquad [6]$$

$$i_n = \frac{I_n}{Y}$$

The increase in employment depends on net investment rate, and expected values for Rci and elasticities. By introducing x^a from equation (2) in equation (6) and rearranging to obtain $\dot{Z}^a$, the marginal global supply function is then written:

$$\dot{Z}^a = \varphi(\dot{L}^a) = \frac{Y}{(e_c^a + e_d^a)L}\dot{L}^a + \frac{e_d^a A\, i_n\, Y}{(e_c^a + e_d^a)} \qquad [7]$$

$$0 \le \dot{Z}^a \le A I_n \qquad -e_d^a A i_n L \le \dot{L}^a \le e_c^a A i_n L$$

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

1.2. Anticipated increase in aggregate demand

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

$$\dot{D}^a = f(\dot{L}^a) \quad [8]$$

The additional demand $\dot{D}^a$ is composed of the additional volumes that entrepreneurs and consumers should spend on consumption and investment, considering the expected increase in employment. The marginal propensity to consume[22] is taken as $p_{\dot{C}}$. Whence:

$$\dot{D}^a = p_{\dot{C}}\dot{Z}^a + \dot{I}^a \quad [9]$$

2. The principle of effective demand

The increase in aggregate demand is then written:

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

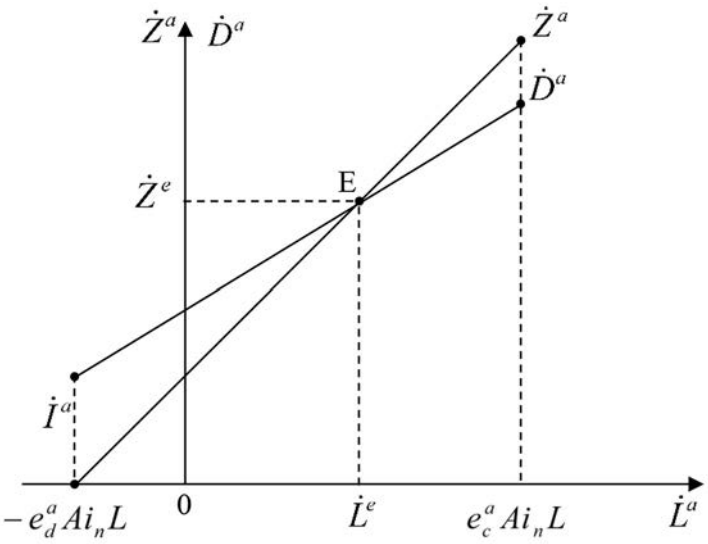
The marginal function of aggregate demand is a linear (increasing) function of the increase in employment and is represented in figure 1.

"Additional effective demand" $\dot{D}^e$ is defined as the anticipated increase in demand at the point of intersection between increases in aggregate supply and demand, with an increase in the volume of employment $\dot{L}^e$. At the point of intersection, the additional supply is equal to the additional demand[23] and the additional output is thus defined. It can then be written:

$$\dot{D}^e = \dot{Z}^e = \dot{Y}^e \quad [11]$$

22. It is considered to be the mean marginal propensity to consume coming from capital income and labor income.
23. At the point of intersection, the anticipated profit is maximum.

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



Now, superscript "e" stands for "effective equilibrium" characterized by x^e. The aggregate supply curve (see figure 1) is also a straight line that necessarily intersects the aggregate demand curve (point E). Point E, called "effective equilibrium", represents the new equilibrium anticipated by entrepreneurs:

$$\dot{Y}^e = Ax^e i_n Y \quad \dot{L}^e = (e_c^a + e_d^a)x^e Ai_n L - e_d^a Ai_n L \qquad [12]$$

$$x^e = \frac{\dot{I}^a}{(1 - p_{\dot{C}})Ai_n Y}$$

3. The principle of competitive supply

At the equilibrium point between additional supply and additional demand, entrepreneurs develop strategies in order to look for the most competitive productive combinations, those which minimize the risk of loss of competitiveness against competing firms and provide the return on investments. This leads them to determine the Rci (x^e) and the elasticities (e_c^a, e_d^a) according to the marginal efficiency of capital (e_K). The entrepreneurs must choose between different technologies with different consequences on these parameters. To this end, entrepreneurs consider three constraints: total cost per unit of output, short-term return and return independent of strategies.

