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PUBLIC INVESTMENT UNDER DISEQUILIBRIUM: A POST KEYNESIAN VIEWPOINT

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Public Investment Under Disequilibrium: A Post Keynesian Viewpoint

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Abstract

Given convex technology and preferences, the neoclassical equilibrium has optimality features that prompted its use for normative analysis. The canonical version of the model assumes that the optimum is reached through the decentralised decisions of atomistic producers and consumers that take prices as given parameters, in a barter economy with no State. In a context where the State is present, any economic policy will be harmful, as it will introduce a distortion into what would otherwise be an optimum. However, as Governments around the world realised in the recent crisis, this optimum cannot be the only reference for economic policy, unless it is demonstrated that, besides being desirable for its optimality features, it is also feasible and relevant for real life decisions, something which in general it is not possible to do.

If the word *equilibrium* is used as a synonymous of neo-classical optimum, and the latter is recognised as a very specific ideal case, all situations relevant for real life policy choices can be qualified as *disequilibrium* ones. The paper discusses the evaluation of economic policies in the field of public investment in such a disequilibrium context. It is argued that the model of the monetary circuit, put into the more general perspective of post Keynesian analysis, is useful to illustrate policy choices in disequilibrium situations, characterized by an underemployment of the labour force and a sub-optimal utilisation of the productive capacity. Indeed, when credit money is introduced, it is easy to understand why situations of insufficient effective demand tend to become permanent. This type of disequilibrium implies also that investment causes savings and that the whole is not the sum of the parts, justifying the claim for macro foundations of microeconomics and giving renewed relevance to fiscal policy and its coordination.

In particular, when new money creation is a possible mean of financing public investment, the model of the circuit shows that if the State budget is restricted to previously accumulated savings for financing its expenditures, it deprives itself of an important instrument for planning long-term budgetary policies that could stabilise the economy by anchoring the diverging expectations of the private sector. This type of “expectational” externality should be quantified in cost benefit analyses that look at the comparison of alternative ways of financing public investment policies. It also gives support to the idea of coordinating European fiscal policy at continental level through the collective management of investment and other public expenditure.

Public Investment Under Disequilibrium: A Post Keynesian Viewpoint (*)

1. Introduction

The idea developed in this paper is that post Keynesian analysis and particularly its monetary variant of the circuit are a suitable generalisation to address situations that would be qualified as "out of equilibrium" in a neo-classical approach and that would therefore be ignored because of their transient nature.

It is well known that the conditions for the neoclassical equilibrium to exist and be unique, which also guarantee its optimality and thus set the basis for its use in normative analyses, are quite unrealistic. In addition, stability, which should be a pre-requisite for the direct application of this particular notion of equilibrium to the description and diagnose of real world problems, has never been proven under sufficiently general conditions.

Rather than being unstable and deprived of practical interest, the situations where not all conditions of neoclassical equilibrium are fulfilled are of interest because they better describe the economic reality and are relevant for policy design. Moreover, if one relaxes the conditions necessary for generating neoclassical equilibria by introducing money, the more general model obtained can still generate the neoclassical equilibrium as a particular "limit" solution and therefore the latter can remain an indirect reference for normative analysis, as it obviously keeps all its optimality features[1].

Once this more general model is defined in its main features, it appears that the need for macroeconomic demand management acquires a prominent role in economic policy and therefore public expenditure in general and public investment in particular have completely different effects than in the "canonical" version of the neoclassical model, as they notably allow to recompose divergent private sector expectations. As emphasized by Seccareccia (1995), this demand management should be oriented towards the long-term, as originally proposed by Keynes[2]. This macroeconomic effect is not always captured by conventional cost-benefit analysis at least in the way as it is generally practiced in EU countries.

After having reviewed the use of the concepts of equilibrium and disequilibrium in the neoclassical model in section 2, section 3 proposes a more general definition and argues that it is legitimate to claim that post Keynesian analysis *lato sensu* is a generalisation of neoclassical one and that it is suitable to address "out of neoclassical equilibrium" situations. Some preliminary consequences for economic policies and public investment are outlined. The argument is further

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[1] By indirect it is meant here that the neoclassical equilibrium can still be a reference for comparing two alternative real life sub-optimal positions, as opposed to comparing directly the pure neo-classical equilibrium to a given sub-optimal real life situation. This corresponds to the distinction between *feasible* and *potential* welfare, made respectively in chapters V and IV of Graaff de V. (1957). See also the discussion of Allais' model in section 2.

