FEBRUARY 1989

N 8905

KALDOR'S GROWTH THEORIES :

PAST, PRESENT AND PROSPECTS

Robert BOYER, Pascal PETIT

This is a significantly revised draft of the paper presented at the Kaldor Conference held in New School for Social Research, New York (October 29-31, 1987). To be published in "Nicholas KALDOR and Mainstream Economics", W. SEMMLER and E. NELL Editors, MacMillan, London, 1989. The paper draws largely on unpublished papers by L. CAUSSAT and P. RALLE. Many thanks to them. The authors aknowledge for comments made by the participants to the Conference.

KALDOR'S GROWTH THEORIES : PAST, PRESENT AND PROSPECTS

Robert BOYER, Pascal PETIT

ABSTRACT

All along his carreer, Nicholas KALDOR has recurrently dealt with factor explaining long run capitalist growth. After a short survey of his various models, the paper proposes an assessement of his last analyses about cumulative growth and dynamic increasing returns to scale. It is first argued that the inner mechanisms of these returns, however intuitive and suggestive, need to be clarified, leading to a more general form for productivity regimes, i.e. the equivalent of the so-called KALDOR-VERDOORN relations. Second, his reduced form analysis has to be refined in order to deal more explictly with the origins and the diffusion mechanisms of productivity increases, in quasi-closed or highly open economies. The notion of demand regime precisely describes such an outcome. The related model is estimated first for US manufacturing from 1899 to 1976, for six European manufacturing sectors from 1960-1976, for twelve OECD countries from 1960-1986. Then the apparent paradox about the breaking-down of the productivity-growth relations can be traced back to a structural change in the roots of productivity and possible shifts in the demand regime from wage led to export led. This might be the basic hypotheses for rejuvenating KALDOR's cumulative causation growth model, a quite appealing project indeed given the prospects for the Nineties.

NICHOLAS KALDOR ET LES THEORIES DE LA CROISSANCE : PASSE PRESENT ET PERSPECTIVES DE RECHERCHE

Robert BOYER, Pascal PETIT

R E S U M E

Tout au long de sa carrière Nicholas KALDOR n'a cessé d'analyser les facteurs et les mécanismes de la croissance à long terme. Après une rapide présentation de ses différents modèles, l'analyse se concentre sur son modèle de croissance cumulative fondé sur des rendements d'échelle dynamiques. Il est d'abord montré que l'origine de ces rendements, même intuitive et suggestive, appelle une clarification analytique, afin de dégager différents régimes de productivité, généralisation évidente des relations dites de KALDOR-VERDOORN. En second lieu, la forme réduite proposée se doit de dériver de mécanismes explicites, décrivant l'origine et la diffusion des gains de productivité, en économie ouverte ou concurrencée. La notion de régime de demande en dérive. Le modèle correspondant est estimé d'abord pour l'industrie manufacturière américaine de 1899 à 1976, puis pour six industries européennes de 1960 à 1976, enfin pour douze économies de l'OCDE de 1960 à 1986. On peut alors rattacher l'apparent paradoxe de la rupture des relations entre productivité et croissance, intervenue dans les années soixante-dix aux changements quant à l'origine des gains de productivité, ainsi qu'au possible passage d'une demande tirée par la consommation et le salaire à un autre régime tiré par les exportations. Telles pourraient être les hypothèses permettant d'actualiser et d'approfondir le modèle de KALDOR, projet qui ne manque pas d'intérêt dans le contexte des années quantre-vingt-dix.

J.E.L. CLASSIFICATION SYSTEM : 042 - 044 - 110 - 210 - 620.

KEY WORDS : Theory of growth, Increasing return to scale, Cumulative causation growth model, Technical change, US long run history, European history.

MOTS CLES : Théorie de la croissance, Rendements d'échelle, Modèles de croissance cumulatifs, Changement technique, Histoire économique américaine du XIXème siècle, Pays Européens et de l'OCDE depuis 1960.

All along his life Nicholas KALDOR has touched and investigated an impressive number of areas within economic analysis. Every economist knows his path breaking papers on speculation, non-linear models of business cycle, his alternative theory of distribution...and so many other topics on taxation economic and monetary policy. However, growth and development theories have been a recurrent theme for him all over his life. Around a basic core analysis, Nicholas KALDOR has continuously been revising his precise views about the factors limiting growth, whereas his hypotheses have been challenged. Still more, the breaking down of previous growth trends in the Seventies and the uncertain prospects about a recovery in the Nineties bring new questions into the cumulative causation model.

The present paper is built as a tribute and critical assessement of KALDOR growth theory and aims at suggesting that it still provides very stimulating insights and analytical tools, for any economist analysing the present state of advanced capitalist countries. First the intellectual biography of Nicholas KALDOR and the main characteristics of his basic growth theories are presented (I). But one of the weakness, often stressed upon, relates to his reduced form analysis. Therefore in a second step a structural form of the model has to be presented. In fact, the distinction between the factors explaining for productivity increases (i.e. the productivity regime) and the demand generating mechanisms (i.e. the demand regime) allows both analytical clarity and a more general analysis (II). Does this framework overcome the unstability of the KALDOR-VERDOORN relations, which many empirical studies use to exhibit ? It is then shown that the econometric evidence available is mitigated, using either long run US data or cross national comparisons (III). Finally, a further deepening of the seminal analysis about the cumulative growth model is proposed, in order to cope with the challenge of the Nineties : is a renewal of fast and steady growth possible ? (IV).

I - BACK TO KALDOR'S GROWTH THEORIES : STRENGTHS AND WEAKNESSES

Let us present briefly the various models proposed by our author and then focus upon the founding principles of the explanation, without duplicating other surveys (F. TARGETTI (1988), (1989), P. THIRLWALL (1987), T. MICHL (1985)).

1. A RECURRING THEME, AN EVER ADAPTING FRAMEWORK.

During the Thirties, Nicholas KALDOR made his first contribution to economic theory by studying the concept of equilibrium, imperfect competition, the influence of wage upon employment and by reinterpreting and generalizing the message of Keynes' General Theory. Therefore he analysed mainly short and medium run equilibrium : using a keynesian reflation policy, can full-employment be steadily maintained ? On the contrary is not the cycle an intrinsic feature due to the mutual adjustment of profit and investment ?

In fact, one of his first paper on growth theory seems to have been published in 1954, unfolding a series of other contributions all over the three subsequent decades. Perceptive of political agenda and basic economic facts as he was, Nicholas KALDOR could not ignore that after world war II the

macroeconomic problem had drastically changed. Given the control by the State of short run fluctuations, is long run growth possible ? Quite originally, he developed path breaking models compared with the so-called post keynesian growth theory worked out by HARROD and DOMAR.

In the Fifties, Nicholas KALDOR (1957) proposes *a theoretical model of growth*, challenging the neoclassical distinction between factor substitution along a given production function and the general shift of this function due to technical change. In this first formalization, the technical progress function relates productivity improvements to the size of the investment sector. Simultaneously he provides another mechanism for explaining factor prices : in his 1956 paper on alternative theory of distribution, the share between wage and profit plays the same role as technical substituability within the R. SOLOW (1956) seminal paper on growth theory. These ideas are extended and refined in the subsequent 1962 paper jointly written with J. MIRRLESS.

These papers could have launched an original brand for Keynesian growth theory, but it was not the case due to earlier criticisms and the progressive surge of neo-classical growth theory. A decade later, Nicholas KALDOR addresses to a *more empirically oriented issue* : "Why is United Kingdom growing so slowly ? Once again, he provides a quite different answer compared to E.F. DENISON (1987) views about the famous issue : why do growth rates differ ? In his 1966 paper, KALDOR still focuses upon the role of technical change, but gives a more applied explanation of growth differentials. He combines three major hypotheses. First, the manufacturing sector is the engine of growth, setting the pace for others including the services. Second *dynamic increasing returns* to scale are the major factors explaining manufacturing productivity improvements. Third, the limiting constraint for this cumulative growth is the scarcity of human resources to be incorporated into the manufacturing sector. According to this model, the early decline of agriculture would be the main reason for the poor british performance, whereas on the contrary France, Italy and Germany have benefited from a fast shift of working population from agriculture towards the manufacturing sector.

But this was not at all his final view. During the Seventies, he kept permanently revising some of his previous hypotheses. A lively debate took place, challenging both the empirical relevance given (the statistical tests seem to be shaky as noted by B. ROWTHORN (1975)) and the theoretical framework itself : were not diverging growth rates the outcome of a catching up effect ? But the major changes in KALDOR's views derive from the tentative to stick to the evolutions observed during the Seventies. It was clear that the rising unemployment challenged the view according to which labour scarcity was limiting manufacturing and therefore economy wide growth. Consequently, he put forward successively three new hypotheses.

Looking at the rising external inbalances, opposing surplus to deficit countries, Nicholas KALDOR then propose that *structural competitiveness* is indeed the limiting factor, extending previous models by W. BECKERMAN (1965) and A.P. THIRLWALL (1987). The 1981 paper published in Economie Appliquée gives a suggestive account for the corresponding model : national growth is set according to the evolution of export and import propensity. A more sophisticated analysis, including the role of increasing returns to scale generally confirms the same conclusion (R. BOYER, P. PETIT (1984)). The

Cambridge Economic Policy Group (1980), F. CRIPPS (1978) provided an international model according to which the world macroeconomic evolutions were set by the economic policy adopted by surplus countries. Here comes a second explanation by Nicholas KALDOR when he observed the decline of Keynesian ideas and the surge of conservative policies. Austerity measures by Japanese and German government would explain the large increase in world unemployment rates from the mid-Seventies to the mid-Eighties.

Therefore, according to a typically Keynesian idea, growth would depend upon *the economic policy* followed by the leading countries. Last but not least, our author proposed a third alternative hypothesis. In his 1976 paper on "Inflation and recession in the world economy" he put forward the impact of a *lagged reaction of primary products supply* to previous changes in relative prices. Roughly speaking, he proposed the equivalent of a long wave Kondratief model : when manufacturing growth speeds up, at the end of the boom, a scarcity of primary and raw materials appears, inducing a worsening of the terms of trade detrimental to the manufacturing sector. Consequently its rate of profit declines, levelling off the investment, therefore aggregate demand and the production ; as most raw product markets are flex prices, the previous evolution is halted and spurs a down-swing. Simultaneously, the new production capacities previously built in the primary sector prepare the next recovery.

Clearly enough, as John Maynard KEYNES used to, Nicholas KALDOR has been expressing various views on the very same issue about growth theory. Nevertheless, let us now extract the core of his analysis.