3.1. The constraint of total cost per unit of output

Entrepreneurs minimize[24] the anticipated total cost per unit of output[25] under a condition linked to the marginal efficiency of capital, given the relationship $\omega L = (1 - \propto) Y$ where ω is the wage and $\propto$ the profit share in income at time t. The expected total cost of output (cost^e) includes the cost of increasing employment and the cost of capacity investment. The minimization of the expected total cost per unit of output is the following:

$$Min \frac{cost^e}{\dot{Y}^e} \ with \ \frac{\omega L^e_c + e_K x^e I_n}{A x^e I_n} = (1 - \propto) e^a_c + \frac{e_K}{A} = f(e^a_c, e_K) \qquad [13]$$

The minimization 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[26]. The minimization is under the following constraint[27]:

$$Subject \ to \ \frac{\omega L^e_c}{x^e I_n} = \frac{C_1}{e_K} \ C_1 = constant \ \Rightarrow \qquad [13]$$

$$C_1 = (1 - \propto) A \, e^a_c \, e_K = constant$$

The solution is easily obtained by the substitution of the condition into the function:

$$f(e^a_c, e_K) = (1 - \propto) e^a_c + \frac{e_K}{A} = (1 - \propto) e^a_c + \frac{C_1}{(1 - \propto) A^2 e^a_c} \qquad [14]$$

$$\frac{\partial f}{\partial e^a_c} = (1 - \propto) - \frac{C_1}{(1 - \propto) A^2 (e^a_c)^2} = 0 \quad \frac{\partial^2 f}{\partial (e^a_c)^2} > 0 \qquad [15]$$

24. This minimization comes from a thought of Schumpeter: "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." [1942, p. 97].

25. We consider the additional cost per unit of additional output. Of course, x^e is assumed not to be zero.

26. This constraint comes from a thought of Keynes: "The output from equipment produced to-day will have to compete, during 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." [1936, p. 141].

27. We use equation (4) and then we rearrange the constraint.

The minimum[28] is such that:

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

This elasticity is now a function of the marginal efficiency of capital.

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:

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

As a result, the Rci is a function of the marginal efficiency of capital. The elasticity e_c^a is also a function of the Rci (equations 16 and 17):

$$e_c^a = \frac{\propto}{(1-\propto)} x^e \qquad x^e \leq 1 \quad 0 < \propto < 1 \quad e_c^a < 1 \qquad [18]$$

The existence of conditions on the elasticity and on the Rci (equation 18) induces a condition on the profit share, which must be less than 1/2:

$$e_c^a < 1 \ \ and \ \ x^e = 1 \quad \Rightarrow \quad \propto < 1/2 \qquad [19]$$

Thus, after having fixed the marginal efficiency of the capital, the entrepreneurs determine the Rci and the elasticity of "supply to jobs created".

3.3. The constraint of return on capital independent of strategies

For entrepreneurs, it remains to determine the elasticity of "supply shortfall to jobs destroyed" e_d^a as a function of e_K. In a stylized way, for the entrepreneurs, two strategies are possible: either a change in the Rci or a change in the elasticities through various technologies used. Both strategies must be equivalent in terms of return so that firms remain profitable whatever strategy is chosen. The return on investment depends on the anticipated increase in employment. Assuming that profit share in income and wages are constant over time, we obtain:

$$\frac{\propto \dot{Y}^e}{I_n} = \frac{\propto}{1-\propto} \frac{\omega \dot{L}^e}{I_n} = \propto A \left[(e_c^a + e_d^a) x^e - e_d^a \right] \qquad [20]$$

28. The solution can also be obtained by writing as equal the two terms of the sum to be minimized.

From equation (20), we can deduce:

$$(e_c^a + e_d^a)dx^e = x^e\, de_c^a + x^e\, de_d^a - de_d^a \quad \Rightarrow \qquad [21]$$