[2] "The modem neoclassical economist, trained in the tradition of Friedman and Lucas, would be surprised to discover that, together with his support of the 'euthanasia of the rentier', Keynes's argument in favour of the 'socialisation of investment' constitutes the only explicit long-term policy proposal to be found in the General Theory" (Seccareccia, 1995, p. 47) … "Keynes envisaged that in his proposed system as much as 'two-thirds or three-quarters of total investment' would be directly influenced by public and semi-public bodies whose activities would be guided by the traditional 'motive of private exchange' as well as by the 'technically social' motives that have normally justified investment in social infrastructure" (Seccareccia, 1995, p. 48).

developed in section 4, which examines the causal role of distributive variables in post Keynesian models without money in the tradition of Sraffa and Kalecki, and in section 5, which looks at monetary equilibria in the model of the circuit. In section 6, the assumption of constant technology is dropped. Section 7 discusses in more detail some implications of the analysis for European public investment policies with particular reference to the countries having integrated more recently the EU or in the process of doing so. There are also implications of the ideas discussed in this paper for European fiscal policy coordination that will be just sketched out here and could be developed later.

2. Equilibrium and disequilibrium in the neo-classical model

The neoclassical synthesis focuses on a very specific and detailed form of static equilibrium, but the main authors that developed it just before and after the Second World War gave also a fair treatment to the case of disequilibrium, mainly in connection with the extension of their analysis to dynamics[3]. For instance Hicks's *Value and Capital*, contains a Chapter X, entitled "Equilibrium and disequilibrium"[4], while Samuelson's *Foundations* address (and avoid) the problem through the use of the concept of "comparative statics", which states that it is legitimate to restrict attention to static equilibrium positions only, as long as the conditions for dynamic stability are assumed to hold[5]. It is noteworthy that the classic texts that gave an organic systematisation to the concepts of neoclassical equilibrium and disequilibrium in the 1930s and 1940s were also key contributions in the field of welfare economics. In this respect, it is probably Allais (1943 and 1994) who developed more thoroughly the link between the definition of equilibrium and disequilibrium and welfare analysis. Indeed, a substantial portion of his *Traité d'économie pure*, is made of two large sections on the "*Dynamique du déséquilibre*" (Chapter III, pp. 272-513, reference to the 1994 edition) and the "*Dynamique de l'équilibre*" (Chapter IV, pp. 514-686)[6]. His whole book can actually be seen as an attempt to build the treatment of equilibrium and its use in welfare comparisons on the basis of what one can assume happens out of equilibrium. In particular Allais uses the neoclassical equilibrium as a reference point to compare two states of the economy, both out of equilibrium, from the welfare point of view. For that purpose he derives a function (called "*la perte*" or "the loss"), which measures the relative distance of both points from the neoclassical equilibrium. This function is derived from the concept of "*surplus distribuable*". Later, Allais offered a better algebraic derivation of these concepts and presented them as the basis for the generalisation of the neoclassical model in his *Théorie Générale des Surplus*. A relatively simple development of Allais' points on these two concepts can be found in a small model annexed to the *Introduction* of the 1994 edition of his 1943 book, which will be briefly described in the two paragraphs below.[7]

The model has 2 goods, 2 factors, 2 agents, 2 producers and no money. In line with the neo-classical approach, it assumes fixed resources, technology and preferences. Equilibrium is defined as a situation where, given relative prices between the two goods and the two factors of production, consumers maximize their utility under constraint of revenue and producers maximize revenue (or profit) under a technology constraint. Allais derives the usual first and second order conditions for the optimum showing that they are necessarily fulfilled on the frontier of maximum

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[3] Later texts were more laconic on the subject. For instance, Arrow and Hahn's *General Competitive Analysis*, (1971, pp. 263-281) which represents the reference for the following generation of the neoclassical synthesis, mentions briefly the issue in connection with "tâtonnement" in their chapter on stability. The same is true for a more recent reference such as Mas Collell, Whinston and Green's *Microeconomic Theory* (1995, p. 625). It is interesting to note that whereas Arrow and Hahn was characterised by the abandonment of the differential calculus approach of Hicks, Samuelson and Allais, in favour of set theory, Mas Collell (1985) suggests to return to differential calculus.

