International competitiveness in post-Keynesian growth theory: controversies and quantitative evidences.

Luciano Boggio[1]
With the collaboration of Laura Barbieri

S.I.E., Riunione Scientifica Annuale, Roma 14 e 15 Octobre 2011
Preliminary draft

Abstract
A fundamental starting point for Post-Keynesian theory concerned with growth in open economies is the following statement by Kaldor: :"[...T]he main autonomous factor governing both the level and the rate of growth of effective demand of an industrial country [ ] is *the external demand for its exports*: and the main factor governing the latter is *international competitiveness, which in turn depends on the level of its industrial cost relatively to other industrial exporters*." Moreover, thanks to increasing returns in manufacturing, export expansion and international competitiveness would interact so as to create vicious or virtuous circles of cumulative causation. A few years later Kaldor, having found a *positive* correlation between the time changes of the main industrial countries' relative manufacturing export shares and that of their relative unit costs - correlation that became known as *"Kaldor paradox"* - was led to dismiss his original cumulative causation theory and adopt a version close to Harrod's 'foreign trade multiplier'. The purpose of this paper is to re-affirm the Kaldorian cumulative causation theory in its original version, by giving to it a firmer analytical basis and showing that, contrary to "Kaldor paradox" time changes in export performance must be "explained" by *levels* rather than by *changes* in unit costs.

Keywords: International competitiveness; post-Keynesian growth theory; Kaldor paradox; replicator equation.
JEL Classification: F43; O10.

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[1] Università Cattolica "Sacro Cuore", Largo Gemelli 1 20145 Milano. luciano.boggio@unicatt.it.
Financial help by the 2007 PRIN "Heterogeneous Sectors, Growth, and Technical Change" are gratefully acknowledged. I also wish to thank, for the stimulating discussion environment, the participants to the Final Conference of that project, held at Naples, April 27-29, 2011 and Bruno Soro for his insightful comments on Kaldor and Harrod views.

1. INTRODUCTION

According to the 'mainstream' theory of growth, based on the assumption of full employment of factors of production, economic growth is simply the combined effect of increases in the supply of factors and in their productivity. No room is left for an autonomous role of effective demand, its pressure on productive capacity and factor employment, its role in determining the rate of investment.

According to another view, proposed in particular by the Post Keynesian Theory of growth and shared by the present writer, the assumption of full employment - of labour in particular- when the time period considered is not a "secular" one, is not the most useful starting point for explaining differences in growth performances,.

An extreme version of this view was given by Nicholas Kaldor in the following terms: "[...] economic growth is [...] always *demand-induced* and not resource-constrained. [...] 'Resources', such as capital and labour do not determine growth, partly because they are mobile between regions, and partly because they are never optimally allocated (there are always economic sectors where labour is in surplus in the sense that is marginal productivity is zero or even negative, as e.g. in agriculture); and partly because capital (in the sense of industrial capacity) is automatically generated as part of, and in consequence of, the growth of demand (Kaldor, 1981, p. 603; italics in the original).

As long as Post-Keynesian theory deals with open economies the following statement by Kaldor (1971, p. 7; italics added) seemed to offer a fundamental starting point:" [...T]he main autonomous factor governing both the level and the rate of growth of effective demand of an industrial country with a large share of exports in its total production and of imports in its consumption is *the external demand for its exports*: and the main factor governing the latter is *international competitiveness, which in turn depends on the level of its industrial cost relatively to other industrial exporters*." Moreover, thanks to increasing returns in manufacturing-'Verdoorn's law' - export expansion and international competitiveness would interact so as to create vicious or virtuous circles of cumulative causation (Kaldor, 1970).

This position was partly modified a few years later in a paper where Kaldor (1978) compared the time changes - over periods longer than ten years - of the main industrial countries' relative manufacturing export shares with that of their relative unit costs[2] and found a *positive* correlation between the two variables.

This "paradox" can have various explanations. The simplest is that "[h]igher prices could equally well reflect higher quality, which, in turn, might justify higher wages. From this perspective higher growth in relative unit labour cost (RULC) could just as well be seen as an indicator of growing quality relative to other countries or increasing - rather than deteriorating - competitiveness." (Fagerberg 2002, p.1.) Or, as Kaldor himself put it: "There is only one important matter on which the events of the 1970s caused me to

[2] An alternative clearer way of visualising this relationship can be obtained from the first two columns of Table 1.

change my mind. This concerns the relative importance of price (or cost?) competition, as against other "non price" factors, such as superiority of design or quality, length and reliability of delivery dates, after-sales service, etc. Exchange rate adjustments operate mainly on cost and prices, and despite vast changes in relative exchange rates – in real, and not just in nominal terms – there was little effect on the pattern of trade in manufacturing" Kaldor (1986, p. 25).