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

Considering equation (18), one obtains:

$$\frac{\propto}{(1-\propto)} x^e + e_d^a = \frac{\propto}{(1-\propto)} x^e + (x^e - 1)\frac{de_d^a}{dx^e} \quad \Rightarrow \quad e_d^a + (1 - x^e)\frac{de_d^a}{dx^e} = 0 \qquad [22]$$

$$e_d^a = f(x^e) = u(1 - x^e) \quad u = constant \qquad [23]$$

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 $\propto A$ associated with pure capacity investment (Rci equal to 1) and pure rationalization investment (Rci equal to 0). 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 a return on capital for rationalization investment $(1-\propto)A\, e_d^a (x^e = 0)$. Finally:

$$\propto A = (1-\propto)Au \quad \Rightarrow \quad e_d^a = \frac{\propto}{(1-\propto)}(1 - x^e) = \frac{\propto A - e_K}{(1-\propto)A} \qquad [24]$$

Ultimately, the elasticity related to jobs destroyed is a function of the marginal efficiency of capital and of the profit share in income. At this stage, the strategies of the entrepreneurs are fully defined, Rci and elasticities being a function of the marginal efficiency of capital.

4. Effective and competitive equilibrium

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

$$\dot{Y}^{ec} = \frac{e_K}{\propto} i_n Y \qquad \dot{L}^{ec} = \frac{2e_K - \propto A}{1-\propto} i_n L \qquad [25]$$

$$\dot{I}^{ec} = (1 - p_{\dot{C}})\frac{e_K}{\propto} i_n Y$$

The growth rates of output, employment and investment at equilibrium are expressed in terms of the marginal efficiency of capital, p_C being the mean propensity to consume[29]:

$$\frac{\dot{Y}^{ec}}{Y}=\frac{e_K}{\propto}i_n \qquad \frac{\dot{L}^{ec}}{L}=\frac{2e_K-\propto A}{1-\propto}i_n \qquad \frac{\dot{I}^{ec}}{I}=\frac{(1-p_{\dot{C}})}{(1-p_C)}\frac{e_K}{\propto}i_n \qquad [26]$$

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

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

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 two simplifying hypotheses, generally observed over a certain period: the mean propensity to consume p_C and the proportion of replacement investment δ are assumed to be constant over time, which makes it possible to write:

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

As a result, the net investment rate is also constant over time[30]:

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

The fundamental equations become:

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

$$0<e_K\leq \propto A$$

Thus, the growth rates of output, employment, and investment at equilibrium are expressed uniquely in terms of the marginal efficiency of capital, the differents parameters (A, $\propto$, i_n) being assumed constant over time. In this context, to each value expected by entrepreneurs for the marginal efficiency of capital corresponds to an effective and competitive equilibrium.

29. Coming from capital income and labor income.
30. See for example De Long and Summers [1991] or Levine and Renelt [1992].

5. The steady states

The process of economic growth is thus modeled by a succession of effective and competitive equilibria anticipated by entrepreneurs, depending on the marginal efficiency of capital. 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[31]. It is shown here that, in the long-term, for the stationary states, the growth rates of output, employment and investment are constant over time; so stationary states are considered as steady states[32].

The expected values of the fundamental variables meet the reality:

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

By definition (see Equation 17), the marginal efficiency of capital is equal to the marginal return on capital q:

$$e_K = \propto Ax = \frac{\propto \dot{Y}}{I_n} = q \qquad [32]$$

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:

$$\frac{\dot{Y}}{Y} = \frac{\dot{K}}{K} \Leftrightarrow \frac{Y}{K} = \frac{\dot{Y}}{\dot{K}} = constant = \frac{q}{\propto} = Ax \qquad [33]$$

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

$$x = constant \qquad r = \propto \frac{Y}{K} = \propto Ax = q = constant \qquad [34]$$

$$\beta = \frac{K}{Y} = \frac{1}{Ax} = constant$$

Ultimately, output and employment growth rates, as well as the capital/income ratio and return on capital over the long-term, are constant over time. Thus, these stationary states are steady states. The main fundamentals in the steady states are expressed simply by the Pci, the Rci, the investment rate and the profit share in income. The steady states are characterized:

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

$$r = q = \propto Ax$$

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

31. Following the line of studies by Harrod [1939, 1948], Domar [1947].
32. It is the definition of steady states. See Barro and Sala-I-Martin [1995].

the growth rates in output, employment and investment being symbolized by g_Y, g_L, g_I. Let us remind that the productivity of capacity investment (A), the net investment rate (i_n), and the profit share in income ($\propto$) are constant over time.

