Walking a tightrope: the neoclassical synthesis in action

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Preliminary draft

Abstract: The neoclassical synthesis which emerged in the late 1950s is associated to a specific understanding of the connection between short-run Keynesian and long-run neoclassical analyses. In the early 1960s, when economists from both Cambridges tried to revisit the conditions likely to guarantee the stability of long-run paths, this view was challenged. Then, issues related to the determinants of income distribution and expectations were raised. Our goal in this article is to discuss the significance of these findings and see how they challenged the whole neoclassical synthesis. Using original archives material from Duke and Cambridge (UK) Universities, the paper pays mostly attention to arguments raised by Frank Hahn, Nicholas Kaldor, Paul Samuelson, Armatya Sen and Robert Solow.

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Introduction

In 1955, Samuelson introduced the notion of neoclassical synthesis in the third edition of his *Economics*. With the works of Robert Solow, James Meade, Trevor Swan and James Tobin, the synthesis started designating the outcome of a process by which short-run Keynesian and long-run neoclassical analyses were made compatible. In a nutshell, as long as the economy was supposed to be managed on a Keynesian-basis in the short-run, the neoclassical growth model was seen as the more appropriate tool to analyze and sustain full-employment growth. In addition, with the publication of Solow 1957 paper, the neoclassical synthesis meant a particular way to empirically deal with the long-run impact of technical progress.

In the early 1960s, economists from both Cambridges tried hard to revisit the conditions likely to guarantee the stability of long-run paths. Rejecting the neoclassical growth model, Nicholas Kaldor, Joan Robinson and Luigi Pasinetti called for a new treatment of income distribution and dynamics. Meanwhile, Solow, Franck Hahn and Amartya Sen strove to craft models integrating new analyses of expectations and investment decisions. Within a few years, neoclassical synthesis was hence twice jeopardized. From outside: "Kaldorism" offered a new way to connect short-run and long-run analyses. From inside: attempts to build new investment functions proved the fragility of the neoclassical synthesis foundations. Using original archives material from Duke and Cambridge universities, the objective of this paper is to examine those debates and to question the solidity of the compromise on which the so-called Samuelson/Solow Synthesis was elaborated. The paper is the opportunity to examine the theoretical as well as the political roots of the Synthesis.

The paper is organized in four sections. The second section clarifies the content of Samuelson's synthesis. Far from having a loose content, it is argued that this notion had a clear meaning, especially in terms of economic stability. The third section, based on new archives materials, provides evidences that Samuelson considered "Kaldorism" (including the so-called Neo-Keynesian growth[2]) as potentially destructive for the

[2] See Sen 1960, p. 53.

synthesis. The bottom line was that "Kaldorism", by resorting to the idea that changes in income distribution were likely to stabilize full employment growth paths, a mechanism which drastically reduces the case for Keynesian government interventions.

External criticism was nevertheless not the only front that supporters of the synthesis had to fight for. The fourth section concentrates on Neo-classical growth and on its internal critics. From 1960, Sen showed that as long as short-run stability is not achieved (when short-run Harrodian instability holds), the neoclassical model of growth became unstable and this regardless factors substitutability. More precisely, once perfect foresight hypothesis is abandoned in Solow's framework, it was shown that there was no more guarantee that the level of investment would permanently equal the level of full-employment savings, an element which "seriously restrict[ed] the validity of the Solow-Swan method of avoiding Harrod's "knife-edge" of equilibrium" (Sen 1960, fn. 18). Finally, some concluding remarks about the (unexpected) rather narrow interpretation which needs to be associated with Samuelson's synthesis in order to provide sound foundations to the whole edifice *i.e.* to make consistent the articulation between short-run and long-run analyses are drawn.

By means of unedited correspondence and unpublished manuscripts recently discovered in Duke[3] and Cambridge (UK)[4] Universities, the paper mainly focuses on major arguments raised by Hahn, Kaldor, Samuelson, Sen and Solow.

1. The neoclassical synthesis

"Samuelson's path breaking undergraduate textbook, *Economics: An Introductionary Analysis* outlined the vision of a "mixed economy" in which Keynesian demand management would secure full employment and the price system operating under the

[3] Paul A. Samuelson Papers. David M. Rubenstein Rare Book and Manuscript library, Duke University and Kaldor's papers at Cambridge University.