A second explanations is that a third factor, like GDP growth, is positively linked to growth in both exports and wages, hence in unit labour costs (GDP growth in turn being strongly influenced – according to the prevailing view – by technology[3]), thus creating a positive link between the two time series. However, this "perverse" relationship", that became known as *"Kaldor paradox"*, by breaking the link between increases in productivity and unit costs decreases on one side, and higher export growth on the other, seemed to destroy Kaldor 's open economy cumulative causation theory and led him to dismiss this theory and endorse Harrod' foreign trade multiplier[4] and Thirlwall's model of balance-of-payments-constrained growth (Kaldor, 1981).

In a that paper cumulative causation was reduced to the fact that, because of increasing returns (in the production of goods and technical progress), "success breeds further success" (*ibidem*, p. 596)., whilst when increasing competitiveness and the widening of international markets shares were an *essential* feature of the cumulative causation process- as in the early Kaldorian formulation –it appeared a much more important and powerful phenomenon.

The purpose of this paper is to re-affirm the Kaldorian cumulative causation theory in its original version, by giving to it a firmer analytical basis and showing that, on the basis also of some preliminary empirical evidence, "Kaldor paradox" *cannot* destroy that theory.

This goal seems important because such theory, put forward in the 1960s and 1970s by Kaldor (and Beckerman before him) to explain the contrast between the fast growth of Japan and some countries of continental Europe-Western Germany and Italy in particular -and the slow growth of the United Kingdom

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[3] This explanation of the "paradox" appears consistent with the sectoral investigations of the determinants of export performance beginning to appear in those years, that were giving to technological variables an essential role, in contrast to the poor or "perverse" (that is, positive) sign, in such investigations, of (the *growth* of) unit labour cost or wages. See *e.g.* Table 3 of Fagerberg, 1996, summarizing five researches of this kind, Dosi and Soete, 1983, Dosi, Pavitt and Soete, 1990, ch.6.

[4] In the 1981 paper Kaldor asserts that "Harrod multiplier" (hence Thirlwall's model) is dynamically stable (I must thank Bruno Soro for attracting my attention to this point.). This assertion seems rather unwarranted, but some kind of crude proof had been already given in Kaldor, 1970 p. 342. On this point see also Palumbo, 2009, p. 351-2. [Both Palumbo (2009) and Soro(2011) show that Harrod himself did not share such assertion.]

and the United States, nowadays seems still very useful for understanding contemporary experiences, like those of the Asian NICs, of fast growth with strong international competitiveness[5].

The "paradox" was amply confirmed by later studies. For instance Fagerberg (1996, p. 41) produced the following Table 1 for the period 1978–94. It shows the low explicative power of unit labour costs in absolute terms and in particular relative to changes in R&D as a share of GDP, a typical variable expressing technological factor s affecting competitiveness.

Table 1

The Kaldor Paradox Re-examined. Twelve Industrialized Countries, 1978–94

	Growth in market share for exports[a]	Growth in relative unit labour cost[a]	Growth in GDP per capita at constant prices[a]	Change in R&D as a share of GDP[b]
USA	0.08	–1.17	1.36	0.24
Japan	0.95	0.82	2.94	1.10
Germany	–1.03	1.62	1.65	0.23
France	–0.98	–0.18	1.36	0.54
Italy	–0.16	–1.13	2.00	0.59
UK	–0.89	0.81	1.57	–0.01
Canada	–0.10	–0.38	0.97	0.36
Belgium–Luxembourg	–0.89[c]	–2.85[c]	1.70	0.31
Netherlands	–1.53	–1.60	1.23	0.13
Korea	4.85	1.89	6.33[c]	1.16
Taiwan	4.68	3.77	5.94[d]	1.13
Hong Kong	8.36	2.58	5.35[c]	n.a.
Regression on growth in market share[e]	slope	1.17	1.43	4.48
		(0.36)	(0.21)	(0.94)
	R^2	0.52	0.82	0.71

Notes: [a] Annual rate of growth. [b] Difference between 1992 and 1979 levels of R&D as a share of GDP. [c] 1978–92. [d] 1978–91. [e] Estimated by ordinary least squares with constant term (not reported), standard deviation in brackets, 12 observations except for R&D (11 observations).
Sources: OECD (GDP per capita and relative unit labour cost); IMF (merchandise exports); and EMF/IMD–World Economic Forum and national sources (R&D).