[4] Hicks (1939 and 1979, pp. 130-140), reference is to the 1979's "second" edition. Hicks later developed his thoughts on the subject, see below par. 3.

[5] Notably in the Chapter II and XI, entitled respectively "Equilibrium systems and comparative statics" and "The stability of Equilibrium: Comparative Statics and Dynamics", cf. Samuelson (1947 and 1983, pp. 7-20 and 257-283), reference is to the 1983's "enlarged edition".

[6] The part of this book devoted to welfare analysis (*Rendement social*, pp. 588-664) is included in the section on the dynamics of equilibrium.

[7] Allais (1943 and 1994), Annex IV pp. 139-151. A development of the concise algebra of this Annex is available upon request.

efficiency in the space of satisfactions, or to the frontier of maximum efficiency in the space of productions. He also defines a curve of minimal production costs given output and derives that the neo-classical equilibrium of "maximum efficiency" corresponds to the point of tangency between the line of maximum efficiency and the curve of minimal production costs in the space of productions. Any point below the line of maximum efficiency is sub-optimal and therefore allows for a "surplus" to be distributed if the economy moves closer to the line of maximum efficiency.

Whereas the developments above are standard, Allais derives an explicit expression for this surplus (*surplus distribuable*). This is defined as the amount of one of the two goods that, starting from any point below the curve of maximum efficiency, could be distributed in moving to another point, which could also be suboptimal, while keeping the level of utility constant. Given the starting point, the surplus depends only on the target point and can be expressed in terms of its parameters. By maximizing the surplus with respect to the parameters of the target point and solving the resulting system of equations, Allais finds an expression for the "loss" associated with any sub-optimal point. This is the maximum of the surplus that can be liberated starting from this point and respecting all the constraints of the model. By studying the first and second differential of the surplus and of the loss, Allais further shows that in any situation of maximum efficiency the surplus that can be distributed is null and its derivative is negative or null, which implies that the *surplus distribuable* is minimized on the maximum efficiency line. He also shows that in the neighbourhood of equilibrium, the first differential of the loss is null and the second one is negative or null, which also implies that the loss is minimized at maximal efficiency.[8] A remarkable implication of this way of setting the problem is that in moving between two sub-optimal points A and B, the change in the loss between these two points can be approximated by the change in consumption, which sets the basis for the cost-benefit analysis. However, it is only when the starting point is sufficiently close to equilibrium that it is legitimate to value this change in consumption at the starting (market) prices.

The concept of surplus and loss can be interpreted as providing the basis for the dynamic of a market economy out of equilibrium. Allais (1989) argued in particular that the existence of a "surplus distribuable" out of equilibrium is the root of the instability of sub-optimal positions, as in any of these situations it would be possible to obtain the same satisfaction at a lesser cost, or, alternatively, that at that cost the agents that form part of the economy can attain a higher level of satisfaction. Therefore Allais conception of disequilibrium dynamics consists of the frictionless search of new combinations of factors of production to obtain similar or higher levels of satisfaction that will stop when all possibilities for improvement are exhausted, i.e. when the economy is on the frontier of maximum efficiency, illustrating the fact that only the points that pertain to the frontier of maximum efficiency can be equilibria of the model Despite assertions of the contrary, the process through which equilibrium is reached is not explicitly described in the model of Allais, implying that the "instability" of non-equilibrium positions is an assumption that is