[4] Nicholas Kaldor's Papers Collection (NK/1/31/397 to 407, King's College Archive Center, Cambridge, UK).

usual neoclassical analysis would govern allocation (Pearce and Hoover, 1995, Boianovsky et Hoover 2014)[5].

By the third edition that vision was coined by the term: "the neoclassical synthesis" (Samuelson 1955, vi). The focus was on the short run - avoiding a replay of the Great Depression and combating the anticipated postwar slump loomed large in Samuelson's vision. With the aim to distance the theory of income determination from "Keynesian" Economics, Samuelson then strived to build a political consensus between laissez-faire and a managed economy accepted by most American economists.

> "In recent years 90 per cent of American Economists have stopped being 'Keynesian economists' or 'anti-Keynesian economists'. Instead they have worked toward a synthesis of whatever is valuable in older economics and in modern theories of income determination. The result might be called neo-classical economics and is accepted in its broad outlines by all but about 5 per cent of extreme left wing and right wing writers." (Samuelson 1955, p. 212)[6].

The practical concern of winning the Cold War clearly strengthened the political dimension of the neoclassical synthesis:

> "Perhaps we should be thankful that the Russian economists have not mastered modern elementary economics; that they do not yet understand the "neoclassical synthesis which, combining modern income determination with the older economic theories of resources allocation, clearly demonstrate the ability of resolute free societies to dissipate the ancient fear of mass unemployment" (ibid, p. 709)

[5] That synthesis was different from Samuelson's attempt - in the *Foundations* - to unify, through mathematics, seemingly disparate fields of economic together into a common analytical framework. The question of how these two syntheses are related is addressed by Backhouse 2014.
[6] See Giraud (2014) for a detailed analysis of the making process of *Economics: An Introductory Analysis*.

Mostly concerned by mass unemployment, Samuelson paid initially no attention to economic growth *per se*. That changed in the sixth edition of *Economics* in which he (1964, vi) added a new chapter on the theory of growth". Since then, he refined the content of the neoclassical synthesis arguing that through judicious government intervention and planning, economists agreed that the economy would behave like a neoclassical growth model[7].

> "In the 1950s there grew up a new emphasis on models of capital accumulation and technical change. [...] Particularly in the writings of such American economists as Solow, Tobin and myself, attention was focused on a managed economy which through skillful use of fiscal and monetary policy channeled Keynesian force of effective demand into behaving like a neoclassical one." (Samuelson 1963, p. 340)[8]

From then, the neoclassical synthesis was understood as a twofold departure from Harrod[9].

First, Samuelson, as well as Solow, knew that Harrod was concerned with the adjustment process between *ex ante* investment and *ex ante* saving and that according to his "instability principle", as soon as *ex ante* saving would fall short of *ex ante* investment, output would be stimulated as producers react to unexpected and undesired reductions of inventories ("stocks" for Harrod). Conversely, as soon as *ex ante* saving would exceed *ex ante* investment, output would be reduced. Most importantly, Samuelson and Solow knew that such adjustment would be self-aggravating, and, in Harrod's words, one could say that no adjustment between the actual growth rate (the rate at which actual output is changing) and the warranted growth rate (the rate for which *ex ante* investment grows at the same pace as *ex ante* saving) were likely to occur. As soon as actual growth rate would be lower than the warranted rate of growth, the gap

[7] This specific point is highly questioned by Arrow (1967) who expresses his doubts that an economy would have reach full employment through government intervention would strictly behave as a full employment economy which would have reached that situation by itself.
[8] See "A Brief Survey of Post-Keynesian Developments" [1963] in *Keynes' General Theory: Reports of Three Decades*, Robert Lekachman (Ed.).
[9] See Hoover and Halsmayer (2016).

would be reinforced and conversely if the actual growth rate would be lower than the warranted rate of growth[10].