2. THE CUMULATIVE GROWTH MODEL : THE BASIC HYPOTHESES.

The model originated in A. YOUNG (1928) seminal paper on increasing returns. According to A. YOUNG, A. SMITH'S famous law, that states that the division of labour depends upon the size of the market, should be understood broadly as implying the existence of increasing returns to scale for the industry as a whole. The originality of A. YOUNG's argument was to stress the fact that this characteristic was not simply the result of the existence of firms with increasing returns to scale (a very real possibility for all that), but was also due largely to the appearance of new products and new modes of productions made possible by the size of the markets. For sure a market implies purchasing power, but also a series of productive activities linked by a network of exchanges. The *extension of a market* may start a chain reaction. In the first instance, it makes possible an *increased division of labour* in the production process concerned, which opens the way for the introduction of new machines., which in turn develop new markets and speed up the scrapping of obsolete production processes. All the activities linked by the market help to yield increasing returns and "change becomes progressive and propagates itself in a cumulative way" to use YOUNG's own terms.

A. YOUNG seemed therefore to add to Adam SMITH's principle that reciprocally the extent of the market depends upon the division of labour (which amounted to restaure the over criticized SAY's law). But as noticed by N. KALDOR (1972), A. YOUNG saw clearly that the combination of SAY's law with Adam SMITH's theorem was not enough to ensure that "change becomes progressive and propagates itself in a cumulative way". To tell more on demand induced by changes in the organisation of production would have

required the bases of Keynesian economics. G. MYRDAL (1957), who coined the term of "*circular and cumulative causation*", was not more explicit on the subject ; he used the model to account broadly for the widening gap between rich and poor countries.

When N. KALDOR (1966) first referred to cumulative causation (then qualified as "process of interaction between increases of demand induced by increases in supply and increases in supply generated in response to increases in demand") as a mean to analyse the causes of the slow rate of economic growth in the U.K., he mainly stressed the role of increasing returns in manufacturing sectors. The empirical P.J. VERDOORN (1959) law, which related productivity gains with demand growth, was exhibited as an unescapable evidence of these increasing returns. The model was made more explicit in further works (N. KALDOR (1970), (1972)) where account was given of both the effects of productivity changes on demand and the origin of the exogeneous changes in demand which could launch the whole process of cumulative growth.

A basic explanation of demand inducement by productivity change relied on J. HICKS (1950) "super-multiplier", which showed that under certain assumptions "both the rate of growth of induced investment, and the rate of growth of consumption, become attuned to the rate of growth of the autonomous component of demand, so that the growth in an autonomous demand-factor will govern the rate of growth of the economy as a whole" (N. KALDOR (1970), p. 146). The major role of the autonomous component of investment was therefore underlined in the early keynesian tradition. Only in the late 60s was fully acknowledged the *role of exports*, as an autonomous demand-factor, able to govern overall economic growth rates (as suggested by W. BECKERMAN (1965) export led growth model and reckoned by N. KALDOR (1970)). But exports themselves depend both on an exogeneous factor (the growth rate of world demand) and on an endogeneous factor : the "efficiency wages" (i.e. the index of money wages divided by the index of productivity) as defined by J.M. KEYNES and reported by N. KALDOR (1970), p. 147).

Leaving this export relationship, it requires the simultaneous presence of a number of favourable factors to link the productivity gains (i.e. supply changes) with demand growth. N. KALDOR underlines the need for a passive monetary system (letting the money supply grow with credit demand) and for merchants who are ready to adjust their stocks so as to maintain prices. The conditions for a big enough "elasticity of demand" to supply changes are stringent and renders "the "self sustained growth" ... a fragile thing" (N. KALDOR (1972), P. 196).

3. A CLARIFYING DEVICE : A TWO SIDED CAUSALITY.

Not withstanding the various specifications set out by KALDOR (on the sectoral dimension of the process or on demand formation), we can see the cumulative causation model as basically combining two assumptions saying respectively :

- That demand growth q favours productivity gains pr .
- That productivity gains pr induce expansion of demand q .

The first assumption expresses a positive relationship between growth rates q and pr where the causation runs from q to pr (pr = f(q)) and conversely in the second assumption the causation goes from pr to q (q=g(pr)).

Even in this simplified version, the cumulative causation model can lead to a great variety of configurations where the economy moves accordingly towards larger or smaller, steady or unsteady, growth rates.

Figures 1 to 4 illustrate this diversity so as to stress the consequence of the various laws of productivity (how productivity gains are obtained) and demand (how productivity gains generate demand growth). This decomposition of the reduced form of the conventional KALDOR-VERDOORN relations brings some clarity into some of the controversies raised by Nicholas KALDOR writings.

- First, a cumulative process of growth, if to be sustained on a permanent basis, derives from the *structural compatibility of a demand regime and a productivity regime* (Figure 1). The stability condition calls for a limited sensitiveness of demand to productivity, for any given elasticity of productivity with respect to growth.

- Second, this generalized model explains why such a process might never occur for a specific economy, for example if the income distribution mechanisms do not fit with the productivity regime (Figure 2). This gives an insight to address the MYRDALL's issue : *why some economy do not experience a cumulative growth* as older industrialized capitalist countries did ?

- Third, the objection by B. ROWTHORN (1975) about the difficulties in estimating KALDOR-VERDOORN relations can be answered. The estimated relation will correspond to the required productivity regime function if the shifts occuring in the economy are affecting only *the demand regime* (Figure 3).

- Fourth, in the general case, structural changes modify both productivity and demand regimes. Therefore, the conventional single equation estimates lead to a biased elasticity of productivity with respect to growth (Figure 4). Since cumulative evidences support such an hypothesis, *the apparent unstability of the KALDOR-VERDOORN relationship* finds a quite natural explanation.

The cumulative causation model has therefore to be more rigourously framed into a complete set of structural equations, as done for instance by H.D. KURZ (1989). Here, one has to explicit the different steps and variables contributing, in each case, to the obtainment and the diffusion of productivity gains.

A CONVENIENT GRAPHICAL REPRESENTATION OF THE CUMULATIVE GROWTH MODEL

FIGURE 1 : A STABLE EQUILIBRIUM

(I) Demand regime $q = c.pr + D$

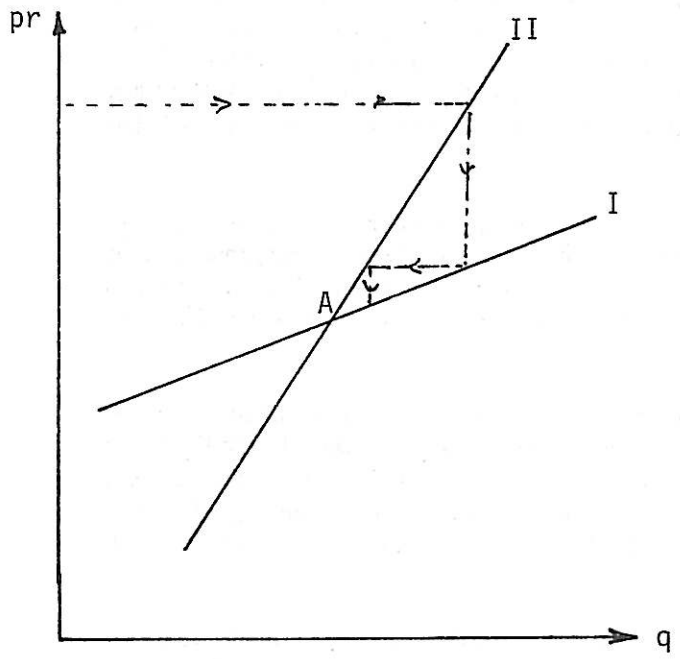


FIGURE 2 : AN UNSTABLE EQUILIBRIUM

(II) Productivity regime $pr = A\,q + B$

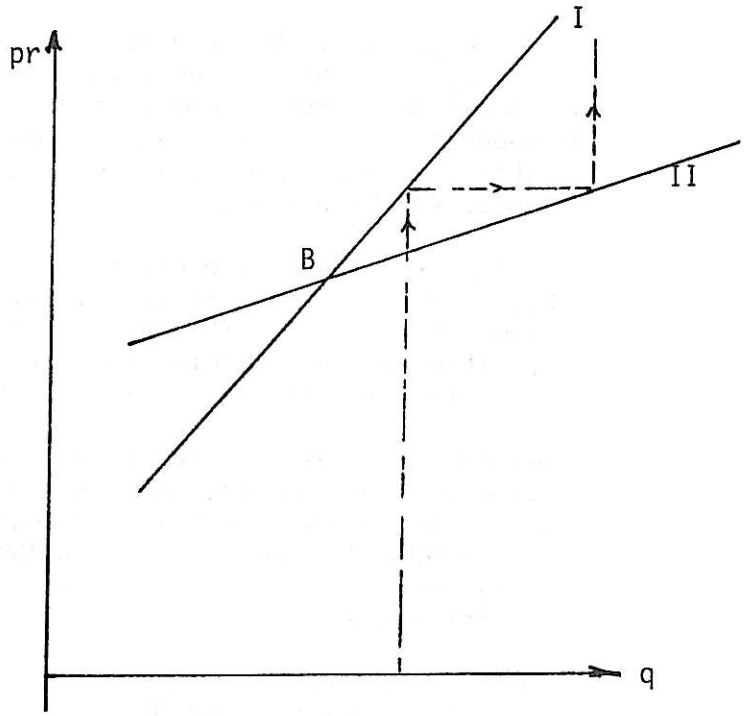


FIGURE 3 : CAN THE KALDOR-VERDOORN RELATION BE ESTIMATED BY SIMPLE LEAST SQUARES ?