[8] Allais (1981 and 1989, pp-301-304, reference to the 1989 edition) notes that concepts similar to his *perte* have been used by his pupils Debreu (1951 and 1954) and Boiteux (1951), but he comments that Boiteux's *perte*, which is based on revenue and thus on prices, depends from the initial situation (and is in fact only relevant starting from a situation of maximum efficiency, NdA), whereas Debreu's *coefficient of resource utilisation*, defined for a composite commodity and based on the convexity of the consumption and production sets, is not suitable for the analysis out of equilibrium. According to Allais, the definitions of Boiteux and Debreu do not respect all the desirable properties of a proper indicator of inefficiency such as the loss should be. This is the case also for other definitions proposed in the literature like those of Dupuit, Pareto, Barone and Hotelling (pp. 159-295). These desirable properties are: i) the indicator should depend only upon the parameters (preferences and resources) of the starting situation; ii) it must depend upon all structural conditions of the economy and only on those. It should not depend on prices; iii) it must integrate symmetrically all the other goods, all indexes of preferences and all production functions; iv) It must be zero at maximal efficiency; v) It must be positive in all realisable situations that are not of maximum efficiency; vi) it must decrease for all changes where some preference indexes increase while others remain constant ; vii) it should be easy to calculate for any sub-group of economic agents in all situations ; viii) it must be invariant for all transformation of the ordinal preference indexes $I'_i=h_i(I_i)$, where the index i refers to agents and the index I to their preferences; ix) it must refer to a common good used by all agents (neoclassical "barter money", see section 5 below); x) it must be defined for both disequilibrium and equilibrium situations; xi) it must be independent of distribution; xii) it must not rely on continuity, derivability and convexity. From these properties it results that such an indicator must be maximal and null in a situation of maximal efficiency (Allais, 1981, p. 328-329). It can be interpreted as a measure of the distance from equilibrium, which puts clearly the analysis of welfare, already fully developed in the *Traité* of 1943, in a disequilibrium perspective.

imposed from outside[9], as in the case of the restrictions imposed by stability conditions for comparative statics in Samuelson's analysis. It therefore falls under the same criticism. [10]

One can observe that this "out of equilibrium" dynamics develops on a path where "real profits" vanish progressively and indeed it stops at a point where real and nominal profits are zero, as required by the conditions for maximum efficiency and as it results from the definition of static equilibrium with perfect competition. One can also observe that on the frontier of maximum efficiency factors of production are fully employed, otherwise there would also be a waste and therefore a *surplus distribuable*. Therefore one can retain three main properties of the neoclassical equilibrium of maximum efficiency:

i) there exists a system of prices that clears all markets[11], present and future, implying notably the equality between investment and savings;
ii) marginal distribution relations hold (the remuneration of different production factors is equal between them and proportional to their marginal productivities);
iii) profits vanish, at least in the long-term when technology is fixed;[12]
iv) production factors are fully employed.

Conversely, any situation where marginal distribution relations do not hold, profits are different from zero and there is unemployment and underutilisation of productive capacity, are "disequilibrium situations" from the neoclassical viewpoint. In these situations it is presumed that savings is a causal factor of investment (see par 3.5). Therefore, the practical question is whether or not equilibrium is something which is normally reached in reality. As already mentioned, the results of the tâtonnement and related stability literature are quite negative, therefore it would be rational to assume that most of the time a real economy will be out of equilibrium.

It is thus a legitimate conclusion of the above arguments that disequilibrium positions are not necessarily unstable and could be seen instead as rest points of unspecified process that end up in situations where real and nominal profits have not vanished, as it will be discussed in the next section with reference to post Keynesian theory. [13]

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[9] There is probably an implicit argument of the type developed in the theory of the core of an exchange economy, but it is not really made explicit. Hildenbrand and Kirman (1976) present the theory of the core in a general equilibrium perspective.

[10] Franklin Fisher (1983) provides the standard modern reference on disequilibrium. As he stated more clearly in Fisher (2003), his conclusions, are rather negative in the sense that in order to have stability one must assume the absence of "favourable surprises", which by and large excludes dynamics (see below par. 3.4). See also the other papers published in the volume of Petri and Hahn (2003). Guerrien (1992) provides an introductory review of the consequences of the so-called *Sonnenschein-Mantel-Debreu theorem* for the stability of the neoclassical equilibrium. He notes that: "le cas où il y a instabilité est bien plus 'probable' que celui où il y a stabilité … cela signifie que, en règle générale, le tâtonnement ne mène pas à un équilibre walrasien".

[11] A market is "cleared" by prices when at that price supply equals demand.