In contrast to Harrod, Solow, Tobin and Samuelson crafted growth models in which constant full employment of factors of production (Solow's seventh assumption of his 1956 paper) was assumed and resorted to the identity of *ex ante* and *ex post* investment (Solow's eighth assumption). Along this line, growth issues could hence be addressed with models in which the economy grows permanently at the natural rate of growth while the actual growth rate is assumed to be constantly equal to the warranted rate of growth. If proponents of the neoclassical synthesis considered that their growth model was complementary and not competing to Keynesian analysis, it is because they thought they were relevant in a "managed economy which through skillful use of fiscal and monetary policy channeled Keynesian force of effective". In the same spirit, we read in Trevor Swan's ([1963] 1970, p. 205) reflection on "golden ages" that his "illustration will be Keynesian, in the sense of the future as Keynes did, and assume either that the authorities have read the *General Theory* or that they are socialists who don't need to; in other words I assume that whatever is saved is invested." Similarly, Meade's exposition of Neo-classical growth theory assumes "ideally successful" monetary and fiscal policy at every point in time, managed to insure full employment (Meade 1961: ix).

Furthermore, the neoclassical synthesis presented an opportunity to address long-run issues without assuming that the economy adjusts "automatically" towards a state of full employment. If that were the case, assuming government's intervention would

[10] Harrod's view of the trade cycle was based on the argument that actual movements away from the "warranted growth path" could be checked. This is so because the warranted rate may "chase" the actual rate upwards or downwards: "If the former eventually overtakes the latter a new equilibrium is achieved and if the former goes beyond the latter forces are generated setting up a reverse movement." (Harrod 2003: 1198–1199) The way expectations and income distribution were supposed to change during the adjustment process was essential to explain the behavior of the warranted rate of growth and comes ultimately with a cycle theory to be endogenously generated along an endogenous trend (see Sember 2010, Assous, Bruno and Dal Pont Legrand 2014). Tinbergen and Marschak were among the first to point out the difficulties inherent in modelling Harrod's theory of cyclical growth. In his famous review of *The Trade Cycle*, Tinbergen (1937b) made clear that Harrod's mathematical formulation could only produce exponential growth.

no more be essential. On returning from England in 1964, here is how Solow attempted to make that point clear to Sen:

> "I got a little annoyed in Cambridge last year by the indiscriminate use of 'Keynesian's adjective meaning 'mine' and 'neo-classical' to mean 'yours'. To the extent that "neo-classical" describes the belief that a capitalistic economy tends automatically to full employment, I am no neo-classical and neither is James Meade" (Solow to Sen, October 26, 1964).[11]

The second departure from Harrod resulted from the breaking with the logic of the "Harrod-Domar" model, a point famously made by Solow who argued that, as soon as labour and capital are smoothly substitutable, warranted and natural rates of growth would eventually adjust to each other[12]. If the natural rate of growth is higher than the warranted rate of growth, firms will move to more labor-intensive technology. Marginal productivity of capital will hence increase till capital coefficient will have sufficiently fallen to raise the warranted growth rate. Conversely, if the warranted rate of growth is higher than the natural rate of growth, that is, if the economy is accumulating capital at a pace higher than the labor force, firms will turn to more intensive capital technologies. So, the capital output ratio will increase making the warranted rate of growth equal to the natural growth rate. With its flexible capital-output ratio, the merit of the neoclassical growth model was to offer "sanguine hope" for growth-promoting macroeconomic policy whose Kennedy administration's investment tax credit of 1962 directly results (Samuelson 1964, p; 787)[13].

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[11] Meade's exposition of neo-classical growth theory was indeed based on the assumption of "ideally successful" monetary and fiscal policy at every point in time, managed to insure full employment (Meade 1961: ix). In the same spirit, we read in Trevor Swan's ([1963] 1970, p. 205) reflection on "golden ages" that his "illustration will be Keynesian, in the sense of the future as Keynes did, and assume either that the authorities have read the *General Theory* or that they are socialists who don't need to; in other words I assume that whatever is saved is invested."

[12] Halsmayer and Hoover (2016) challenged the accuracy of Solow's interpretation of Harrod on this point. A comparison between Solow's 1956 growth model and Harrod's theory of dynamics in this respect is provided in Harald Hagemann (2009).