In practice the consequence of Kaldor paradox that became common can be put as follows. Let the traditional multiplicative form of export demand be

$$x = \varepsilon_x(-p+p^*) + \eta_x y^* \qquad (1)$$

where $x,e, p, p^* y^*$ are the growth rates of, respectively, exports, home and foreign price indexes measured in common monetary unit, rest of the world income; ε_x and η_x are , respectively, the price and income (positive) elasticities of export demand. Hence (p^*-p) is the relative price of foreign goods. Because of the paradox, there is a change of sign in relative price effect and the addition of other variables of the above mentioned kind, effect of which is here expressed by T:

[5] Data and analysis supporting this proposition can be found in Boggio 1995 for Italy and Boggio 2003 for the Asian NICS.

$x = \varepsilon_x(p-p^*) + \eta_x y^* + T$ *(1#)*

In Section 2 and 3 we briefly examine the two main theoretical strands of Kaldorian derivation, namely the Kaldorian Models of Balance-Of-Payments-Constrained Growth (BPCG) and the Kaldorian Models of Export-Led Growth (ELG), in order to assess their relationship with the Kaldorian cumulative causation theory. Then in Section 3 we propose an alternative approach to that theory, based on the replicator equation and Beckerman Model. In Section 4, after a brief examination of the literature on the replicator equation, a first attempt at an empirical comparison between the ability of the Kaldor paradox and the replicator-like approach in explaining the growth of export is performed.

2. KALDORIAN MODELs OF BALANCE-OF-PAYMENTS-CONSTRAINED GROWTH (BPCG)

Another problem with the original Kaldorian approach was that the possibility of balance-of-payments' problems was not considered. Thirlwall (1979) suggested a simple model avoiding such possibility, based on traditional demand equations for both exports and imports and their equality. It can be summarized as follows.

We use the standard multiplicative form of export demand (1), which was expounded above. Similarly for import demand:

$m = \varepsilon_m(p-p^*) + \eta_m y$,

But, if, as Thirlwall maintains, either relative prices did not vary in the long run,

$(p-p^*)=0$,

or, alternatively, $\varepsilon_x+\varepsilon_m-1 \approx 0$

then we get

$\eta_x y^* = \eta_m y \longrightarrow \quad \longrightarrow y/y^* = \eta_x/\eta_m$

which "explains" growth rate differentials in terms of income elasticity differentials. Thirlwall could show that the growth rate of income of the main industrial countries in the period 1960-73 was very well approximated by the formula $y = \eta_x y^* / \eta_m$.

According to him, (1979, pp. 52-3), supported by Kaldor's opinion (Kaldor, 1981, p. 603), the income elasticities of this model reflect 'the innovative ability and adaptive capacity' of the producers in different countries.

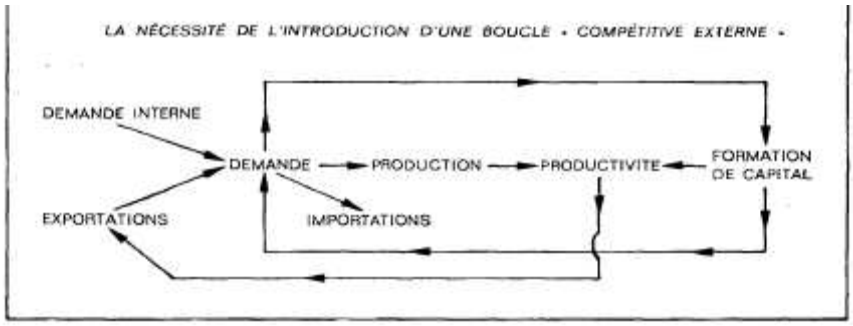
Many empirical estimates have been produced in the following years about the two crucial assumptions of the BPCG model, each eliminating the role of relative prices: a) no long run changes in relative price ; b) the sum of price elasticities of export and import approaching zero. They tend to support the view that in the "very long period" (50 years or more) – but *not for shorter periods*, ranging from one to a few

decades - such assumptions are likely to be confirmed.[6] *What matters more from our viewpoint is that here the Kaldorian cumulative causation processes disappear from sight and no theoretical foundation is offered to them.*

3. KALDORIAN MODELS OF EXPORT-LED GROWTH (ELG)

The Kaldorian theory of cumulative causation circles in open economies in the last decades did not cease to attract the attention of economists.