[12] See McKenzie (2002 p. 192, condition II) or Guerrien (undated). With reference also to the discussion in sections 3 and 4, the term profit means actually different things in classical and neo-classical approaches, at least if one compares the "natural price" of Smith and Ricardo, which corresponds to the "price of production" of Marx and Torrens, to the "long-period normal price" of Marshall. As noted by Kurz and Salvadori (1995, p. 29), the "profit" for Marshall is the "extra-profit" of classical economists, whereas what classical economists called profit is what Marshall calls interest. In this sense a uniform rate of profit in the classical sense is compatible with the fact that "extra-profits" vanish in the long-term as long as the there is a single rate of interest in the economy.

[13] There are other important practical implications of admitting the possibility of neoclassical disequilibria being in fact equilibrium points of unspecified dynamic processes, in addition to the fact that profits do not vanish. The first is that optimal resource allocation can not be achieved independently from distribution, since distribution (or redistribution) can reduce the loss and then move the economy closer to the efficiency frontier once a starting point where a loss exists is admitted (this argument is further developed in section 4). This runs contrary to one of the main assertions of the modern public finance literature implicit in the mind of many economists when they think about policy questions, which asserts that the economy must first be let finding its maximum efficiency position by the working of decentralised markets, then policy can redistribute the maximal amount of production permitted by technological constraints and availability of factors of production according to political preferences. First the market should bring the economy on the maximum efficiency frontier, and then politics could decide how to move along the frontier through redistribution. Whereas several economists taking some distance from the neoclassical equilibrium approach are aware of this aspect, less thought is devoted to a second implication that most of the pricing models used in the modern literature on risk and derivatives assume a neo-classical equilibrium *stricto sensu*. Indeed it is not an exaggeration to say that the "no-arbitrage" assumption retained in this literature is equivalent to the "no-profit" condition of "real economy" neo-

3. Post Keynesian analysis as a dynamic generalisation of the neoclassical equilibrium

It may sound unduly restrictive to qualify post Keynesian economics[14] as an analysis of what happens "out of neoclassical equilibrium", although some of the economists more clearly associated with this "revolution to be accomplished"[15], such as Nicholas Kaldor (1972/1989, p. 1240), have clearly espoused "anti-equilibrium" viewpoints:

> " … equilibrium theory has reached the stage where the pure theorist has successfully (though perhaps inadvertently) demonstrated that the main implications of his theory cannot possibly hold in reality, but has not yet managed to pass his message down the line to the textbook writer and to the classroom"[16].

Other closely related authors, such as the structuralist Lance Taylor (2004), reject the relevance of the notion of equilibrium altogether. Without pretending undue generality, it is argued in this section that for practical policy purposes, post Keynesian analysis can be seen as a tool for addressing what in the neo-classical model are considered to be out of equilibrium situations and it therefore provides the way for its generalisation. The argument relies on the definition of equilibrium as a point of rest of a system (par 3.1), where there are endogenous and exogenous variables (par 3.2), which have causal relations between them (3.3), that interact in time (3.4). This implies that, contrary to the neoclassical model, the causality goes from investment to savings (3.5), which has relatively obvious implications for economic policy and particularly public investment.

3.1 Equilibrium and associated economic theories: As seen above, the neoclassical characterisation of equilibrium assumes given resources, as well as tastes and technology. Demands and supplies result from a process of optimisation under the constraints imposed by the predetermined parameters, which include also prices, assumed to be the equilibrium ones. The rigorous mathematical conditions and properties of this type equilibrium have been made explicit in the classical works of Arrow and Hahn (1971), Debreu (1959), Mc Kenzie (2002) and others that, while confirming the main results obtained by early writers, also detailed how particular and strong were the conditions required for the neoclassical equilibrium to hold. Machlup (1978) used instead a more general definition of equilibrium, generic enough to be applied in characterising different economic theories:

> "The equilibrium concept in economics is primarily a tool for the explanation of movement: we explain a movement by pointing to "causes" that are responsible for the departure from one position and an approach to another one. These two positions are idealized as positions of rest, an initial equilibrium and a "new" equilibrium. The movement is thus "understood" as an adjustment to a "disequilibrating" change. We need the assumed "balance of forces" in this initial position in order to isolate the "disequilibrating change", that is in order to make sure that nothing else has occurred and that the movement exhibited by the operation of the model can be attributed without any doubt to the specified disturbance. We need the assumed "balance of forces" in the new position in order to make sure that the adjustment is complete and all the effects of the disequilibrating change have been fully recorded."