[13] In the chapter regarding growth, Samuelson presents what he calls the six "Basic trends of Economic Growth": "Trend 1. Population has grown, but at much more modest rate than the capital stock, resulting in a "deepening of capital". Trend 2. There has been a strong upward trend in real wage rates. Trend 3. [...] the share of wages and salaries relative to the total return to

> "One of the consequences of the neoclassical synthesis was the sanguine hope that a modern society could increase its rate of growth at full employment by coaxing out a deepening of capital through expansionary monetary policy, while using an austere enough fiscal policy to prevent demand-pull inflation. These combined devices could, in effect, lower the share of full employment income going consumption and yet not jeopardize full employment itself." (Samuelson 1963, p. 341)

One of the faults of the Harrod-Domar model[14], in Samuelson's view, was that, by regarding technology as fixed, it suggested that economic policy would be helpless to deepen capital and raise *per capita* income, once surplus labor had been absorbed,

property has shown considerable consistency in the long run […]. Trend 4. Instead of observing a fall in the rate of interest or profit, we actually observe their oscillation in the business cycle but no steady upward or downward trend in this century. Trend 5. Instead of observing a steady rise in the capital-output ratio as the deepening of capital invokes the law of diminishing returns, we find that the capital-output ratio has been approximately constant in this century. Trend 6. The ratio of saving to output has been oscillated in the business cycle - reaching about the same level at various high-employment phase of the cycle. Or taking into account the approximate consistency of the capital-output ratio, we can convert this approximate consistency of the ratio of investment to income into the following: national product has generally been growing at a roughly constant percentage per year."

Those Trends bear a striking resemblance with Kaldor's 1957 Stylized Facts, yet Samuelson doesn't mention his English colleague at this point of his argumentation. For him, those trends can more or less easily be explained by the Neo-classical theory. Trends 1 and 2 fit perfectly into the Neo-classical framework. Trend 3 would be "in an interesting coincidence" consistent with a growth model featuring a Cobb-Douglas production function. The dynamic facts underlined by Trends 4 and 5 can only be explained through the introduction of the notion of technical progress into the Neo-classical growth model.

Those empirical considerations had an important place in the mind of our protagonists while they were following their research program, as evidenced by Swan's remark about the "stunning fact" (Stiglitz, 1970) that the growth rate is totally independent from the rate of saving or Solow's empirical works. (See Boianovsky and Hoover, 2014)See Hoover and Boianovsky 2014.

[14] Harrod never abandoned the conviction that the effective and the warranted rates of growth diverge naturally, still claimed that the divergence is not necessary as strong as Robinson and others interpreted it in 1939. Indeed, in 1973 he even uses for the first the concept of *corridor* that he certainly borrowed from Leijonhufvud (1973). Nevertheless, in the 1960's, he focused his attention on growth dynamics and in that perspective, the natural rate of growth became for him of fundamental importance. His main contribution was in the "Second Essay in Dynamic Theory" published in 1960–as stressed also by Sen (1961), where he identifies clearly the natural growth rate as the "welfare optimum" rate. Then the search for the optimal saving rate started involving ones of the most prominent economists of that period.

and that, once fully employed, society must "accept the growth rate that fate meet out it." (Samuelson (1966, p. 809, n. 1; see also 196', p. 788)

> "Of course this mechanism presupposes that there is no fixity of the capital output ratio. Many American economists, like Hansen, Gerhard Colm, and Robert Eisner, have questioned the practical validity of this hypothesis. They would perhaps point to the sluggishness of capital formation following the 1956-7 equipment boom as evidence that any deepening of capital contrived in the short run is unlikely to be sustainable and will tend to be followed by such investment sluggishness. A final judgment is not yet possible. Chronic deficits in America's international balance of payments have inhibited the use of expansionary monetary policy and so a test case has not been possible." (Samuelson 1963, p. 341-2)

As long as the warranted rate of growth exceeds the natural rate of growth of population, it cannot last long. The warranted rate of growth can exceed the natural rate of growth, but this can only be a temporary situation.