Boyer and Petit (1981), while discussing "Un modèle d'inspiration kaldorienne", summarized their essence by the following figure (p. 1128), which offers an immediate comprehension:



The algebraic translation of a Kaldorian ELG model goes back to Dixon and Thirlwall (1975), who set a tradition with which we disagree in a fundamental point, namely the export equation. In this exposition we shall use the more recent versions -very similar to the first one- by Setterfield and Cornwall (2002, p.72) and Blecker (2010). The ELG model can be written, using the symbols already introduced, as

$$x= \varepsilon_x(-p+p^*) +\eta_x y^* , \qquad \varepsilon_x , \eta_x >0 \qquad (1)$$

It is interesting to see that the "Kaldor paradox" is completely neglected/forgotten. Note also that in this paper we shall object that that, outside *long-run* comparative static or dynamics, time changes in export performance must be "explained" by *levels* rather than by *changes* in unit costs.

By the small country assumption, foreign price p^* is taken as exogenously given. Setting w and q as changes in wages and labour productivity, changes in domestic price are determined by changes in unit labor costs $(w-q)$ and the gross profit markup, τ:

$$p=w-q+\tau \qquad (2)$$

By Verdoorn's Law:

$$q = q_0 + \alpha y , \qquad 1>\alpha> 0. \qquad (3)$$

here q_0 is a parameter representing autonomous technical change.

Finally

[6] For an accurate discussion of the literature on this point, see Blecker (2010).

$y=\lambda(\omega_x x+\omega_A a)$ (4)

λ is an expenditure multiplier, ω_x and ω_A are, respectively, the share of exports and that of other exogenous expenditures in total demand, a is the rate of change of the latter.

By combining equations (1), (2), and (4) and, assuming:

$e = w =\tau= 0= w^* =\tau^*$,

$p^*=w^*-q^*+\tau^*$ (2')

$q^* = q_0^* + \alpha y^*$ (3')

one gets

$$y = f_{DR}(q) \equiv \Omega + \lambda\omega_x\varepsilon_x q\,, \qquad (5)$$

$$\Omega \equiv \lambda[\omega_a a - \omega_x\varepsilon_x q_0^* + \omega_x(\eta_x - \alpha^*\varepsilon_x)y^*]$$

that according to Setterfield and Cornwall (2002) -following a tradition established since Boyer and Petit, 1988 - may be called the "demand regime" (DR) equation. This goes together the twin-notion of "productivity regime" (PR), defined using (3) as follows:

$$y = f_{PR}(q) \equiv (q - q_0)/\alpha$$

Using (3)

$$y = \Omega + \lambda\omega_X\varepsilon_X(q_{0+}\alpha y)$$

Iff $1-\alpha\lambda\omega_X\varepsilon_X \neq 0$ (5a)

the last equation gives a well defined constant rate of growth for national income, y,

$$y_e = \frac{\Omega + \lambda\omega_X\varepsilon_X q_0}{1-\alpha\lambda\omega_X\varepsilon_X},$$

generating a constant rate of growth also for all the other endogenous variables p, q, x. Since

f_{PR}', $f_{DR}' > 0$,

sufficient conditions for a $y_e>0$ are:

$\Omega>0$ (satisfied if the sum of direct and indirect effects of y^* on x is positive),

$1/\alpha > \lambda\omega_x\varepsilon_x$.(satisfied if the Verdoorn effect α is small relative to the price effect *via* exports on y, or

$f_{PR}'=1/\alpha > f_{DR}' = \lambda\omega_x\varepsilon_x$

There is a further problem with the above equation system: the behaviour of the economy outside the constant rate of growth cannot be established.

But if we introduce a lag in the system, as Dixon and Thirlwall (1975) did, we can deal with this problem. We may for instance assume a slow Verdoorn effect, so that

$$q_{t+1} = f_{PR}^{-1}(y_t) \equiv \alpha y_t + q_0$$

$$y_t = f_{DR}(q_t)$$

$$y_{t+1} = f_{DR}(q_{t+1}) = f_{DR}[f_{PR}^{-1}(y_t)]$$

The stability will prevail if and only if

$f_{PR}'/f_{DR}' = \alpha\lambda\omega_x\varepsilon_x < 1$

which is the condition for the existence of the constant growth rate path!

A time lag between the two sides of the PR and DR equations seems to be taken for granted by several authors., who then discuss the stability issue[7]; whilst others, like Blecker, just mention it, to conclude that "the mere existence of cumulative causation is not sufficient to create a disequilibrium situation." (p.14). For, as he correctly notices - "[…] it may seem contrary to the spirit of Kaldor (1972) to represent his ideas using a model that has an equilibrium solution." (*ibidem*) The suggestion by Setterfield (2002) to retain rather than dispense with the notion of equilibrium, "therefore allowing for the existence of point [weak] attractors" and to build "a model of Kaldorian traverse", is interesting. However, we cannot but agree when in a footnote (p. 230, fn. 12) he admits that "In fact, it is far from obvious that there is any place at all for equilibrium in Kaldor's growth schema."