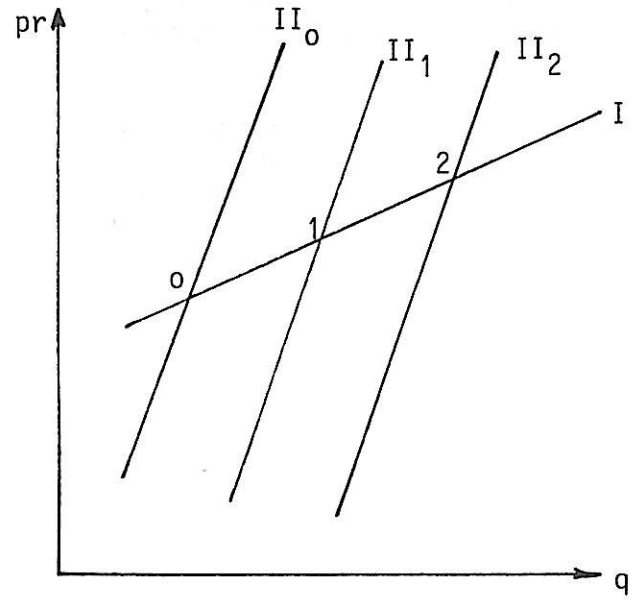
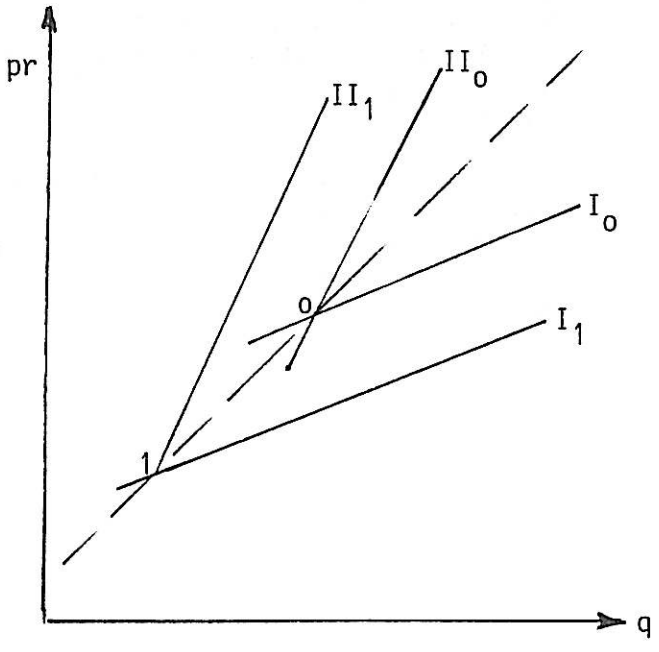


FIGURE 4 : THE GENERAL CASE : THE THE NEED FOR A COMPLETE ESTIMATION



II - TOWARDS A FULLY-FLEDGED STRUCTURAL MODEL

Let us now consider with more details which are the theoretical grounds and the empirical basis for both relationships between demand and productivity. Endogeneous and exogeneous variables have to be brought in to account for each specific equilibrium. The schematic form, presented above, considered only exogeneous changes in productivity gains and demand growth to assess the stability of the current growth path. The real world is submitted to a large variety of exogeneous changes along time and to a great diversity among countries. Empirical tests have therefore to rely upon explicit models accounting, as much as they can, for these differences. We shall first consider how demand growth stimulates productivity gains.

1. A GENERALIZATION OF THE KALDOR-VERDOORN LAW : THE NOTION OF PRODUCTIVITY REGIME.

According to Nicholas KALDOR own writings, as well as the huge literature about technical change, many mechanisms may lead to an ex post positive relationships between productivity trends and growth rate in the medium long run. But how to disentangle so numerous interrelated factors ? Just for simplicity sake, five different mechanisms might be at work in modern capitalist economies.

° As far as *static increasing returns to scale* are concerned, the size of the equipment in some manufacturing industries is a key factor in unit cost formation : the larger the size, the lower the cost. Such a relationship is clearly operating in process industries, in which for instance, the cost varies as the surface, whereas capacity and therefore productivity grows as the volume. Therefore, the elasticity of production with respect to inputs should be around 2/3. This feature could be captured by a conventional variable in industrial economics i.e. *minimum efficiency scale* (MES).

° But according to A. SMITH and A. YOUNG or even A. MARSHALL, the returns to scale are not limited to the internal organization of the firm but express themselves too by *the deepening of the division of labour* due to the expansion of the market. By nature, this link between average productivity and market size can only be reaped at the macro level of the whole economy. From a formal point of view, this could be expressed either by a static relation between the absolute level of productivity and total production (for example in a cross section analysis), or by a dynamic link between a productivity trends and demand increases (to be used in time series). This is precisely the conventional KALDOR-VERDOORN expression. Nevertheless three other mechanisms can deliver such a relationship.

° The previous mechanism could be obtained only via labour division and changes in human skills, whereas many monographies and statistical evidences suggest that some *technical advances are embodied* into specific equipments and machine tools. Two sub-hypotheses have to be combined in order to explain accordingly an ex-post close relationship between productivity and growth. First, following W. SALTER (1960) and many macroeconometric models which retain a vintage analysis of capital, average productivity should depend upon the size of investment which brings up to date technologies and upon the rate of scrapping. Second, investment decisions should be related to demand expectations, themselves formed

according to past sales, and scrapping set according to the pressure exerted by real wage increases. A priori, such combination of hypotheses could contribute to a positive relationship between productivity and growth.

° Another source of dynamic increasing returns to scale has been put forward by many monographs, managerial investigations (Boston Consulting Group), applied econometrics studies (A.A. ALCHIAN (1948), M. KURZ & A. MANNE (1963)) and taken into account in growth theory for instance by K. ARROW (1962). *Learning by doing* and by extension *learning by using*, do provide a mechanism according to which the repetition of tasks, as well as of managerial problems solving, spurs invention and innovation by workers and managers. The cumulativeness of such a process is usually captured by adding an endogeneous improvement of total factor productivity into conventional production functions. This factor is measured by an index of cumulated past production, at the micro or macro level. Analytically, this is not exactly similar to productivity-growth relationships, but the flavour is quite similar indeed.

° A final insight can be added : empirical studies have suggested that *innovative activity is enhanced by buoyant demand outlook*, according to a demand driven view of technical change (E. MANSFIELD (1961), SCHMOOCKLER (1966)). Therefore, on one side productivity growth benefits from innovation, on the other side the very success of the growth process spurs innovation. This virtuous circle between innovation and demand therefore exhibits another root for a possible KALDOR-VERDOORN function. Similarly, along a given socio-technical paradigm and trajectory, (G. DOSI Ed. (1988)), the probability of success of any RD expenditure is the higher, the larger the available stock of knowledge deriving from previous innovations. Again, a form of cumulativeness is embodied into such a formalization.

Then, *an aggregate productivity regime* can be generated by combining the previous five mechanisms and elaborating a complete system. The initial reduced form pr = pr(q) can thus be split into the following system :

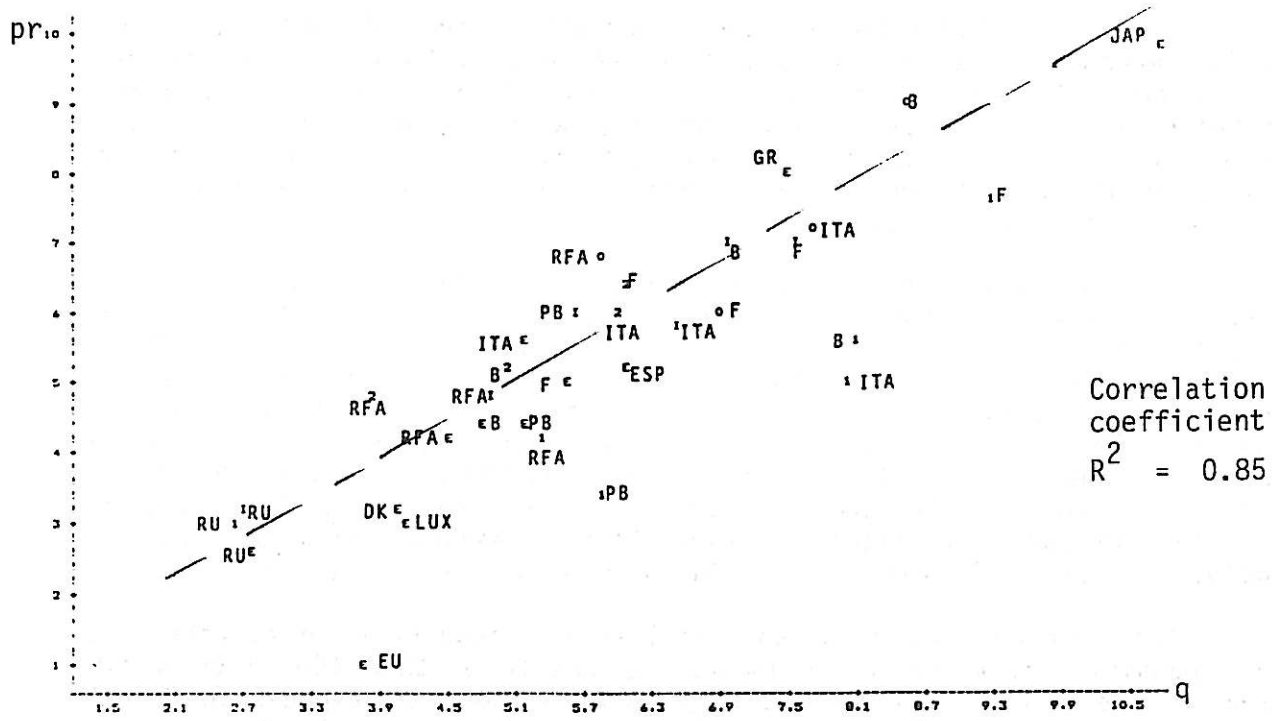
$$pr = F(q,Q,I/Q,MES,INNO,...) \quad (1)$$
$$I/Q = G(q,PRO/PQ,INNO,...) \quad (2)$$
$$MES = H(Q,...) \quad (3)$$
$$INNO = J(STOCKINNO,q,RD,...) \quad (4)$$

with Q level of production, q its growth rate, I the level of investment, INNO an index for innovation, MES minimum efficiency scale, PRO/PQ the share of profit in value added, RD the current expenditures in Research and Development. The first equation gives the main factors for productivity increases (growth, size of the market, investment rate, minimum efficiency scale, innovation). The second explains the rate of investment by demand growth, profit share and innovation. The third one gives the minimum efficiency scale in function of the size of the market, whereas the fourth one describes current innovation with respect to past stock of knowledge, demand growth and RD expenditures. This system leads to the following reduced form for the productivity regime :