> "if deepening of capital were impossible, so that the capital-output ratio could never be increased, fiscal policy would have to be set fantastically at so expansionary a levels to bring down the percentage of income saved to the level set by the rate of population growth and the capital-output ratio. Society would have to accept passively this fate-given growth rate (plus what technical change will itself bring). (Samuelson 1961, p. 809, n. 1)

For all these reasons, Samuelson finally concluded that the neoclassical synthesis drastically departed from Schumpeter's gloomy vision of growth and economic stability:

> "Social prophets of our day, such as Schumpeter and Toynbee, to say nothing of the earlier Veblen or Spengler, thought of the mixed economy as "capitalism in an oxygen tent""[15] As a matter of fact, the Neo-classical synthesis holds a

15 Economics , 8th edition (1970), p.712

> new view that goes against the one dominant global and declining economic perspective from those "social prophets".

On the contrary, state interventionism is long term working solution that has already proven its worth: "It is true that the Great Depression of the 1930s was one of the worst the capitalism system has ever known; but it is also true that a mixed economic system subsequently replaced rugged individualism and *laissez faire*. The mixed economy introduced fiscal and monetary policies to moderate business cycles and control chronic slumps. We live in a world no prophet ever predicted!"[16] The world he describes is a world where state interventions are not that "unnatural". They might have their place in the natural order of things, allowing capitalism to find or to recapture its proper pace.

2. Debunking Kaldorism

According to authors like Samuelson, Solow, Tobin and Hahn (1961), Kaldorism offered no serious alternative to the neoclassical synthesis. First, they pointed out that adjustments arising between the warranted rate of growth and the natural rate of growth were due to changes in the capital output ratio and not to changes in the global saving[17]. Second, and most importantly, they consider that neither Kaldor, Pasinetti nor even Robinson had succeeded in addressing Harrod's instability principle and producing an analysis of the adjustments between the actual and warranted growth rates. Samuelson was certainly the one who feels as much urgency to prove that failure.

> "[...] Kaldor's [...] very clearly adheres to a theory of full employment brought about by equilibrating shifts in the distribution of income; and on this occasion I am not concerned with the merits and demerits of a macro versus neoclassical theory of distribution, but rather with the developments in employment analysis since the *General Theory*". (Samuelson 1963, p. 343)

16 Economics, 7th edition (1967), p 707.
[17] The point was raised too, but in passing, by Mathew and Hahn (1964).

Strikingly, « far from being branded in Cambridge as a renegade, Kaldor is apparently orthodox in having an equilibrating theory of income distribution » (Samuelson 1963, p. 343) [18]. This, claims Samuelson -- a stance that he shared with Sen - - was due to the difficulty to identify the causal dynamics at work in Kaldor's analysis. Between 1955 and 1962, Kaldor developed several models whose consistency with each other was far from obvious. To address that problem, Samuelson naturally suggested comparing these models once rephrased in mathematical terms. Once done, he strenuously criticized Kaldor whose, according to him, failed to produce logical as well as empirically valid arguments.

> « In your dynamic growth models, implicit or explicit, of 1955, 1957, Corfu, and 1962 – as I examine your equations explicit or implied, I am not able to find a validly reasoned and empirically plausible system that makes distribution be determined by the shifts in income between thrifty-residual profit-receivers and less-thrifty wage recipients." (Samuelson to Kador November 8th, 1963).

Indeed, Kaldor's alleged innovation was the implicit or explicit behavior equations, which say that the aggregate of profit or the ratio of profit to income can be expected to fall as long as actual employment is less than full employment. For brevity, Samuelson writes down a two-dimensional Kaldor's system, involving autonomous investment, $I(t)$, desired saving $S(t)$, the actual level of income and employment Y, and the full employment level Y^*, the ratio of profits to income, π =profit/income, which is of course 1-(Wage bill/income).