The model we shall propose, derived from Beckerman's (1962), but based on Kaldor's original cumulative causation version, avoids altogether convergence.

We summarise the critical remarks on the ELG Kaldorian model as follows: a) the "Kaldor paradox" is completely neglected/forgotten; b) the positivity of the "equilibrium" constant rate of growth is not granted; c) the behaviour of the economy outside the constant rate of growth is not clearly examined and may give rise to anti- Kaldorian solutions; d) it is contrary to Kaldor's assertion, that the rate of growth of effective demand of an industrial country depends on *international competitiveness, which in turn depends on the level of its industrial cost relatively to other industrial exporters,*

4. BECKERMAN MODEL AND THE REPLICATOR EQUATION

4.1. Replicator equation[8]

To capture Darwin's notion of the survival of the fittest, Fisher (1930) introduced what are now called - after Richard Dawkins - *replicator equations,* of which we give below a very simplified version.

Let us consider a population to be composed of *n* distinct **competing** "varieties" of a given natural species; $x_i, i \in \{1,2,...n\}$, $\sum_i x_i = 1$, is the relative frequencies of the *i-th* variety. To each "variety" is associated its fitness level or function $f_i(x_i)$. In continuous form, their evolution might be described by the following equations:

$$\dot{x}_i = x_i(f_i(x_i) - \bar{f}(x)), \qquad f_i'>0, \quad \bar{f}(x) = \sum_i x_i(f_i(x_i))$$

[7] Cf. *e.g.* Castellacci (2001).

[8] For a much more complete treatement see *e.g.* Hofbauer and Sigmund, 1988 or Silverberg 1997, Silverberg and Verspagen1995.

This equation embodies the principle of natural selection: varieties with above-average fitness will expand, those with below-average fitness will contract and the average fitness $f(\boldsymbol{x})$ will increase. If the fitness functions *fi* are simple constants, the average fitness will increase monotonically towards a state where only the varieties (or group of varieties) with maximum fitness survive(s).

Notice that the last equation can be put in the form:

$$\dot{x}_i / x_i = f_i(x_i) - \bar{f}(x)$$

which can be read: the proportional change in the share of the i-th variety is an increasing function of its fitness advantage.

But for purpose of empirical analysis a discrete version is necessary. It can be obtained by adapting Verspagen (1993, p.191).

Let x_{it} be the level of export in country i at time t,

$i \in \{1,2,3...n\}$, $t \in \{1,2,3..\}$ and $y_{it} \equiv \frac{x_{it}}{\sum_{i}^{n} x_{it}}$, $\hat{y}_{it} \equiv (y_{it+1} - y_{it}) / y_{it}$

Then

$$\hat{y}_{it} = \sum_{1}^{m} \varphi_j (E_{jit} / \overline{E}_{jt} - 1) \qquad \text{(R)}$$

$$j \in \{1,2,...m\}, \overline{E}_{jt} \equiv \sum_{1}^{n} y_{it} E_{jit},$$

E_{jit} is the competitiveness variable j of country i at time t, φ_j the corresponding (fixed) parameter to be estimated.

4.2. Beckerman Model

In this sub-section we shall consider the model published by W. Beckerman in 1962, therefore a few years *before* Kaldor's papers mentioned before, and anticipating some of their main ideas, in particular the cumulative growth model in open economies. But, *differently from all later Kaldorian models, Beckerman adopts a replicator equation form for his export equation, therefore anticipating also the application of that idea to economic problems.* [9]

In this model export changes are a decreasing function of 'the price of given country relative to competitor countries' (Beckerman, 1962, p. 914). More precisely, the rate of growth of the share of world exports held by a given country, hence the differences in the growth of exports, depend not on relative

[9] Dixon and Thirlwall (1975) noticed that Beckerman's model "[…] bears many similarities to Kaldor's and predates it "(p. 202, n. l), but (mis)interpreted Beckerman's export equation as a wrong specification of an export demand. (p. 211). Cf. also Thirlwall and Dixon (1979, p, 177ff.f.).

price **changes**, but on cross-country price **difference**; whilst in the traditional approach to export determination, exemplified by the export equation of the BPCG and ELG models, the share of each market held by a particular firm or country fully corresponds to the underlying cost/price conditions, and changes with it.