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classical models. To the extent that the neo-classical set of equilibrium assumptions is not fulfilled in the real world, the pricing of most modern financial products is "wrong", which, together with the wide possibilities of window dressing of balance sheets in both banks and corporations (much less for Government who cannot depreciate its fixed assets), helps understanding how huge financial imbalances can accumulate. Moreover, a third implication has even more important accounting consequences. Since out of the neoclassical equilibrium, the "law of present value" does not hold: it is by definition not true that "A l'équilibre, la valeur d'un bien durable à un instant donné est égale à la somme des valeurs actuelles à cet instant de ses revenus futurs" (Allais, 1943, p. 337). Generalising to all assets, out of equilibrium, the market value of any asset is not equal to the present value of its future revenues (its "equilibrium" value). Accordingly, if one admits, as argued below in sections 5.2 and 6.1, that the economy is always out of the neoclassical equilibrium, there is no reason to give to the market value of an asset any preferential role in accounting practices. More generally one can observe with Davidson (2009, *Postscript on The Great Financial Crisis of 2008-2009*, pp.190-191) that one of the causes of the recent crisis is that the financial deregulation that started in the 1970s and that progressively eliminated the regulatory framework established after the Great Depression was based on *Efficient Market Theory*, which essentially translates real neoclassical equilibrium theory in financial jargon and notably assumes that asset prices are always equilibrium ones.

[14] Or post-classical, see Henry (1982a).

[15] Pasinetti (2007).

[16] At first sight, it doesn't seem that the message has impressed policy makers a lot in the last 30 years.

In this definition, there is implicitly a distinction between some variables, which are "caused", and other variables, which are "causing". In technical jargon, "caused variables" are called "endogenous", and are determined within a particular theory, whereas "causal variables" are called exogenous, or predetermined, and are treated as given parameters not explained by the theory (see below 3.3). According to Machlup's definition equilibrium is defined as the rest point of the endogenous variables, once the exogenous ones have exerted all their effects. There is no requirement that the equilibrium value of the endogenous variables be the result of an optimization process, nor any specific indication of which variables should be endogenous and which should be exogenous.

If one admits the idea of Machlup that an equilibrium concept is needed in order to trace out the effect of something exogenous to the system on something else which is endogenous, then any serious discussion about the effects of an economic policy action should also start from a complete characterization of the equilibrium concept used. This applies *a fortiori* to welfare judgments on policy actions: the presumed policy impact on welfare is not independent of the equilibrium concept considered[17].

Drèze, Marchand, Johansson and others have elegantly illustrated this point in the context of the different "regimes" of a "fix-price" model à la Malinvaud-Bennassy. This literature, which is in the tradition of "quantity rationing" equilibria[18], examines the cases where, given a "short-term" neo-classical static framework where all resources are fixed, not all the markets "clear" (or balance) through price adjustments due to some "exogenous" price rigidity. As a result, some market participants are rationed in the quantities they supply or demand (for instance unemployed customers rationed in their labour supply or firms rationed in their output due to lack of demand). The rationing in one market produces spillover effects on other markets, providing a microeconomic base for the traditional macroeconomic multiplier, in the tradition of Clower (1965).

In this approach[19] typical "regimes" are distinguished, depending on who is rationed on which market. The welfare analysis of a small change in economic conditions in each of these "regimes", such as the one brought by a small project, confirms that the effects of the change depend on the type of equilibrium prevailing in the initial situation[20].

This literature confirms that the impact of an investment should be assessed taking into consideration the type of equilibrium prevailing in the economy[21]. Closed form expressions have been derived for each of the possible economic regimes (typically classical unemployment, Keynesian unemployment and repressed inflation) showing how the shadow prices at which inputs should be valued out of the traditional walrasian equilibrium depend also on the usual macroeconomic multipliers, particularly in the Keynesian unemployment case, which is the most

[17] Leijonhufvud (1973) noted that only a limited number of problems in economics would have the same answer independently from the equilibrium assumption retained, a statement he applied in particular to the assessment of the social cost and benefits of public investments, originally in A. Leijonhufvud (1973), republished in Informazione, coordinamento e instabilità macroeconomica, Laterza 2004, cf. p.19, footnote 5.