$S(Y,\pi) = I(t)$ where $\frac{\partial S}{\partial Y} > 0$ and $\frac{\partial S}{\partial \pi} \geq 0$

$\frac{d\pi}{dt} = K(Y - Y^*)$ where $K(0) = 0$ and $K' > 0$

This last behavior equation involving the function identified by the "honorific symbol K in Kaldor innovation" is quite necessary if this system leads to full

[18] « At Berkley in January I gave a provocative debunking of Kaldor, hoping to provoke Scitovsky and Lipsey (visiting professor 1963-4) into a defense. But Kaldor appears to have no defenders, except for himself and it is not clear to me that he defends his 1955-1957, 1966 alternative theory of distribution although he may think he is defending it. » (Samuelson to Sen June 23, 1964).

employment equilibrium. Conversely, provided $\frac{\partial S}{\partial \pi}$ is empirically sufficiently large, the system can be shown to be unique and stable. Reproducing here the arguments of Samuelson (1963), the result can be proved as follows.

"I reproduce the crucial words that can lead to a complete Kaldorian set of equations, which deduced (2)'' [$0 = (Q - Q^*)$] as a theorem rather than merely postulating it: "a rise/in total demand will raise prices and profit margins…whist a fall…in total demand causes a fall in prices (relatively to the wage level)…" (p. 95)

We have deliberately omitted some words which claim that the quoted mechanism is powerful enough to compensate for I^* fluctuations and to ensure stable full employment, because that is precisely the result which we want to investigate in order to see whether it can be validly deduced under serious hypotheses.

Whatever we may think of the empirical exactitude of the quoted mechanism, we must admit that there is no similar mechanism operating to shift the terms-of-trade flexibility between brunettes and non-brunettes. Indeed the quoted mechanism does break the symmetry between profits and wages in all the remaining Kaldorian equations: this behavior postulates an asymmetric relationship between wages and residual profits; so, if we have $S_W > S_\pi$, the system becomes dynamically unstable.

"To pin down exactly what is the intended dynamics of the Kaldor system, we must replace (2)' by some equation implied by the quoted passage. This is an ambiguous task. More than one interpretation is possible, as the later discussion of Pasinetti may indicate/ I shall here give one possible interpretation of Kaldor's flexible profit margin: Profits fall at a rate roughly proportional to excess capacity i.e., to the level of unemployment, $L^* - L$, or the correlated deviation from full-employment output $Q - Q^*$. So my version of 1955 Kaldor, call it K-S, becomes

$0 = I^* - S(Q, \pi)$ where $\frac{\partial S}{\partial Q} < 1$ and $\frac{\partial S}{\partial \pi} \geq 0$

$\beta \frac{d\pi}{dt} = Q - Q^*$, $\beta > 0$

How, it is easy to deduce (1)'' and (3) that the system does ultimately approach the $Q = Q^*$ condition, and a a speed dependent upon the adjustment constant β^{-1} .

(…)

the system can be shown to be unique and stable.

"In the course of clarifying and extending certain Kaldorian concepts, Luigi Pasinetti makes the pregnant remark (which I quote out of context) "… There is in the [Kaldor] system a price mechanism by which the level of prices with respect to the level of wages (profit) margins rises or falls according as to whether demand exceeds or falls short of supply…" "We seem almost back postulating (2)', which is what most of us want to see proved"

Once formally "completed", Samuelson then addressed his empirical critic to Kaldor.

> "I know of no evidence (…) that profit margin get eroded endlessly at a less-than-full employment plateau of production and capital stock. This, I believe, is important in revealing the Achilles heel so some versions of Kaldorism."

« I have had eight years now to study the empirical validity of Kaldor's basic equation (2) and I cannot find telling evidence in its favor. Indeed our unemployment rates as persistent 6 per cent levels over half a dozen years suggest that to whichever economic system it may apply, it does not apply to American capitalism ; The mechanism of Jean Baptiste Kaldor seems to involve an extremely Invisible Hand. In particular one should not mistake the commonsense tendency of corporate profits to fall sharply when businessmen experience a drop in sales that they had not counted upon when contracting their overhead expenses, for the strong Kaldor equation (1). The empirical validity of the one does not testify to the validity of the other.