From equation (36), we easily obtain the new production function:

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

In general, the greater the share of investment engaged in additional output, the stronger the growth and return on capital. In other words, the more entrepreneurs succeed in implementing 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. The second depends on monetary conditions, which are not discussed here.

Appendix 3: The data sources

The data is from the World Bank (World Development Indicators-WDI-June 2021) for the GDP growth rate and the gross investment rate (in % GDP), from the Groningen Center for the growth rate of total hours worked (The conference Board and Groningen Growth and Development Center, Total Economy Database, June 2021, http://www.ggdc.net). Data on the profit share in income (adjusted share to factors costs) from 1961 to 2019 is taken from the European Commission (Annual macro-economic database -AMECO- June 2021). The sometimes-missing data (between 1961 and 1969) come from the European Commission (Report n°73-2001). In the absence of net investment in databases, it is assumed that the proportion of replacement investment is typically 30%.

Appendix 4: The 17 advanced economies (1961-2018): data (in %)

Economy	Period	g_Y	g_L	i_n	$\propto$	Rci	Pci
Australia	1961-1974	4.7	2.3	21.4	35.4	92.1	23.6
	1975-1992	2.9	1.4	18.8	31.5	103.2	14.8
	1993-2000	4.2	1.9	17.3	35.5	86.9	27.7
	2001-2008	3.3	1.9	18.5	38.6	93.8	19.1
	2009-2018	2.6	1.3	18.4	40.9	79.2	17.7
Austria	1961-1974	4.8	– 0.3	20.0	27.4	45.8	52.9
	1975-1993	2.3	– 0.2	18.0	29.4	45.8	28.5
	1994-2000	2.9	0.6	17.9	34.0	62.1	25.8
	2001-2008	2.2	0.5	16.4	38.5	60.9	21.8
	2009-2018	1.0	0.3	16.0	37.5	68.4	9.3
Belgium	1961-1974	4.9	– 0.1	18.2	36.5	48.9	55.0
	1975-1993	1.9	– 0.8	15.5	30.0	34.3	35.8
	1994-2000	2.8	1.3	15.2	30.8	106.5	17.6
	2001-2008	2.1	0.8	15.5	32.2	86.0	15.4
	2009-2018	1.2	0.6	16.0	32.7	103.0	7.4
Canada	1961-1974	5.1	1.8	16.1	31.4	82.5	38.3
	1975-1992	2.5	1.4	15.7	34.1	103.6	15.5
	1993-2000	3.4	1.9	13.7	34.4	107.3	23.3
	2001-2008	3.7	1.4	15.2	38.3	72.1	33.7
	2009-2018	1.7	0.8	16.4	37.6	80.2	12.7
Denmark	1961-1973	4.6	0.4	17.2	31.7	55.9	47.4
	1974-1993	1.7	– 0.7	14.6	31.5	34.4	34.7
	1994-2000	3.3	1.3	14.2	36.3	76.2	30.9
	2001-2007	1.6	0.5	15.1	35.5	67.5	16.0
	2008-2018	0.9	– 0.1	14.0	35.1	46.3	14.5
Finland	1961-1973	4.8	– 0.1	19.0	26.7	48.3	52.6
	1974-1993	2.1	– 1.1	19.1	29.1	30.8	35.3
	1994-2000	4.8	1.6	14.8	37.9	68.1	48.0
	2001-2008	2.9	1.0	16.0	40.6	65.8	27.5
	2009-2018	0.2	– 0.1	15.8	37.4	33.9	4.4
France	1961-1974	5.6	– 0.4	18.0	27.1	45.5	68.1
	1975-1993	2.2	– 0.5	16.1	28.2	39.1	35.8
	1994-2000	2.7	0.7	14.2	34.4	67.4	28.5
	2001-2008	1.7	0.6	15.4	35.5	73.8	14.9
	2009-2018	0.9	0.2	15.5	33.2	66.8	8.9
Germany	1961-1973	4.2	– 0.9	18.3	31.6	40.9	55.8
	1974-1993	2.3	– 1.1	16.8	31.8	33.5	41.0
	1994-2000	1.9	– 0.1	16.2	35.8	48.4	24.3
	2001-2008	1.3	0.0	14.0	37.6	49.9	18.6
	2009-2018	1.3	0.5	14.1	36.3	77.5	12.0