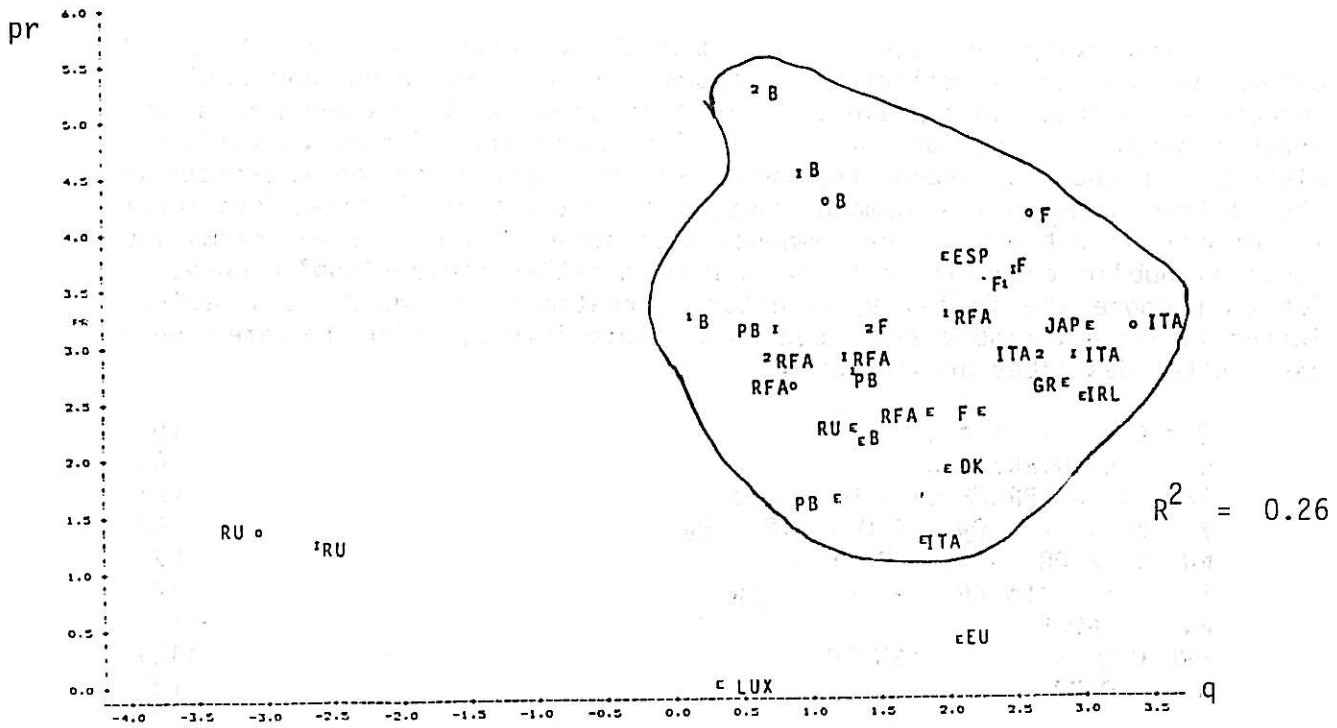
THE RELATIONSHIP BETWEEN GROWTH AND PRODUCTIVITY: THE REDUCED FORM APPROACH AND ITS LIMIT

(Extract from BOYER R. & P. RALLE (1986))

GRAPH 1 : BEFORE 1973, A CLOSE LINK



GRAPH 2 : AFTER 1973, THE BREAKING-DOWN OF THE RELATIONSHIP.



Data : Average annual rates 1960-1973 and 1973-1984 for 10OECD countries, three manufacturing subsectors.

$$pr = pr(q, Q, INNO, PRO/P.Q, ...) \quad (I)$$

Such a framework has a clear advantage : a separate analysis of the various mechanisms can be made and the relative contributions of each of them investigated. Still more, each socio-technical system is probably characterized by an original mix, combining capital embodiement, learning by doing, innovation, static increasing returns to scale and so on. Conversely, any breaking down of such a system might explain the breaking down of the previous productivity regime equations.

This seems precisely to have taken place during the Seventies in most OECD manufacturing sectors. Converging evidences (T. MICHL (1985), R. BOYER, P. PETIT (1981), R. BOYER, P. RALLE (1986)) oppose two periods. Before 1973, even a crude econometric test exhibit a close relationship between productivity trends and growth (Graph 1). The result is quite at odds with standard neo-classical theory which basically assumes an exogeneous technical change. But then, the KALDOR VERDOORN relation should be horizontal, whereas the upward slope is obvious, even when slowly growing (United Kingdom) and highly growing (Japan) manufacturing sectors are included. After 1973, this clear relationship vanishes (Graph 2)?

Most institutionnal and empirical studies suggest a key hypothesis : the transition from one technological system to another (Ch. FREEMAN Ed. (1984)). The shift in the productivity regime would be the expression of such a structural change. This suggested generalization along kaldorian lines seems to cope with one of the major objection addressed to the 1966 formulation. But now the cumulative causation model has to deal with the complementary relation about demand generating mechanisms.

2. THE IMPACT OF PRODUCTIVITY UPON INCOME AND DEMAND : DEMAND REGIMES.

Productivity increases can act upon the various components of demand either through price effects or through changes in wages and profits. Therefore, in order to explain the link between productivity and demand, one needs to account first for the parting of productivity gains between price or distribution changes, second the impact of these price and income effects on the various components of demand. Households consumption, C, firms investment I, net exports X-M define the components of demand Q (in constant terms and ignoring public expenditures). According to rather conventional hypotheses let us propose the following structural equations, in which each capital letter labels a variable expressed in absolute levels, while the same lower-case letter describes growth rates.

$$Q = C + I + (X-M). \quad (5)$$
$$C = c.(N.RW) + g \quad (6)$$
$$I/Q = a.(PRO/P.Q) + b.q + d \quad (7)$$
$$X - M = e \,.\, \underline{QW} + f.Q + h(P - \underline{PW}) \quad (8)$$
$$NW = k.PR + l \,.\, P + o \quad (9)$$
$$P = m \,.\, (SN/PR) + r \,.\, \underline{PW} \quad (10)$$
$$RW = NW/P \quad (11)$$
$$PRO/P.Q = 1 - (SN/PR) \quad (12)$$
$$N = Q/PR \quad (13)$$

$q = q(pr, \underline{gw}, \underline{pw}, \ldots)$ Demand regime reduced form (II)

Aggregate production (5) varies according to effective demand, a rather keynesian and kaldorian hypotheses. Household consumption (6) derives from real wage (RW) and the employment level. It would be a minor difficulty to add a positive propensity to consume out of profit (H. HAGEMANN (1989)), but the model will be kept as simple as possible. The rate of investment (I/Q) (7) is linked jointly to the profit share and the rate of growth, the relative intensity of these two factors distinguishing between keynesian ($b >> 0$ and $a \approx 0$) and classical regimes ($b \approx 0$, $a >> 0$) of investment. The shift could be made endogeneous (S. MARGLIN (1989)) net export (8) are related to the trends in world and home demand (QW and Q) as well as to a price competitiveness factor, comparing domestic and foreign prices. The nominal wage (9) is the outcome of a double indexation, with respect to productivity increases and inflation. In the following discussion, the degree of indexation with respect to productivity will play a major role in generating various demand regimes. The general level of prices (10) is set according to a mark-up applied to labour unit cost, given the world prices. The three last equations define respectively real wage (11), the share of profit (12) and the employment level (13).

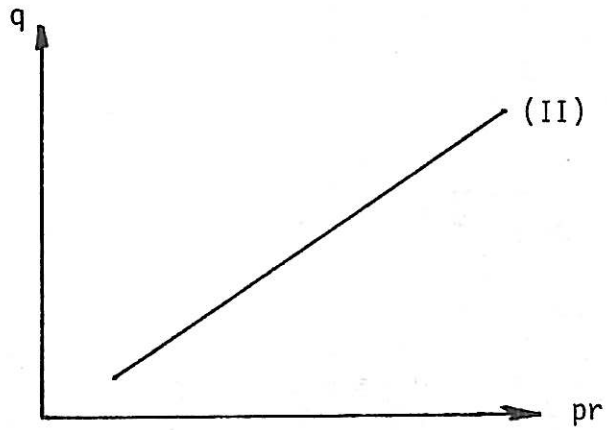
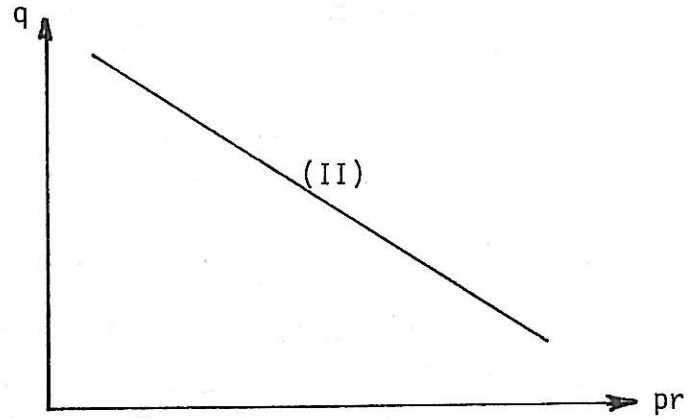
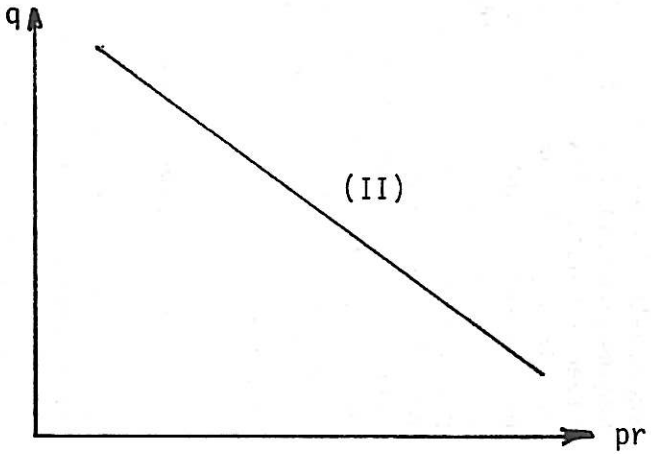
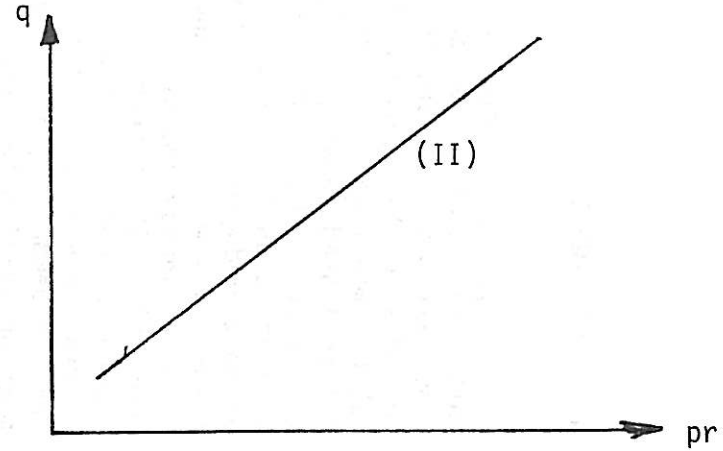
From this complete system of structural equations, one derives an aggregate demand function, which can be conveniently summarized by *a demand regime reduced form* (function (II). Basically it describes the impact of any given productivity trend upon demand generation. It shows the variety and complexity of the transmission mechanisms, which are crucial to any analysis of the self reinforcing adjustment of technical change and demand, i.e. the core of the A. SMITH-A. YOUNG-N. KALDOR views about the growth process. But precisely, the conditions on the elasticity of demand (N. KALDOR (1972)) can now be addressed. On one side, for a given regime the demand may shift according to international and exogeneous changes. On the other side, in the long run, the very dynamic of the system might lead to significant changes into some crucial parameters, basically productivity sharing between wage and profit, the degree of openness and the competitiveness of each national economy.