If only Kaldor syllogisms were empirically valid, how nice the world would be. Raising labor's share in the national income would be child's play. By following an austere budget policy of surplus financing, which even the late Montagu Norman would consider orthodox, you could introduce an additive constant on the left-hand side of equation (1) which would be sufficient so squeeze profits down to a much reduced level. Who believes that possible? Anyone who subscribes to the above Kaldorian system should." (Samuelson 1963)

"Dear Nicky, I enclose a paper (yet another one!) on your distribution theory. It arises from Samuelson's question about the employment mechanism in your model. Briefly, I accept Samuelson's question as legitimate, but his interpretation of your model is not quite O.K, nor the employment mechanism he suggests constructing from certain sentences from you and Luigi [Pasinetti]. I also suggest an alternative employment mechanism depending on the reaction of entrepreneurs to unfulfilled expectations, and this sometimes take us to (a) Keynesian (General Theory) unemployment equilibrium and sometimes to (b) Kaldorian distribution situation. My main disagreement with you would be in your assumption of an automatic system of full employment, that is only considering (b) and not (a) also." (Sen to Kaldor 1964)

Sen agrees with Samuelson on the interpretation of the equation defining the dynamics of the share of profit: "Samuelson regards Kaldor's distribution theory only as good as equation [(4)], which he regards as 'an inadmissible behavior equation,[...] and being at variance with theoretical expectation.' I agree with this assessment, [...]".

Nevertheless, he has a nuanced position regarding the theoretical representation of Kaldor's way of thought: "[...] I am less convinced than Samuelson is, that equation [(4) $\beta \frac{d\pi}{dt} = Q - Q^*$] is implied by Kaldor, or Pasinetti. In fact the only statements about[19] prices changing vis-à-vis money wages that I can find in Kaldor or Pasinetti, seem to be made in the context of an already postulated full-employment. […] It seems to me that it is best to treat the NK model as one of postulated full-employment, rather than one that leads to full-employment through equation [(4)]." For Sen, the main weakness of Kaldor's model of distribution lies rather in its "complete independence of the production side of the picture", argument he already underlines in his 1963 article.

3. A fragile edifice

[19] Nicholas Kaldor's Papers Collection (NK/1/31/397 to 407, King's College Archive Center, Cambridge, UK).

Sen truly tested the neoclassical synthesis in several papers published in the early 1960s. Two lines of thought could be identified. First, the problem was to determine if price movements, In Solow-Swan model could still play an equilibrating role in a context of fixed money rate of interest. Second, the question was to explore the functioning of the neoclassical model by relaxing the assumption of constant equality between the warranted growth rate and actual growth rate.

Was money rate of interest rigidity likely to prevent the warranted rate of growth to adjust to the natural rate? Sen's point was that because the warranted rate of growth depends on the real rate of interest (defined as the difference between money rate of interest and the expected rate of change of price), prices will change in such a way as to shift the own rate of interest in the direction of bringing warranted and natural rate of growth together. With that respect, the neoclassical synthesis holds up quite well.

> « It was further claimed that if a not too implausible assumption is made out the relationship between unemployment and the rate of change in money wages, the 'own' rate of interest will move in a way to make the warranted growth rate equal to the natural rate of growth, even if the money rate of interest is kept constant. The process does not make it possible to have warranted growth with full employment, but in the long run the warranted rate of growth gives a stable proportion of unemployment. » (Sen 1963, p. 280)

…

Regarding the second problem, Neo-classical synthesis reveals to be more fragile. The bottom line was that the neoclassical synthesis is relevant only as long as it is based on the assumption that the actual rate of growth remains permanently equal to the warranted one. This naturally refers to all questions that arise when investment is given an independent existence of its own. Now, "What kind of an investment function we should introduce is not very clear, and this deals with one of the most untraceable elements in a capitalist economy." (Sen 1963, 277). The assumption of perfect foresight was obviously a first candidate for elimination when the actual investment is different from the one warranted.

Keeping as much as possible of the Solow-Swan type of a neoclassical model, Sen suggested introducing an independent investment function based on an expected rate of growth. His point was that as soon as the actual income differs from the expected income, actual growth rate moves in the opposite direction of the warranted growth rate. Sen admitted that there has been a feeling, with a certain amount of justification that Harrod overstated this instability property[20]. As Baumol observed it:

> "...if income has been rising at the warranted rate for some time before the difficulty in question arises, entrepreneurs may refuse to be moved to pessimism by a single unhappy experience. It is even possible that entrepreneurs will generally believe in the "normalcy" of the economy and so will regard any case of overproduction as a temporary phenomenon soon likely to disappear.' (Baumol, *Economic Dynamics* 1959, pp. 54-5).