On the contrary, we believe that market shares are often far from their long-run equilibrium value and that their rates of change over time are to be explained by inter-country differences in international competitiveness, along the lines expressed by the competition theory underlying the replicator equation and expressed in Beckerman's model. This does not mean that shares adjustment to their long run value is expressed in the best possible way by the replicator equation: more complicated adjustment patterns with lagged variables may fit better their actual disequilibrium behaviour. The replicator equation however can be considered as a first step in the right direction.

More importantly, stressing the cross-country differences in unit costs or prices - as in Kaldor's sentence, in our application of the replicator approach to the field of international competition and in Beckerman model - instead of time changes in relative prices is of fundamental importance, because normally they also imply cross-country differences in profit margins, hence in the ability of the single firm to invest, expand its productive capacity, pursue technical progress and spend in non-price competition.

Contrary to an approach to export growth based on the demand side only - as in the model of the previous Sections - in this way we implicitly introduce the supply side of the firms as well[10].

We shall now give a description of Beckerman model (Beckerman, 1962, 918-9), in which we shall also introduce slight modifications that will make further formal developments easier.

The symbols used are the same as those to be used in later years by the models expounded above, but for the productivity growth rate, for which we shall maintain q as above.

The most interesting equations are the first ones, embodying the replicator equation principle:

$$x = a + b(1 - \alpha) \qquad (1a)$$

where α is the price level of a given country relative to competitor countries and "a can represent the rate of increase in world trade"(*ibidem,* p. 919).. The meaning of α is made more clear by introducing explicitly the **level** of prices in the two countries: let P_i be the level of prices (in common unit) in country i, $i \in \{1,2\}$. Then $\alpha = P_1 / P_2$.

For a competitor country, we choose

$$x = a + b(1 - 1/\alpha) \qquad (1b\text{-bis})$$

instead of Beckerman's

[10] Models spelling out a plausible description of the causal link between across firms differences in unit cost levels on one side and differences in profits, investments and productive capacity growth on the other can be found in Boggio (2003), (1996) and (1974).

$x = a - b(1 - \alpha)$ (1b)

Then we have:

Productivity (output per head) equation[11]	$q = c + dx$	(2)
Wage equation	$w = m + nq, \quad n<1$	(3)
Price equation	$p = w - q$	(4)
From (3) and (4):	$p=m+q(n -1)$	(5)

From (1) and (2) for the given country:

$$p= m+q(n -1) = m+(n -1) [(c + ad) + bd(1-\alpha)] \quad (6a)$$

and for the competitor country, in our version:

$$p= m+q(n -1) = m+(n -1) [(c + ad) + bd(1-1/\alpha)] \quad (6b)$$

Hence, "assuming the parameters in the basic equations are the same in all countries, […] a country having a competitive advantage will have a faster than average rate of growth of productivity. Hence prices will rise less (or fall more) in the country starting with the competitive advantage. Thus, an initial price disparity will tend to be further accentuated and to be accompanied by a growing disparity in growth rates." (*ibidem*)

In this way, the substance of the Kaldorian cumulative causation process in open economies is clearly expounded some years in advance.

Since the replicator principle can be summarized in the sentence: "the proportional change in the share of the *i*-th variety is an increasing function of its fitness advantage", the same is true of Beckerman's first equation, if we remember that "*a* can represent the rate of increase in world trade" and notice that, when eq.(1a) is written as

$x- a =b(1-\alpha)$

the l.h.s. is the rate of growth of the share or the country's exports in the "world" total, that is made dependent on the competitiveness factor α.

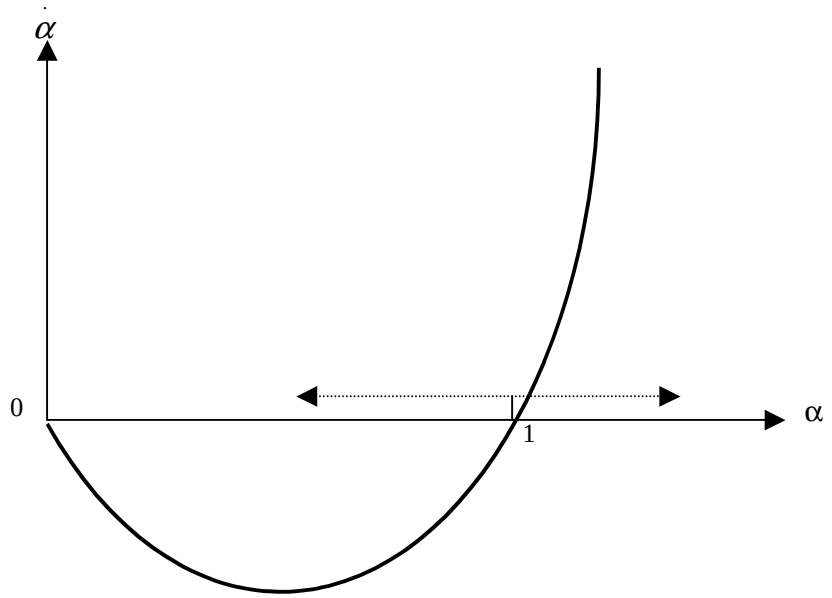
If we maintain the assumption that "the parameters in the basic equations are the same in all countries", then