[18] The 1970's literature on "fix-price" equilibria cannot strictly speaking be qualified as neo-classical, and indeed Benassy talks for instance of "non-walrasian equilibria", despite the fact that the concept of fix price (introduced by Hicks) tries to bring to its ultimate conclusion the IS-LM attempt to integrate Keynesian effects into a an optimising and neo-classical inspired framework of analysis by assuming some of the prices, and particularly wages, as fixed exogenously. It is however not really an "out of equilibrium" analysis, as the instantaneous adjustment through prices is replaced by an instantaneous adjustment through quantities.

[19] Standard references are Malinvaud (1977); Barro and Grossman (1971); Benassy (1975); Drèze (1975). See also Benassy (1982, and 2002).

[20] See Johansson (1982), Marchand, Mintz and Pestieau (1985) and Drèze (1984). The case corresponding to the more traditional IS-LM interpretation of Keynes is treated in Hill (1999).

[21] As noted by Florio (1991), this idea is already implicitly present in the formula for shadow wages proposed by Little and Mirrlees for use in projects appraisal in developing countries, which contains a term corresponding to the usual macroeconomic multiplier.

relevant empirically.[22] In particular Drèze (1984) has developed the dependence of the shadow prices on the traditional "Keynesian" multiplier.

Kahn (1977) and Taylor (2004) have criticized the rationing literature from a post Keynesian viewpoint, the first because its treatment of the Keynesian regime is not consistent with Keynesian analysis, notably because of the equalisation of investment demand and savings supply by the interest rate, whereas the second noted the practical difficulty that when more than the three markets are considered, the number of possible regimes increases so much as making the mathematical treatment of the model impossible. Parguez (1975) demonstrated the shortcomings in the analysis of Clower (1965).

The literature on rationing attempted to provide a more solid foundation for economic policy than that offered by the hypothesis of wage rigidity in the IS-LM model, but has not succeeded in becoming as popular. Although generally neglected by the influential literature of public choice and rarely brought out in policy discussions at official level, other concepts of equilibrium also exist in the post Keynesian economic literature. These are examined in the next sections.

3.2 Endogenous and exogenous variables in post Keynesian models: Rationing equilibria are based on exactly the same grouping between endogenous and exogenous variables as the neoclassical model: prices are parametrically taken as given by optimizing agents in the determination of quantities demanded or supplied, but they are not the market clearing ones. Post Keynesians writers have defined other types of equilibria characterised by a different grouping of endogenous and exogenous variables that do not necessarily require an optimisation process for the determination of the endogenous variables.

Petri (1989, p. 291) looked for instance at a price/quantity model in the tradition of Walras. He argued that in the "classical" approach[23], for what concerns the determination of the rate of profit[24], the pre-determined variables are:

a) the quantity produced
b) the real wage rate (or, alternatively, the rate of profit, if the wage is endogenous, see below section 4.1)
c) the technology

whereas in the neo-classical model what are assumed as given instead of a) and b) are the quantities of available factors of production and preferences. The neoclassical model looks at the equilibrium where all prices, including wages and the rate of interest, are determined simultaneously together with the associated quantities. On the contrary, by construction, the classical equilibrium, although simultaneous, admits a separation between the determination of some prices relating to distribution (either the wage or the rate of interest) and some quantities (demand).

Similarly, Marglin (1984), looking at a growth model studied in the long-run and characterised by a simple linear technology showed that depending on the choice of essentially the same variables and their grouping between endogenous and exogenous ones, three different models can be derived, one which is illustrative of the neo-classical approach, a second which is closer to the Keynesian approach and a third which is typical of Marxian analysis, each economic theory relying on its own characterisation of equilibrium.