3. KEYNESIAN VERSUS CLASSICAL DEMAND REGIMES.

Previous investigations (R. BOYER (1988)) have exhibited *four configurations* according to the combination of two main mechanisms : the degree of indexation of wage with respect to productivity and the relative influence of demand and profit upon investment decisions. The corresponding framework is here extended to an open economy, therefore adding a competitiveness term in the analysis. In this simple model, the role of profit upon investment on one side, that of unit cost upon net exports on the other side are similar, which eases such a generalization (Figure 5).

- A *pure keynesian demand regime* comes out when wage indexation is sufficiently high, whereas accelerator effects outrun the profit motive in setting investment levels and the national economy is not submitted to any strong external pressure. Then quite intuitively, aggregate demand

FIGURE 5 : THE DIFFERENT DEMAND REGIMES

WAGE FORMATION \ THE DEMAND IS	PROFIT AND/OR COMPETITIVENESS LED ($\leftarrow$: $(a,h) > (\tilde{a},\tilde{h})$)	CONSUMPTION LED ($\rightarrow$: $(a,h) > (\tilde{a},\tilde{h})$)
LOW PRODUCTIVITY SHARING — $k < \tilde{k}$	Configuration 1 : A PURE CLASSICAL DEMAND REGIME  Demand is increasing with productivity	Configuration 2 : AN HYBRID CLASSICAL DEMAND REGIME  Demand is decreasing
$k = \tilde{k}$	Configuration 4 : AN HYBRID KEYNESIAN DEMAND REGIME  Demand is decreasing	Configuration 3 : A PURE KEYNESIAN DEMAND REGIME  Demand is increasing
HIGH PRODUCTIVITY SHARING — $k > \tilde{k}$		

increases with productivity (Configuration 3). Implicitely at least such a configuration can be labelled as a Keynesian, since it fits quite well with the conception of General Theory and Nicholas KALDOR's writings. Similarly it has some connection with the Fordist regime, put forward by the "régulation" approach in order to explain the unprecedented post world war II growth (R. BOYER (1989)). Section III.1 gives some empirical evidences about this period.

° *An hybrid Keynesian demand regime* associates a high indexation of wage with a strong profit motive and/or external competitiveness pressure. Under such circumstances, the negative influence of productivity upon profit, therefore investment and net exports, is not balanced by consumption growth. Therefore, the demand is now decreasing with productivity (Configuration 4). This case seems representative for the advanced capitalist economies during the Seventies, when a spreading internationalisation and the levelling of profit and investment have exerted a strong pressure upon the previous keynesian demand regime. This hypothesis is tested by section III.3.

° A *pure classical demand regime* is obtained when prevails a low degree of indexation of wage with respect to productivity. Then, if productivity increases, unit costs are lower which enhances net exports while profit share rises and spurs investment. In that case, these positive effects are strong enough to balance the negative impacts upon real wage and consumption. Consequently, the demand regime is again upward sloped (Configuration 1). Let us note in passing that configurations 3 and 1 lead to the same reduced form equation, in spite of contrasted mechanisms for productivity diffusion.

° *An hybrid classical demand regime* corresponds to the last configuration available : the investment is mainly demand driven and the national economy slightly or not at all open to foreign competition, but wage-earners don't benefit from a sufficient indexing with respect to productivity. The demand regime is therefore declining with productivity (Configuration 2). Again, this case and the hybrid keynesian demand regime exhibit clear similarities, even though the structural characteristics are at odds. This hybrid classical demand regime apparently prevailed in the US during the inter war (R. BOYER (1988), C. LEROY (1988)).

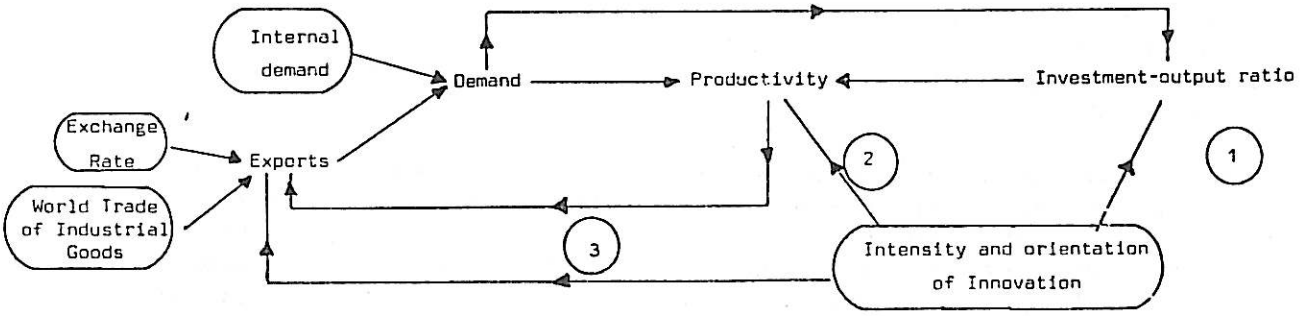
How does this framework enlighten post world war II growth and crisis? Does it solve some of the puzzles which hindered the initial cumulative causation model ? It is now time to address to more empirical issues : what is the relevance of this generalization ?

III - FROM GROWTH TO CRISIS:A CHALLENGE TO GENERALIZED THE KALDOR'S MODELS

Any empirical test of such a framework has to face very specific constraints and requisites. Initially N. KALDOR (1966) and then F. CRIPPS and R. TARLING (1973) have used simple regression upon cross national long run average rates from main macroeconomic variables. But strong objections have frequently been raised (B. ROWTHORN (1975)) : is there any reason for the model to be universal ? How to solve the simultaneity problem between

T A B L E 1 : A FIRST ESTIMATION OF A CUMULATIVE CAUSATION MODEL SIX EUROPEAN MANUFACTURING INDUSTRIES : 1960-1976.

(Extract from BOYER R., P. PETIT (1981))



$$n = \underset{(3.7)}{5.6} - \underset{(4.4)}{0.43} \times (I/Q) + \underset{(4.5)}{0.54} \times q + \underset{(0.03)}{0.002} \times RAT - \underset{(1.6)}{0.27} \times ORINNO \quad (1)$$

$$I/Q = \underset{(11.0)}{12.4} + \underset{(1.9)}{0.26} \times q + \underset{(2.7)}{1.3} \times INNO + \underset{(3.1)}{1.7} \times BELG - \underset{(2.7)}{1.8} \times R.U \quad (2)$$

$$q = - \underset{(0.9)}{0.4} + \underset{(6.9)}{0.32} \times ex + \underset{(12.9)}{0.56} \times D \quad (3)$$

$$ex = \underset{(1.2)}{4.6} + \underset{(1.9)}{0.57} \times pr - \underset{(2.4)}{0.37} \times Change + \underset{(0.5)}{0.026} \times ORINNO \quad (4)$$

$$pr = 100 \times [- 1 + (100 + q) / (100 + e)] \approx q - e \quad (5)$$

ESTIMATION METHOD : Full information maximum likelihood method as given in TSP.

(Growth rates are average annual growth rates over cycle)

° ENDOGENEOUS VARIABLES

n	Growth rate of industrial employment
I/Q	Ratio of investment to added value in current prices
q	Growth rate of added value in constant prices
ex	Growth rate of volume of exports of industrial goods
pr	Growth rate of productivity (added value in constant prices per man employed)

° EXOGENEOUS VARIABLES

RAT	Share of machinery in total investment
ORINNO	Percentage of process innovations in the total of innovations, ten years before common values for the five industries
INNO	Ratio of RD expenditures (military excepted) to GNP (both in constant prices) five years before.
R.U.	Dummy variable for UK industry, to account for the weakness of the investment ratio in that country
Change	Growth rate of the exchange rate (i.e. the value of national currency in US dollars) ; this variable expresses partly the effect of the differences in financial capacities between countries.
D	Growth rate of volume of total demand.

STATISTICAL SOURCES : O.S.C.E. 1980, except for Change and RD : see BOYER R. & PETIT P. (1981).

Data : Average annual rates over four periods 1960-65, 65-69, 69-73, 73-76, 6 European manufacturing industries.

employment, demand and productivity ? Do not the results rely too much on extreme case such as Japan and U.K. ? A priori, historical time series should be used in order to take into account national specificities. But sufficiently long series have to be available, which in fact restricts most of the econometric studies to the US economy. Even in that case, it turns out to be very difficult to disentangle two very different mechanisms explaining a positive correlation between growth and productivity. *In the short run*, the well known *productivity cycle* take place : when the economy recovers, productivity is booming and conversely declines during down-turn. Traditional employment functions incorporate such a pattern (R. BRECHLING, P. O'BRIEN (1967)). *In the medium-long run*, quite different mechanisms explain such a correlation : the role of investment, dynamic increasing returns to scale, learning by doing, now play a proeminent role (see former section II.2). Econometric tests on annual data usually mix these two mechanisms (C. LEROY (1988)). Therefore, it might be prefered to build medium term data, smoothing out cyclical patterns and then to estimate the model on this new set of variables (L. CAUSSAT (1981)).

Given these caveats, let us summarize briefly the major conclusions suggested by the various available studies. First the generalized KALDOR's growth model is used in order to explain growth differentials between major European countries until the Seventies. Then, an extension of this model will be estimated in order to understand long run growth, for the United States manufacturing sector. Finally, the changes in the productivity regime will be investigated and simultaneously some hypotheses about the shift in the demand regime will be tested for main OECD economies, using the more recent data for the Eighties.

1. A CROSS SECTION ANALYSIS FOR EUROPEAN MANUFACTURING : A CORRECT FIT UNTIL THE CRISIS.

Attempts to disembody the respective effects of capital formation, work organization and technical change have brought some more backing to the cumulative causation model, if restricted to manufacturing industries (A. PARIKH (1978)). Thus pooling cross sections and time series data for six European countries, R. BOYER and P. PETIT (1981) show that a four equations formulation of the cumulative model was rather consistent to account for average productivity differentials over four business cycles during the period 1960-1976. The model, summarized in Table 1, includes an employment relation and an investment function which helps to distinguish between the effects tied to capital formation and those due to work organisation and endogeneous technical change. Innovations variables stand for the exogeneous part of productivity advances. Three main results have to been stressed upon:

- The *apparent elasticity of productivity* with respect to growth turns out to be around 0.60. Nevertheless, this ex post estimate derives from two different mechanisms : pure increasing return to scale (around 0.57) and the impact of investment and the acceleration mechanisms (about 0.03), as shown by combining the equations (1), (2), (5). This global estimate is basically consistent with most of the available direct estimates.

- The *demand regime* –obtained by using relations (3) and (4)– is slightly upward sloping. Given the elasticity of export with respect to productivity and the impact upon aggregate demand, the slope is around 0.18. Therefore,

any exogeneous shift in the productivity regime raises output growth but lowers significantly the employment level. The competitive motive is not strong enough to balance the direct and mechanical negative effect of technical change upon the employment trends.

° The statistical fit is rather satisfactory given the simplicity of the structural model which has been estimated. At the confidence level of 10 %, the returns to scale are significantly superior to 1, which seems to contradict a basic hypothesis of general equilibrium theory, as well as standard neo-classical growth models.