Economy	Period	g_Y	g_L	i_n	$\propto$	Rci	Pci
Greece	1961-1973	8.5	– 0.9	18.5	32.7	45.1	102.5
	1974-1993	1.5	0.8	18.2	42.0	81.8	9.8
	1994-2007	3.6	1.2	16.1	44.0	63.7	35.2
	2008-2018	-2.5	– 1.5	10.3	41.5		
Italy	1961-1974	5.4	– 1.0	17.7	29.6	40.8	74.3
	1975-1993	2.4	0.3	16.2	34.2	55.6	26.5
	1994-2000	2.2	0.4	13.7	40.5	58.7	27.3
	2001-2007	1.1	1.1	14.9	40.9	170.9	4.4
	2008-2018	-0.4	– 0.5	12.9	39.3		
Japan	1961-1973	8.8	1.1	23.8	28.6	59.6	62.3
	1974-1991	4.0	0.6	22.7	26.2	62.1	28.5
	1992-2007	1.2	– 0.5	19.2	33.8	34.3	17.6
	2008-2018	0.5	– 0.1	16.2	37.2	40.8	7.8
Netherlands	1961-1974	5.1	0.8	18.9	30.3	61.3	43.8
	1975-1993	2.1	0.3	15.3	29.0	59.2	23.6
	1994-2001	3.8	2.1	15.3	33.5	109.8	22.5
	2002-2008	2.0	0.7	14.9	36.1	70.0	18.6
	2009-2018	0.9	0.5	13.9	35.2	99.2	6.5
Portugal	1961-1974	6.7	0.0	17.9	26.1	50.3	74.1
	1975-1993	3.0	0.7	19.2	29.2	69.5	22.3
	1994-2000	3.7	1.9	17.9	32.7	106.8	19.2
	2001-2008	1.1	– 0.1	16.8	33.3	45.7	14.3
	2009-2018	0.2	– 0.4	12.0	38.7	20.7	11.8
Spain	1961-1974	7.2	0.5	17.8	29.9	54.0	74.6
	1975-1993	2.2	– 0.9	16.3	31.1	34.9	39.0
	1994-2008	3.4	2.9	17.9	36.4	203.6	9.2
	2009-2018	0.4	– 0.7	13.5	39.8	21.9	14.8
Sweden	1961-1975	4.0	– 0.3	20.9	33.1	46.2	41.0
	1976-1993	1.3	0.0	18.0	35.3	50.9	14.6
	1994-2000	3.7	1.1	14.6	40.2	63.7	40.0
	2001-2007	3.0	0.5	16.0	39.1	56.7	33.3
	2008-2018	1.7	1.1	16.6	38.0	104.6	10.0
United Kingdom	1961-1973	3.5	– 0.7	14.2	35.0	42.2	57.6
	1974-1992	1.9	– 0.3	15.9	36.0	43.6	26.9
	1993-2000	3.4	0.8	12.6	39.4	60.6	44.0
	2001-2007	2.8	0.7	12.4	35.6	65.5	34.1
	2008-2018	1.1	0.9	11.5	34.4	194.9	5.1
USA	1961-1973	4.3	1.6	15.5	32.6	80.7	34.3
	1974-1991	2.8	1.5	15.8	34.3	101.6	17.5
	1992-2000	3.8	1.9	15.0	35.1	91.8	28.0
	2001-2007	2.5	0.3	15.6	36.1	56.2	28.7
	2008-2018	1.6	0.6	13.9	38.9	69.6	16.4

References

AGHION P., HOWITT P. [1998], *Endogenous Growth Theory*, MIT Press.