$$\hat{\alpha} \equiv \frac{d \log \alpha}{dt} = p_1-p_2=\beta\,(\alpha-1/\alpha), \qquad \beta\equiv(1- n)\, bd >0$$

$$\dot{\alpha} \equiv \frac{d\alpha}{dt} = \beta(\alpha^2 - 1)$$

so that the model gives rise to a differential equation and assumes the following graphic representation:

[11] "[T]he rate of increase of productivity is positively correlated with the rate of increase of output, which is in turn correlated with the rate of increase of exports."(*ibidem*). No further justification of this equation is given, nor mention to Verdoorn papers appears, but in the twin paper (Beckerman 1965, 380-1) all features supporting "Verdoorn Law" are brought in.



Within the open interval (0, ∞) only one equilibrium, $\alpha = 1$, exists. Outside this equilibrium, α moves away from it, entering either (to the left of it) a "virtuous" circle of cumulative causation or (to the right of it) a "vicious" one. In the former case, competitiveness, the growth of exports, output, productivity and wages all increase and, for a while, at an increasing speed. In the latter, competitiveness, the growth of exports, output, productivity and wages decrease at an increasing speed.

Obviously, only a neighbourhood of the equilibrium should be considered as economically meaningful, because, as long as a less extreme version than Kaldor's of the premises of the Post Keynesian Theory of growth is adopted, it should be stressed that many supply-side factors concur in dampening the divergence brought out by the model[12]. However, the resulting picture is one of divergent circles of cumulative causation based on national competitiveness, as in the original Kaldorian theory.

5. EMPIRICAL EVIDENCE

The empirical tests of replicator-like equations to be found in the literature are very few, since the bulk of the literature on the effect of international competitiveness on exports growth is based on **growth,** rather than **levels,** of competitiveness variables. Anyway on the whole they show (see the Appendix) that *unit cost/wages levels are significant (with the right sign) in the explanation of export shares, sometimes more significant than technology variables*.

[12] Against admitting an effect on growth of the supply of labour, Beckerman in his original paper objected (ibidem, 921, f. 2) that "the suggestion […]that differential rates of growth of the labour force may be an important explanation for differential growth rates […] simply does not stand up to empirical verification.**"** See also his "Reply" (Beckerman, 1963) to Balassa (1963).

Therefore we decided to try some preliminary, crude tests, in order to begin to assess the relevance of Kaldor paradox relative to that of replicator-like equations.

Our preliminary tests.

Very simple regression equations were performed, starting from OECD data for 33 countries -including India China Mexico and Brazil - on aggregate good exports in US dollars (EXP) and manufacturing unit labour costs (ULC) for the period 1993-2007. The regressions are based on equation (R) (replicator): the dependent variable is the average growth rate of export share (EXPGR) over the 15 years; the independent variables are the average unit labour costs (ULCAV) and their average growth rate (ULCGR) over the 15 years:

$$\hat{y}_{it} = \sum_{1}^{m} \varphi_j (E_{jit} / \overline{E}_{jt} - 1) \qquad \text{(R)}$$

$$j \in \{1,2,...m\}, \overline{E}_{jt} \equiv \sum_{1}^{n} y_{it} E_{jit},$$

$\hat{y}_{it}$ is here EXPGR of country *i*, while E_{jit} is the value of the *j-th* competitiveness indicator for country i.
In the first set of regressions (Table 2) *t* refers to the whole 15 years period, for both growth rates and averages. In the second (Table 3), *t* refers to the single year (pooled regressions).
According to the Kaldor paradox (EXPGR) should mainly be determined by (ULCGR) and according to replicator-like equations by (ULCAV). The results are in Table 2 and 3, below.