All these results bring a clear support to N. KALDOR's views, while replying to earlier criticisms about the bias towards a reduced form approach and the shakiness of econometric tests. Nevertheless, this generalized model is not without clear shortcomings. On one side, international heterogeneity is not totally explained, since dummy variables for Belgium and U.K. had to be added. Again the validity of a unique and universal model can be challenged. On the other side, internal demand has been kept exogeneous, which skips aside the sensitiveness of demand with respect to productivity. In order to overcome these two limits, let us now turn towards another data set.

2. A MODEL FOR US MANUFACTURING : MERITS AND LIMITS.

In a very stimulating, but alas unpublished working paper, L. CAUSSAT (1981) has elaborated and estimated a cumulative causation model for the American manufacturing sector from 1899 to 1976. In order to abstract from short run fluctuations, he built aggregate data smoothed over the 18 cycles which took place in United States during this period. Simultaneously, very long series about patenting allows two original measures for innovative activity (INNO1 , INNO2) to be included in the employment, investment and external trade equations. Furthermore, real wage is now endogeneous and reacts to productivity variations. The very building of data over a whole cycle makes sure that the estimates capture medium-long run mechanisms and not the short run productivity cycle. Three major results emerge (Table 2) :

° The existence of *increasing returns to scale* cannot be rejected at a very high confidence level. Again, the ex post elasticity of productivity with respect to growth is around 0.5 , as exhibited by both relation (1) and (4). With respect to the previous model, two other factors contribute to productivity increases. Firstly, machinery and manufacturing building have opposite effects upon employment : the former enhances productivity, while the later spurs employment. Therefore investment, according to its composition, has both productivity and capacity effects. Secondly, innovation plays a significant but modest role in productivity improvement, directly via labour saving biases, indirectly in stimulating investment in machinery.

° *The demand regime* is clearly upwards sloping, since now real wage reacts to productivity according to an elasticity around 0.3 (equation (3)). Simultaneously, the ratio of export to import is strongly sensitive to productivity advances with an elasticity about 2.65 (equation (2)). Therefore aggregate demand now increases by 0.43 % when productivity is raised by 1 % (equations (5) and (6)). Consequently, any exogeneous upwards

T A B L E 2 : A SECOND ESTIMATION OF A CUMULATIVE CAUSATION MODEL AMERICAN MANUFACTURING SECTOR OVER 18 CYCLES FROM 1899 TO 1976.

Extract from L. CAUSSAT (1981)

1. ESTIMATES

$$n = \underset{(0.72)}{-\ 0.35} + \underset{(8.52)}{0.5}\ q - \underset{(2.38)}{0.02}\ m\text{-}1 + \underset{(3.04)}{0.06}\ c - \underset{(2.67)}{0.08}\ INNO1 \qquad (1)$$

$$tc = \underset{(2.46)}{-\ 6.97} + \underset{(10.82)}{2.65}\ pr + \underset{(4.05)}{0.16}\ INNO2 \qquad (2)$$

$$s = \underset{(2.83)}{0.8} + \underset{(7.72)}{0.3}\ pr + \underset{(62,56)}{1.06}\ p + 0.43 \qquad (3)$$

$$m = \underset{(3.94)}{-\ 4.71} + \underset{(13.32)}{1.96}\ q + \underset{(2.21)}{0.21}\ INNO1 \qquad (4)$$

$$d = \underset{(1.95}{1.06} + \underset{(44.29)}{0.82}\ ms + \underset{(11.55)}{0.13}\ m \qquad (5)$$

$$q = \underset{(1.72)}{-\ 0.26} + \underset{(14.90)}{0.05}\ tc + \underset{(76.51)}{1.05}\ d \qquad (6)$$

$$pr = 100 / (100 + n)\ (q - n) \qquad (7)$$

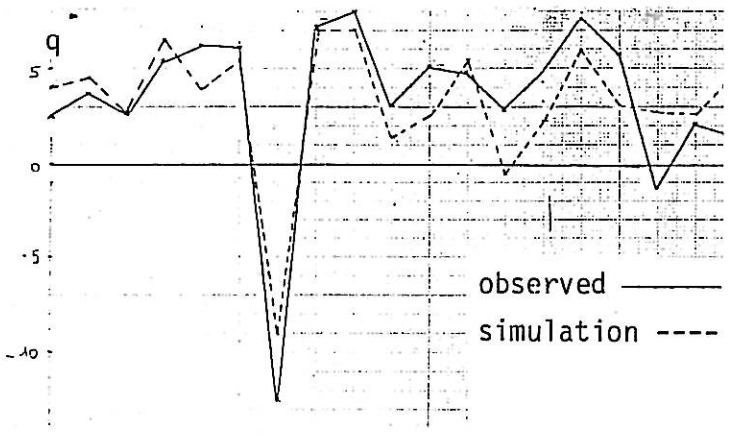
$$w = 100 / (100 + p)\ [s + n + (s \times n) / 100) - p] \qquad (8)$$

2. NOTATIONS

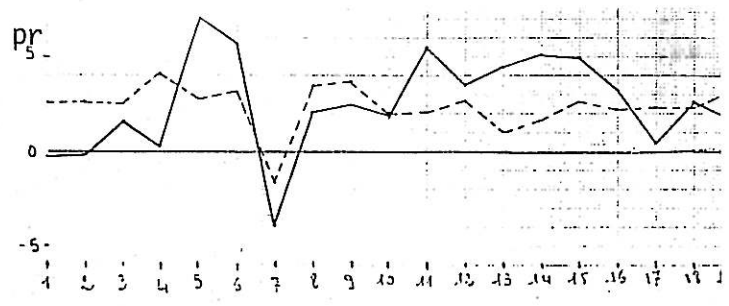
	Same notations as TABLE 1.
m	Volume of machinery delivered to manufacturing
e	Volume of construction for manufacture
INNO1, INNO2	Lagged variables over American patents
tc	Rate of evolution of the ratio export/import
s	Nominal wage
w	Total wage bill.

3. SIMULATION RESULTS.

GRAPH 3 : MANUFACTURING VALUE ADDED
(annual rate)



GRAPH 4 : LABOUR PRODUCTIVITY



shift in the productivity regime, enhances growth but seems to destroy employment. Again, a desindustrializing biais of technological change emerges : when innovation speeds up, as far as the model is correct, the absolute and relative levels of manufacturing employment are decreasing.

° *The statistical fit* is rather good, as shown by the very high significance level of most variables. The basic mechanisms cannot be rejected, on the evidence of three quarters of century in American history. Nevertheless, the simulations somehow mitigate such a positive assessement. Of course, the major fluctuations in growth rates are well captured by the model (Graph 3), specially during the interwar period. Nevertheless, after 1965, one notes a large discrepancy between observed and theoretical values for manufacturing value added. The discrepancy is rather impressive for productivity (Graph 4). After 1965, the model predicts a mild acceleration, whereas American manufacturing has experienced a very significant slow-down.

Therefore, *a rather constrasted picture* comes out. For any follower of Kaldorian ideas, the acceptance of the cumulative growth model is seemingly strengthened. Quite on the contrary, many others might challenge the relevance of this model : after all it does not solve the American productivity puzzle that it intended to enlighten. Nor did E.F. DENISON (1987). But as D. GORDON (1989) pointed out, the Kaldorian system probably exhibits too much cumulation and too little disaccumulation. The British manufacturing industry in the Eighties would provide quite similar diverging trends : high productivity rate, but moderate sales growth. Basically, scrapping and modernizing via rationalization are not dealt with by the Kaldorian model, an evident drawback indeed in analyzing the Seventies and Eighties.

The stability of the model in the long run is therefore challenged. Two other studies seem to confirm some major changes occuring in the American economy. After the second World War, wage formation seems to have shifted from mainly competitive to administered, with an explicit sharing of expected productivity increases (R. BOYER (1988), C. LEROY (1988)). After the mid-Sixties, the productivity regime has shifted downward by 1.5 %, and this slow-down cannot be accounted by most of conventional factors. In this respect, the estimation of a two sections model (M. JUILLARD (1988)) does confirm this conclusion, already reached at by the growth accounting method (E.F. DENISON (1987)). Still more, real wage undergoes an equivalent slowing-down after 1972. Again it cannot be explained by the traditional factors such as the rise in unemployment or the decay in the bargaining power of the labour unions.

Clearly, even for a single country, the generalized Kaldorian model is *not stable in the long run*. Does this conclusion emerge too from a cross section analysis among OECD countries ?

3. A CROSS NATIONAL ANALYSIS : THE BREAKING-DOWN OF THE PRODUCTIVITY REGIME IN THE SEVENTIES.

After a decade of slow growth and large unemployment in most industrialized countries it appears that some relationships, at the core of the cumulative causation model, do not hold any more ... or have shifted

TABLE 3 : A THIRD ESTIMATION OF A CUMULATIVE CAUSATION MODEL. TWELVE OECD ECONOMIES OVER THREE PERIODS.
(Extract from P. RALLE (1988))

A - 1960-1973 : A TYPICAL KALDORIAN MODEL

(1) pr = - 0.32 + 0.69 q + 0.06 rd
(-0.3) (3.0) (0.7)

(2) i = 5.03 + 1.37 q + 2.07 (pro/q) - 1.36 r + 4.62 IRL
(1.6) (4.4) (2.2) (2.1) (3.1)

(3) c = - 0.46 + (sr + n)
(2.0)

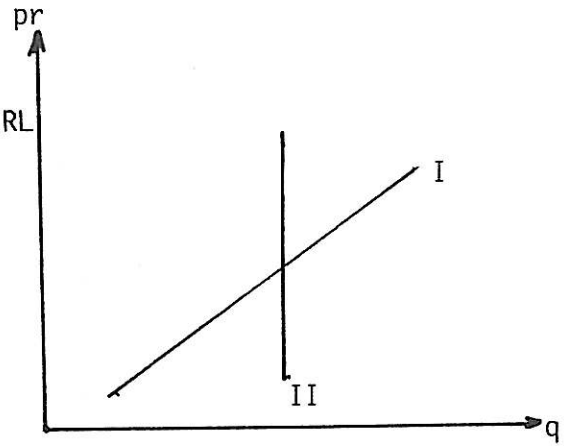
(4) w = 0.31 + 1.02 pr - 2.17 GRE
(0.7) (9.4) (3.9)

(5) (pro/q) = 1.73 (q - sr - n)
(2.4)

(6) q = 0.85 c + 0.15 i

(7) n = q - pr

GRAPH 5



B - 1973-1979 : THE BREAKING DOWN

pr = 0.21 + 0.40 q + 0.15 rd
(0.4) (2.0) (4.2)

i = 0.58 - 0.08 r + 5.39 IRL
(1.7) (-0.6) (4.6)

c = - 0.12 + (sr + n)
(-0.5)