AMENDOLA M., GAFFARD J. L. [1998], *Out of Equilibrium*, Oxford, Clarendon Press.

BARRO R. J., SALA-I-MARTIN X. [1995], *Economic Growth*, McGraw-Hill, Inc.

BHADURI A., MARGLIN S. [1990], Unemployment and the Real Wage: The Economic Basis for Contesting Political Ideologie, *Cambridge Journal of Economics,* 14(4), 375-393.

BLECKER P. A. [2014], Wage-led versus Profit-led Demand Regimes: The Long and the Short of it, *Conference "Inequality and the future of Capitalism"*, sponsored by the Macroeconomic Policy Institute (IMK), Hans-Bœckler-Fondation, and Research Network Macroeconomics and Macroeconomics Policies (FMM), Berlin Germany, October 30-November 1.

BLECKER R. A. [1989], International Competition, Income Distribution and Economic Growth, *Cambridge Journal of Economics*, 13(3), 395-412.

COBB C. W., DOUGLAS P. H. [1928], A Theory of Output, *American Economic Review*, 18(1), 139-165.

DOMAR F. D. [1947], Expansion and Employment, *American Economic Review*, 37(1), 34-55.

DOSI G., FAGIOLO G., ROVENTINI A. [2010], Schumpeter Meeting Keynes, a Policy-Friendly Model of Endogenous Growth and Business Cycles, *Journal of Economic Dynamics and Control,* 34(9), 1748–1767.

DOSI G., NAPOLETANO M., ROVENTINI A., TREIBICH T. [2017], Micro and Macro Policies in the Keynes+Schumpeter Evolutionary Models, *Journal of Evolutionary Economics*, 27(1), 63–90.

DOSI G., NAPOLETANO M., ROVENTINI A., STIGLITZ J., TREIBICH T. [2020], Rational Heuristics? Expectations and Behaviors in Evolving Economics with Heterogeneous Interacting Agents, *Economy Inquiry,*58(3), 1487-1516.

DUTT A. [2010], Reconciling the Growth of Aggregate Demand and Aggregate Supply, in: Setterfield M. (ed.), *Handbook of Alternatives Theories of Economic Growth*, Cheltenham, Edward Elgar, 220-240.

FERRI P. [2016], *Aggregate Demand, Inequality and Instability*, Cheltenham, Edward Elgar.

GIGERENZER G., GAISSMAIER W. [2011], Heuristic Decision Making, *Annual Review of Psychology,* 62(1), 451–82.

HARROD R. F. [1939], An Essay in Dynamic Theory, *Economic Journal*, 49(193), 14-33.

HARROD R. F [1948], *Towards a Dynamic Economics*, London, Macmillan.

JONES C. I., ROMER P. M. [2010], The New Kaldor Facts: Ideas, Institutions, Population, and Human Capital. *American Economic Journal: Macroeconomics*, 2(1), 224-245.

KALDOR N. [1956], Alternatives Theories of Distribution, *Review of Economic Studies*, 23(2), 94-100.

KALDOR N. [1961], Capital Accumulation and Economic Growth, in: Lutz F.A., D.C. Hague (eds.), *The Theory of Capital*, London, London. Also, in: Kaldor N. [1978], *Further Essay on Economic Theory*, London, Duckworth.

KALDOR N. [1972], The Irrelevance of Equilibrium Economics, *The Economic Journal,* 82(328), 1237-1255, Quote page 1246.

KARABARVOUNIS L., NEIMAN B. [2014], The Global Decline in the Labour Share, *Quaterly Journal of Economics*, 129(1), 61-103.

KEYNES J. M. [1936], *The General Theory of Employment, Interest and Money.* London, Macmillan [edition 1964], Quote page 141.