The problem was that anything that would make G_w moves towards G_n, would itself raise questions about the equality of the actual rate of growth, G, with G_w. As a result, any assumption about the entrepreneurial expectations of the normalcy of the economy which would stabilize the warranted growth path when G_w is unchanging likely makes the actual adjustment of G_w to G_n even more strenuous. This is the case when the expected rate is equal to the warranted rate of growth, but $G_n > G_w$. Now, suppose G_w rises towards G_n, through a rise in the profit rate. If the entrepreneurs still expect the same rate of growth (equals to the previous and smaller value of G_w), the actual rate of growth G will in fact be smaller. Thus, G and G_w move in opposite directions, and the very process that will bring G_w towards G_n, will take G away from G_w. Thus, concluded Sen, "Harrod's problem of instability, which can be dodged with the assumption of 'normalcy' of the economy when G_w is constant, becomes extremely important when the 'knife-edge' balances between G_n, and G_w is relieved through a

[20] To be more precise here, what can be said is that Harrod did not make efforts to discuss the role entrepreneurs' expectations could have in a stabilization process of the system. Nevertheless, it is clear that Harrod very much disliked the interpretation many (like Robinson) had of the nature of the instability, stressing that Gw was a moving equilibrium and that for this reason, G and Gw could not continuously diverge (see Bruno and Dal Pont Legrand, 2014).

changing capital-output ratio. Needless to add if the 'knife-edge' balance is relieved through a change in the saving ratio through redistribution of income, the same problem will crop up." Regarding the neoclassical synthesis, this point was highly problematic. For "if growth theory is to have any relevance to policy, it cannot do without an investment function; and once that is given a fair play, it is easy to recognize that anything that reduces the 'knife-edge' balance between G_n, and G_w will tend to highlight the 'knifedge' balance between G and G_w." (Sen 1964 279)

> "In the Solow-Swan model, a rise in the interest rate reduces the actual rate of growth and a cut in it raises the latter, so that the topsy-turvy result is not seen there. This is because in the Solow-Swan model actual growth takes place continually with full employment. Given time this actual growth rate equals (or approaches) the warranted growth rate, as the warranted growth rate equals (or approaches) the natural growth rates. Since, however, no independent investment function is introduced, and since expectations are not given an independent existence (e.g. basing them on past experience), the problem of being away from warranted growth to start with, is not allowed to trigger off a disequilibrium in the Harrod-Domar fashion. Thus what Solow and swan do consist not merely of relaxing the assumption of fixed coefficients, but also of changing the expectational assumption. This robs Harrod's warranted growth path of its unstable equilibrium property, even before its reconciliation with the natural growth rate is started." (Sen 1963, p. 279)

« In the presentation of Solow and Swan, actual growth always takes place at the natural rate, and it equals the warranted rate only after the latter has shifted to equal the former, *i.e.* only after equilibration is complete. While this avoids the topsy-turvy impact of interest on actual growth during the period of adjustment, this is achieved by ruling out the problems that Harrod outlined in the case of the actual growth diverging from the warranted rate, *i.e.* the problem of unfulfilled expectations.

« Finally, it was claimed that to show that the balance between the warranted and the natural rate is not a 'knife edge' one, answers Harrod's original problems only

partially. In fact anything that makes G_w move towards G_n, will itself raise some questions about the equality of the actual rate of growth with G_w. Any assumption about the entrepreneurial expectation of the 'normalcy' of the economy, which stabilizes the warranted growth path when G_w is unchanging will make the actual of G_w to G_n even more strenuous. The difficulty is usually concealed by doing without an independent investment function in the growth models, and thereby eliminating the influence of expectations. **It is a dodge, and like all clever dodges it has its usefulness, but it is easy to outlive that**." (Sen 1963, p. 280)

Conclusion

TBD

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