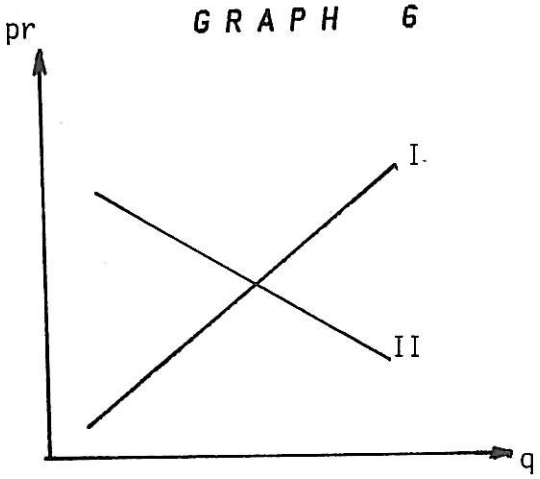
sr = 0.56 + 0.76 pr + 1.66 GRE
(1.7) (4.7) (3.5)

(pro/q) = 2.78 (q - sr - n)
(3.4)

q = 0.85 c + 0.15 i

n = q - pr

GRAPH 6



C - THE EIGHTIES : NO CLEAR SUBSTITUTE TO THE PREVIOUS MODEL.

pr = 0.82 + 0.26 rd
(1.8) (1.8)

i = - 3.86 + 2.56 q + 1.10 (pro/q) - 0.17 r - 2.80 IRL
(-2.5) (3.7) (2.6) (-0.9) (-2.1)

c = 0.49 (sr + n) - 2.00 IRL
(2.1) (-2.6)

sr = 2.12 + 1.73 pr + 0.32 n + 3.11 GRE
(-3.9) (5.8) (1.4) (4.6)

(pro/q) = 0.99 (q - sr - n)
(2.6)

q = 0.85 c + 0.15 i

n = q - pr

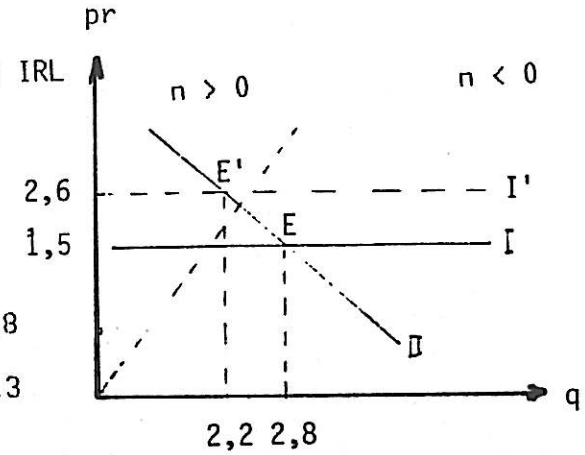
qE = 2,8

nE = 1.3

I pr = 1,5%

II q = 3,8 - 0,6 pr

GRAPH 7



noticeably. The alteration of the KALDOR-VERDOORN law is itself a central example. The linear relationship between demand and productivity growth rates do not account for the recent slower growth in demand and productivity (see previous Graphs 1 and 2). This result stems from different international comparisons pooling cross sections and time series (cf. T. MICHL, (1985), R. BOYER, P. RALLE (1986), P. PETIT (1986)) or from time series econometric studies allowing for simultaneity problems of estimation (V.G. STAVRINOS (1987)).

P. RALLE (1988) has adopted a similar strategy and has estimated both productivity and demand regimes for ten European economies, Japan and US. The model is therefore extended from manufacturing to other industries, such the services. The theoretical reasons for such a generalization one to be carefully discussed (P. PETIT (1988)). In any case, the sample from 1960 to 1987 has been split into three sub-periods : 1960-1973, 1973-1979, 1979-1987. Of course, given the limited number of data, the econometric results are somehow shaky, whereas the linearisation of the basic model is not without drawbacks, even if very useful in order to analytically solve the model. The main concern is about the stability/unstability dilemma (Table 3).

- The heyday of *a typical Kaldorian model* seems to have occured from 1960 to 1973 (Table 3.A). Quite all the basic hypotheses are confirmed. The increasing returns to scale are significant and rather impressive (around 1.7). The indexing of wage with respect to productivity is complete and plays a major role in effective demand dynamism. The investment reacts both to demand and profit share, but this ratio is kept sensibly constant due to the perfect indexation of wage. Consequently, the simplified cumulative causation model is a good approximation for a more complete formalization : the demand regime is quite insensitive to productivity (Graph 5) ; Therefore the KALDOR-VERDOORN equation can be estimated by a simple least squares procedure.

- *This model breaks down after* 1973 (Table 3.B). First, the productivity growth equation looses significance : increasing returns are lower, but research and development per capita seems to play a more important role in international productivity differentials. This is another evidence for a complete change in the productivity regime. But the demand regime itself is drastically modified : investment growth differentials cannot be explained by any of conventional variables, whatever profit, demand, or real interest rates. The stability of productivity sharing cannot be rejected, but the previous changes deliver a new demand regime, downwards sloping (Graph 6). As for the previous period, the influence of net export cancels out and therefore has been excluded. Therefore, it is difficult to check the shift from a pure keynesian demand regime to a competitive and profit led regime or any hybrid case.

- *Not any clear model has yet emerged in the Eighties* (Table 3.C). The productivity regime is puzzling indeed : basically productivity is independent from any conventional factor, even RD expenditures play a modest and not very significant role. The demand regime is surprising too. On one side, the accelerator mechanism takes place again, whereas the role of profit becomes significant. No problem with consumption, but contrary to a widely held view, real wage indexing would not have declined....but this might describe a spurious result. Adding up these various changes, the global demand regime comes out as downward sloping (Graph 6). If the

exogeneous variables of the early Eighties were kept constant, the model would forecast a growth rate around 2.8 % per year, and a recovery in employment around 1.3 % per year, a rather optimistic new which might be challenged.

Two opposite conclusions can be drawn from the previous exercice. Either the econometrician will argue that the misspecification of the model tested explains the apparent unstability of the generalized Kaldorian model. Or a "régulationnist" approach would emphasize that such unstability is a real phenomena, deriving from the structural character of the present crisis : numerous institutionnal evidences support the hypothesis about the demise of post W.W. II growth model. In any case, KALDOR's ideas do bring fresh and genuine hypotheses, in analyzing contemporary capitalist economies.

IV - REINVESTING GROWTH THEORY ALONG KALDOR'S SEMINAL CONTRIBUTIONS.

It is time now to summarize the main conclusions and to suggest an agenda for future researches. By itself the variety and the quality of the contribution to the conference "Nicholas KALDOR and mainstream economics" is a testimony upon his long lasting influence. Let us propose the following statements and prospects, given our own previous researches.

1. Nicholas KALDOR's vision about growth becomes now more and more relevant. When he first opposed to the overemphasis of general equilibrium theory about short run phenomena and proposed the cumulative causation growth model as an alternative, his impact on mainstream economists was quite small indeed. Paradoxically enough at the end of the Eighties, very numerous and distinguished scholars now consider *growth theory* as a key agenda, and still more *increasing returns* as a necessary ingredient for any relevant formalization. P. KRUGMAN (1981), R. E. LUCAS (1985), P. DASGUPTA, J. STIGLITZ (1986), P.M. ROMER (1986), R. DAY (1987), have all worked at rejuvenating the basic hints in the tradition of A. SMITH, and A. YOUNG. One can only regret N. KALDOR having been right too early with respect to academic profession.

2. Of course, his various models, *if very stimulating, were far from perfect.* Most of them were under specified, some basic hypotheses have continuously been changed from period to period in order to cope with the various phases of modern capitalist economies. Therefore he never converged towards a central theory and formalization, which would have define a clear and finally fledged alternative to the elegant, but poorly relevant, general equilibrium theory. Similarly, the statistical tests provided by Nicholas KALDOR and his followers were sufficient for pointing out some major stylized facts but not necessarily to convince modern macroeconomists and sophisticated econometricians. Still more, the precise roots of increasing returns to scale are more suggested than totally elucidated, whatever the sympathy one might have with this hypothesis. Nicholas KALDOR launched a research agenda, but until recently only few scholars have been devoting their time in exploring it.

3. After and among many others (A.P. THIRLWALL (1987), F. TARGETTI (1988), P. SKOTT (1988), H. KURZ (1989), D. GORDON (1989)), the present paper has put forwards a *generalized model* form along a Kaldorian vision about long run growth. Basically the idea is simple enough : first, to define a *productivity regime* which generalizes the too crude KALDOR-VERDOORN reduced form approach ; second and symmetrically, to build a *demand regime*, which describes the impact of productivity increases upon income distribution and demand generation. The viability and stability of any institutionnal and technological organization is up to the compatibility between these two regimes. Even if kept analytically very simple —excluding for example any strong non-linearity—, the corresponding models shed some interesting insights about post world war II growth, for US as well as for major European or OECD countries.

4. Nevertheless, *this framework has encontered its own limits*, typically during the last decade. First, comes out an intrinsic difficulty in estimating such models. Either, one assumes the universality of the same growth model all accross advanced capitalist economies, and therefore estimates cross section model. The specificity of most, or at least of some national trajectories, points then to a major shortcoming of such an hypothesis. Or alternatively one supposes the invariance through time of the cumulative causation growth model...which then contradicts some basic hints about the structural changes which have occured both in productivity regime (the slowing-down in US manufacturing sector during the mid-Sixties) and in the demand regime (new trends in wage formation and external trade in the Seventies). The available econometric studies do suggest some *national specificities*, as well as the occurrence of *structural changes through time*. This might explain why Nicholas KALDOR has sequentially been changing his view about the factors limiting growth successively : labour scarcity, external constraints, lagged adjustment of primary products supply....

5. Therefore, *a rejuvenation of the Kaldorian model* has to be undertaken. First should be discussed the *general vision* according to which the growth process derives from the interplay of technical changes with institutions governing income and demand formation. Second, the roots and conditions of *various productivity regimes* have to be investigated via converging researches, monographical and statistical, which would associate scholars in technical change and the macroeconomists, combine cross sectoral and national studies with long run time series analyses. Third, *the demand regime* seems to undergo some significant changes in the Eighties. For instance, investment dynamics, still defines a puzzle for most analysts, whereas it plays a key role in any modelling of demand and technical change. Similarly, external trade is harder and harder to formalize, in spite of (or due to) large swings in relative prices exchange rates and the growth differentials. The hypothesis of a shift from a consumption led to a competitive led demand regime has therefore to be carefully checked.