Table 2. Dependent variable: export share growth

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.170044	0.030345	5.60	0.000
ULCAV	-0.135248	0.050488	-2.68	0.012
		R-squared		0.1880
C	0.086913	0.006799	12.78	0.000
ULCGR	-0.000709	0.000537	-1.32	0.197
		R-squared		0.0531
C	0.167744	0.036716	4.57	0.00
ULCAV	-0.131888	0.058992	-2.24	0.033
ULCGR	-6.71E-05	0.000582	-0.12	0.909
		R-squared		0.1883

Table 3. Dependent variable: export share growth
(pooled regressions)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.056997	0.012628	-3.65	0.000
ULCAV	-0.077247	0.021188	4.51	0.000
		R-squared		0.0263
C	0.126642	0.003446	3.67	0.000
ULCGR	-0.000734	0.011322	-0.06	0.948
		R-squared		0.0000

C	0.056996	0.012641	4.51	0.000
ULCAV	-0.077264	0.021217	-3.64	0.000
ULCGR	0.000344	0.011188	0.03	0.975
		R-squared		0.0263

The variable ULCAV is always significant, also when coupled with ULCGR. The latter never reaches the 5% level of significance. Hence *the replicator-like specification turns out very relevant, whilst the Kaldor paradox specification is not significant*.

CONCLUDING REMARKS.

Since we consider the original Kaldorian cumulative causation theory as a most important tool of analysis to understand the historical experiences of fast growing open economies, the main purpose of this paper - as stated at the beginning - was to re-affirm such theory, by giving to it a firmer analytical basis and showing that “Kaldor paradox” cannot impair that basis.

We think that our discussion of the replicator equation and the developments of Beckerman model we presented provide such firmer theoretical basis. On the other hand, the results of the quantitative work done along the lines of the replicator equation by various authors and by ourselves support the view that export growth depends on *levels* of competitiveness factors - labour cost in particular - rather than on their growth, hence that the Kaldor paradox, even when statistically significant, as in some paper discussed in the introduction, cannot diminish the importance Kaldorian original cumulative causation theory.

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Appendix Tests of replicator-like equations to be found in the literature.

Verspagen (1993).

Regressions are performed for the whole sample of pooled observations (1964-1987) for each of the 18 industrial sectors. The equation employed basically is (R) and the whole exercise is explicitly under the heading of the replicator equation.

In the various specifications tried wage and labour productivity variables give good results, much better than those for the specifications of the patent variables (p. 215).

Amendola Dosi Papagni (1993).

This paper that deals with manufacturing export market shares of 16 OECD countries from 1967 to 1987, is the only one referring to *total* manufacturing export of each country. Starting from an equation almost identical to (R), a general autoregressive-distributed lag (ADL) is derived, giving rise also to long-run multiplier estimates. The independent variables are unit labour cost, investment in machinery and total patent. However the reformulated ADL equations with long-run multipliers the independent variables are again **time changes.** The Kaldor paradox - they assert - "[a]s a long-term phenomenon […] seems the outcome of a 'spurious correlation'" (p. 465).

Amable and *Verspagen* 1995.

"The paper present an estimation of an empirical model of market share dynamics for five industrialized countries and 18 industries".(p. 197)

A long run export market share ***X**** is built as follows

$$X^*_{ij} = k_{ij} + a_{ij}PC_{ij} + b_{ij}IN_{ij} + c_{ij}PT_{ij}$$

PC is a measure of unit labour cost, *IN* is (derived from) the ratio of investment to production, *PT* is based on total patent for each sector.

For each independent variable the following bell shaped lag structure is adopted:

$$A = (A(-1))^{0\ 3}(A(-2))^{0\ 4}(A(-3))^{0\ 3} \qquad A = PC,\ IN,\ PT.$$

The long-run value of the market share is given by

$$X^*_{ij} = k_{ij} + a_{ij}PC_{ij} + b_{ij}IN_{ij} + c_{ij}PT_{ij}$$

on which the error correction mechanism is built

$$\Delta X_{ij} = (\mu + \mu_i)[X^*_{ij} - X_{ij}(-1)]$$

where μ_i is a country dummy.

The unit labour cost variable on average performs very well, better than the other two.

Verspagen and Wakelin (1997).

"The specific functional form is not an exact replicator, but is based upon earlier empirical models, such as Amendola et al. (1993) and Amable and Verspagen (1995).

Market shares on each other market are estimated for 10 countries and 15 manufacturing sectors. The average rate of growth of market share against the average for the competitiveness variables for the period 1980-85. These are

Patents and R&D, share of investment in output and wages in dollars (significant in 22 or16 cases out 45)

Share of investment in output (significant in 29 cases)

Wages (significant in 20 cases).