MARGLIN S. A., BHADURI A. [1990], Profit Squeeze and Keynesian Theory, in: Marglin S.A., Schor J.B. (eds.), *The Golden Age of Capitalism*, Oxford, Oxford University Press, 153-186.

NELSON R. R., PHELPS E. S. [1966], Investment in Humans, Technological Diffusion and Economic Growth, *American Economic Review*, 56(2), 69-75.

ONARAN O., GALANIS G. [2012], Is Aggregate Demand Wage-led or Profit-led?, *National and global effects, Conditions of work and employment series*, International Labour Office, n° 40, Geneva.

PALLEY T. I. [1996], Growth Theory in a Keynesian Mode: Some Keynesian Foundations for New Endogenous Growth Theory, *Journal of Post Keynesian Economics*, 19(1), 113-135.

PALLEY T. I. [1997], Aggregate Demand and Endogenous Growth: A Generalized Keynes-Kaldor Model of Economic Growth, *Metroeconomica*, 48(2), 161-176.

PIKETTY T. [2014], *Capital in the Twenty-First Century.* The Belknap Press of Harvard University Press. French Translation: *Le capital au XXI^e siècle* [2013], Paris, Seuil.

ROMER P. [1986], Increasing Returns and Long-Run Growth, *Journal of Political Economy*, 94(5), 1002-1037.

SCHUMPETER J. A. [1911], *Die Theorie der wirtschaftlichen Entwicklung*, Berlin, Duncker and Humblot. French Translation [second German edition of 1926], *Théorie de l'évolution économique* [1999], Dalloz, Paris, Quote page 121.

SCHUMPETER J. A. [1942], *Capitalism, Socialism and Democracy*, New York, Harper and Row, New York, Quote page 97.

SETTERFIELD M. [2010], *Handbook of Alternatives Theories of Economic Growth*, Cheltenham, Edward Elgar.

STORM S., NAASTEPAD C. W. M. [2017], Bhaduri-Marglin Meet Kaldor-Marx: Wages, Productivity, and Investment, *Review of Keynesian Economics*, 5(1), 4-24.

VILLEMEUR A. [2019], Profit Share in Income: Is 1/3 a Reference Value?, *Annual Meeting of the AFSE*, Orléans, France, June 17-19.

VILLEMEUR A. [2021], Part du Profit dans le Revenu: 1/3, une Valeur de Référence?, *Revue Française d'économie,* 35(3), 125-176.

YOUNG A. [1928], Increasing Returns and Economic Progress, *The Economic Journal*, 38 (152), 527-542.

C. P. P. A. P. N° 0927 T 82119
Directeur de la publication : Stéphane Duret, président des Éditions Dalloz
Directrice des Éditions : Caroline Sordet
Directrice « Public, immobilier, Action sociale, HSE » : Corinne Gendraud

---

Composé par LUMINESS SAS 561, rue Saint Léonard, 53100 Mayenne
Imprimerie MAQPRINT, 43 rue Ettore Bugatti – 87280 Limoges
Dépôt légal : Octobre 2023

SUBMISSION GUIDELINES

The *Revue d'économie politique* accepts only orignal papers, written in French or English. An article submitted to the *Revue d'économie politique* must not be simultaneously under consideration at another journal.

The *Revue d'économie politique* also publishes review articles, adapted to its readership (in the *Bilans et essais* section), and shorter comments on economic policy or current scientific debates (in the *débats et opinions* section).

Submission is electronic. Two PDF documents should be sent to the address rep@dalloz.fr.
The first PDF document should contain:

- A front page with the names, addresses and contact details of all of the authors, and the paper's title. In the case of multiple authorship, indicate the corresponding author;
- A page containing the abstract in both English and French, keywords in both English and French, and JEL codes. Also include the title in English if the paper is in French, and vice versa.

The second PDF document should include only the title and the text of the paper.

Submissions should adhere to the following guidelines:

- Short articles are encouraged and submission should not in any case exceed 60 000 characters (including spaces, punctuation, tables and figures), which corresponds to 20 printed pages. Articles for the *Bilans et essais* section should not exceed 90 000 characters, and those for the *Débats et opinions* section 20 000 characters.
- Footnotes and references should be in the style of the *Revue*.
- The abstract should be around 200 words long, and not contain figures, tables or equations.