6. To conclude, *an ambitious research agenda* could combine the experience and analytical tools of a large spectrum of social scientists : specialists in engeniering, economists of technological change, macroeconomists of keynesian-kaldorian style, institutionnalists and "régulationnists" could add up their projects. First in order to converge towards a clear and analytically rigourous basic model of cumulative growth. Second, to

undertake an investigation in long run history, at the light of such a model. Finally, to assess the viability and stability of the recovery and growth process, which has been initiated since the mid-Eighties.

This would probably be the best tribute to Nicholas KALDOR. To stick to the major transformations occurring in modern capitalist economies, to elaborate relevant models, then derive key insights for economic policy, these are the major issue at the top of the agenda. At least for any economist who does not believe to the universal and permanent self equilibrating mechanisms, conventionally associated to pure markets. As some generals and strategists who prepare the last war and therefore loose the next one, the economists understand better the Thirties than they cope with today challenges ! Nicholas KALDOR would urge us to address to the largely genuine present structural crisis and to innovate, not to repeat his own findings.

REFERENCES

ALCHIAN A.A. (1948) : "Reliability of Progress Curves in Airframe Production", Mimeograph RAND Corporation, in *Economic Forces at Work*.

ARROW K. (1962) : "The Economic Implications of Learning by Doing", *Review of Economic Studies*, Vol. 29, n° 2.

BECKERMAN W. (1979) : *Slow growth in Britain : causes and consequences*, Cambridge University Press.

BECKERMAN W. & Alii (1965) : *The British Economy in ◊#⊃≦*, Cambridge University Press.

BOYER R. (1988) : "Formalizing growth regimes". In *Technical Change and Economic Theory*, G. DOSI, C. FREEMAN, R. NELSON, G. SILVERBERG, L. SOETE Editeurs, Frances Pinter, London.

BOYER R. (1988) : "Wage Labor Nexus, Technology and Long Run Dynamics : An Interpretation and preliminary tests for US", Mimeograph prepared for the Siena workshop on "Technological and Social Factors in Long Term Fluctuations". R. GOODWIN Ed, Springer Verlag, Berlin.

BOYER R. (1989) : *Regulation Theory : A Critical Assessement*, Columbia University Press, New York.

BOYER R., CORIAT B. (1986) : "Technical Flexibility and Macro-Stabilisation", *Ricerche Economiche*, Vol. XL, n°4, Ottobre-Dicembre.

BOYER R., PETIT P. (1981) : "Progrès technique, croissance et emploi : un modèle d'inspiration kaldorienne pour six industries européennes", *Revue Economique*, Vol. 32, N° 6, novembre.

BOYER R., PETIT P. (1984) : "Politiques industrielles et impact sur l'emploi : les pays européens face à la contrainte extérieure", *Revue d'Economie Industrielle*, n° 27, 1er Trimestre.

BOYER R. RALLE P. (1986) : "L'insertion internationale conditionne-t-elle les formes nationales d'emploi ?", *Economies et Sociétés*, série p. 29, 1er trimestre.

BRECHLING R., O'BRIEN P. (1967) : "Short-run Employment Functions in Manufacturing Industries : an International Comparison", *Review of Economic and Statistics*, Vol. XLIX, n° 3, August.

CAMBRIDGE ECONOMIC POLICY GROUP (1980) : "An appraisal of World Development Prospects in the 1980s, together with a Critical Review of Work in this Field", *Cambridge Economic Policy Review*, Vol. 6, n° 3, November.

CAUSSAT L. (1981) : "Croissance, emploi, productivité dans l'industrie américaine (1899-1976)", Mimeograph, CEPREMAP-ENSAE, Septembre.

CRIPPS F. (1978) : "Causes of Growth and Recession in World Trade", *Cambridge Economic Policy Review*, Vol. 5, n° 4.

CRIPPS F., TARLING R. (1973) : "Cumulative causation in the growth of manufacturing industry", Mimeo, Dept. of Applied Economics, Cambridge U.K.

DASGUPTA P., STIGLITZ J. (1986) : "Exercices in the Economics of Learning by Doing", Mimeograph presented at the Conference on Innovation Diffusion, Venice, March.

DAY R. (1987) : "Economic Development in the Very Long Run", Mimeograph Universiy of Southern California, Los Angeles, September.

DENISON E.F. (1987) : "Growth Accounting", *The New Palgrave. A Dictionary of Economics*, John EATWELL, & Alii Eds, Vol. II., Mc Millan.

DENISON E.F., POULLIER J. (1967) : *Why Growth Rates differ ?*, Brokkings Institution, Washington.

DOSI G., FREEMAN C., NELSON R., SILVERBERG G., and SOETE L. Eds (1988) : *Technical Change and Economic Theory*, Frances Pinter, London.

FREEMAN C. Ed. (1984) : *Long Waves in the World Economy*, Frances Pinter, London.

GORDON D. (1989) : "Kaldor's Macro System : Too much Cumulation, Too little Disaccumulation", in *Nicholas KALDOR and Mainstream Economics : Confrontation or Convergence ?*, NELL Ed. and SEMMLER W. Eds, Mac Millan, London.

HAGEMANN H. (1989) : "A Kaldorian saving Function in a Two-Sectoral Linear Growth Model", in *Nicholas KALDOR and Mainstream Economics : Confrontation or Convergence ?*, NELL Ed. and SEMMLER W. Eds, Mac Millan, London.

HICKS J. (1950) : *A Contribution to the Theory of the Trade Cycle*, Oxford Clarendon Press.

JUILLARD M. (1988) : "Un schéma de reproduction pour l'économie des Etats-Unis : 1948-1980. Une tentative de modélisation et quantifications", *These*, Université de Genève, Juillet.

KALDOR N. (1950) : "Hicks and the Trade cycle", *The Economic Journal*.

KALDOR N. (1954) : "The Relation of Economic Growth and Cyclical Fluctuations", *Economic Journal*, March.

KALDOR N. (1957) : "A Model of Economic growth", *Economic Journal*, December.

KALDOR N. (1966) : *Causes of the Slow Rate of Growth in the United Kingdom*. Cambridge University Press.

KALDOR N. (1970) : "The Case for Regional Policies", *Scottish Journal of Political Economy*, Vol XVII, N° 3, nov. 1970, reprinted in *Further Essays on Economic Theory*, DUCKWORTH, London, pp. 139-154.

KALDOR N. (1972) : "The Irrelevance of Equilibrium Economics", *Economic Journal*, Vol 82, December reprinted in *Further Essays on Economic Theory*, DUCKWORTH 1978, London pp. 176-201.

KALDOR N. (1979) : "Equilibrium Theory and Growth Theory", In BOSKIN M.J. ed. *Economics and Human Welfare*, Academic Press.

KALDOR N. (1981) : "The Role of increasing returns, Technical Progress and Cumulative Causation in the Theory of International Trade", *Economie Appliquée*, Vol. XXXIV, n° 4.

KALDOR N. (1986) : "Limits on Growth", *Oxford Economic Paper* 38, p. 187-198.

KALDOR N., MIRRLESS J. (1962) : "A New Model of Economic Growth", *Review of Economic Studies*, Vol. 29, n° 3.

KRUGMAN P. (1981) : "Trade, Accumulation and Uneven Development", *Journal of Development Economics*, n° 8.

KURZ H.D. (1989) : "Technical Change, Growth and Distribution : A Steady-State Approach to "Unsteady" Growth on Kaldorian Lines", in *Nicholas KALDOR and Mainstream Economics : Confrontation or Convergence ?*, NELL Ed. and SEMMLER W. Eds, Mac Millan, London.

KURZ M. and A. MANNE (1963) : "Engineering estimates of capital-labour substitution in metal machining", *American Economic Review*, 53.

LEROY Cl. (1988) : "Un modèle de croissance de longue période de l'industrie manufacturière américaine". Mémoire de D.E.A., Mimeograph E.H.E.S.S., Octobre.

LUCAS E. (1985) : "On the mechanisms of Economic Development", Mimeograph, Marshall Lecture, May.

MANSFIELD E. (1961) : "Technical Change and the Rate of Innovation", *Econometrica*, 29, n° 4.

MARGLIN S. (1989) : "Profit Squeeze and Keynesian Theory", in *Nicholas KALDOR and Mainstream Economics : Confrontation or Convergence ?*, NELL Ed. and SEMMLER W. Eds, Mac Millan, London.

MICHL T. (1985) : "International Comparisons of Productivity Growth : VERDOORN's law revisited", *Journal of Post Keynesian Economics*, Vol VII, N° 4, Summer.

MYRDAL G. (1957) : *Economic Theory and Underdevelopped Regions*, London Duckworth.

PARIKH A. (1978) : "Differences in Growth Rates and KALDOR's laws", *Economica*, 45, Febr. p. 83-91.

PETIT P. (1986) : *Slow Growth and the Service Economy*, Frances Pinter, London.

PETIT P. (1988) : "Incidences de la tertiarisation sur l'organisation industrielle et le rapport salarial", Chap. IV Rapport collectif CEPREMAP-CGP, Aspects de la crise, Tome I, février.

RALLE P. (1988) : "Estimation d'un modèle en coupe internationale, 1960-1987", Mimeograph, Contribution to *La seconde transformation*, R. BOYER Ed. forthcoming, Economica, Paris.

ROMER P.M. (1986) : "Increasing returns and Long run Growth", *Journal of Political Economy*, October, 94.

ROSENBERG N. (1982) : *Inside the Black box : Technology and economics*, Cambridge University Press.

ROWTHORN B. (1975) : "What Remains of Kaldor's Law ?", *Economic Journal*, March.

SALTER W.E.G. (1960) : *Productivity and Technological Change*, Cambridge University Press.

SAWYER M. (1981) : "The influence of Cost and Demand Changes on the Rate of Change of Prices", *Applied Economics*.

SCHERER F.M. (1980) : *Industrial Market Structure and Economic Performances*, Houghton Mifflin.

SCHMOOKLER J. (1966) : *Invention and Economic Growth*, Harvard University Press, Cambridge.

SOLOW R. (1956) : "A Contribution to the Theory of Economic Growth", *Quarterly Journal of Economics*, Vol. 70, n° 1.

STAVRINOS V.G. (1987) : "The intertemporal stability of KALDOR's first and second growth laws in the U.K.", *Applied Economics*, 19, 1201-1209.

TARGETTI F. (1988) : *Nicholas KALDOR*, Il Mulino, Bologna.

TARGETTI F. (1989) : "Change and Continuity in Kaldor's thought on Growth and Distribution", in *Nicholas KALDOR and Mainstream Economics : Confrontation or Convergence ?*, NELL Ed. and SEMMLER W. Eds, Mac Millan, London.

THIRLWALL A.P. (1987) : *Nicholas KALDOR*, Wheatsheaf Books, Brighton.

VERDOORN P.J. (1959) : "The Role of Capital in Long Range Projections", *Cahiers Economiques de Bruxelles*, Vol. 5, October.

YOUNG A.A. (1928) : "Increasing Returns and Technical Progres", *Economic Journal*, December.