All submissions are sent double-blind to two referees. Following the referees' reports, the editors may ask for a revision. This revision should be resubmitted to the journal within three months, and will be sent back to the two orginal referees. After an article is definitively accepted, the authors will receive a set of proofs, which should be returned corrected within five days. No further corrections to the original text will be accepted at this stage.

Éditions Dalloz, Société par actions simplifiée au capital de 3 956 040 euros – Siège social : 10, place des Vosges, Tour Lefebvre-Dalloz, 92400 Courbevoie – RCS Paris 572 195 550 – Siret 572 195 550 00098 – Code APE 5811Z – TVA FR 69 572 195 550 (Filiale du groupe Lefebvre-Sarrut)

ABONNEMENT annuel partant du 1er janvier 2023 :

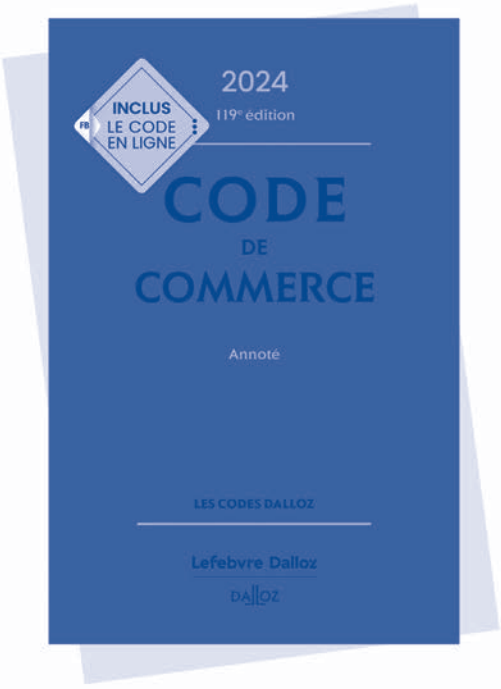
France et D.O.M.		Étranger	
Institutions	937,28 €	Institutions	947,85 €
Particuliers	605,45 €	Particuliers	619,44 €

Montant de l'abonnement à l'ordre de DALLOZ
à adresser à

Editions DALLOZ, 10, place des Vosges, Tour Lefebvre-Dalloz, 92400 Courbevoie
Responsable relation clients : Corinne Routier. Tél. : 01 40 92 36 64 - wrene@editions-legislatives.fr - Internet : http://www.dalloz.fr

Les abonnés qui à la réception de ce numéro, constateraient que la livraison précédente ne leur est pas parvenue, sont priés d'en aviser le service des abonnements, sans délai, *l'éditeur ne pouvant garantir* pendant plus de 6 mois *le service des numéros manquants.*

ÉDITION 2024



CODE DE COMMERCE 2024, ANNOTÉ

L'édition 2024 est notamment à jour des textes suivants :

- décret du 11 mai 2023 complétant et modifiant les dispositions relatives au registre des sûretés mobilières et autres opérations connexes ;
- loi du 30 mars 2023 tendant à renforcer l'équilibre dans les relations commerciales entre fournisseurs et distributeurs (dite « EGalim 3 ») ;
- ordonnance du 28 mars 2023 portant partie législative du code de l'artisanat ;
- décret du 16 novembre 2022 relatif aux modalités de publicité du transfert universel du patrimoine professionnel de l'entrepreneur individuel ;
- décrets du 19 juillet 2022 relatifs au Registre national des entreprises et portant adaptation d'autres registres d'entreprises.

L'ouvrage comprend le code officiel et de nombreux textes complémentaires intéressant la matière. Il est enrichi d'annotations de jurisprudence et de références bibliographiques, y compris en matière de sociétés commerciales et de baux commerciaux. Celles relatives au livre VI ont été partiellement refondues pour cette édition.

Lefebvre Dalloz

DALLOZ

En vente également en librairieet sur www.boutique-dalloz.fr

ISSN 0373-2630
réf : **522305**