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[22] See Sneessens and Drèze (1986) or Lambert (1988). One can also note that studies on the long-run properties of large macro-econometric models conclude that the long-term is non-walrasian. These studies look at the internal dynamics of models taken as representative of actual economies, at least at the level of the interrelationships existing between observable variables: "… It is clear that the long run of macroeconometric models is not walrasian: it would be advantageous for firms to produce more and for consumers to work more at equilibrium prices; this is blocked by the monopolistic behavior of the agents". Deleau, Le Van and Malgrange (1991).

[23] Classical is used here in the sense of "pre-neoclassical", i.e. the type of analysis that dominated economics before marginalism: going from Petty to the Physiocrats, Smith, Ricardo and ending with Marx.

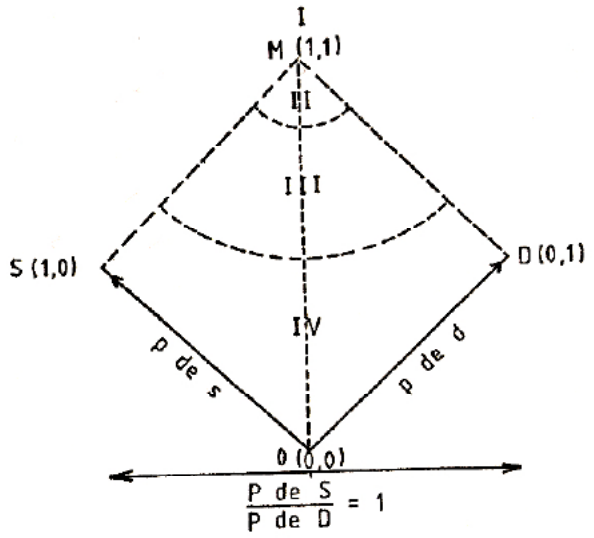
[24] Which in this context is equivalent to the rate of interest of the neoclassical model.

The examples above show that even within a model that describes the same set of variables, a different identification of the exogenous variables determines equilibrium in a different way and thus shapes the questions that can be answered to with the associated theory.

Equilibrium and the associated theory can also differ if, having the same endogenous variables, the models used to represent them differ in the number of exogenous and predetermined variables. In the *carré des éventualités* reproduced below, Robert Leroy (1983, p. 264) illustrated nicely the idea of the neoclassical equilibrium as a limit case of a model with a more general set of predetermined variables and a larger set of possible outcomes with reference to the functioning of the labour market.[25]

Chart 1: The "carré des éventualités"

GRAPHIQUE 6.1. LE CARRE DES EVENTUALITES



Source: Reproduced from Leroy (1983, p. 284) p

In this picture, 4 regimes are described according to the balance of "social power" in the exchange between supply (S) and demand (D), expressed in symbols by the ratio (P of S)/(P of D). This "negotiation power" is assumed to depend from the capacity of demand or supply to "exit" from the exchange relation (Hirschman, 1970) and it is expressed graphically by the vectors (p of s) and (p of d), whose length can in principle be quantified econometrically through the wage elasticity of labour supply and demand, estimated through geographical cross-section regressions carried out at the level of Belgian municipalities (Leroy et al., 1983).

Regime I coincides with point M of perfect neo-classical equilibrium (canonical market model), where the exit capacity of both labour supply and demand are infinite and wages perfectly clear the market thanks to high demand and supply elasticities to the wage rate, eliminating any excess demand or supply. Regime II is relatively close to Regime I. It is a mode of working of the labour market, which can for instance be described by the models of job search equilibria. In Regime III price elasticities are low and quantity adjustment prevail over price clearing. This regime is seen by Leroy as a field of application for "Keynesian" type of analyses. Finally Regime IV, which includes points (0,0) where labour supply and demand are totally inelastic to wages or have the wrong sign, is a socio-political mode of working of the labour market where it is obviously unlikely that a reduction in the wage rate is going to increase employment[26].

[25] Leroy is clearly not amongst those economists stigmatised by Solow (1990, p. 4) for whom: "it is not obvious at all that labour as a commodity is sufficiently different from artichokes and rental apartments to require a different mode of analysis".

[26] In this regime "voice" is more relevant than "exit" as a mode of exchange interaction, these concepts referring again to Hirschmann (1970).

In conclusion, if one determines equilibrium as a process of adjustment of some endogenous variables to some exogenous factors, it is clear that both equilibrium and the associated theory depend on the type of factors considered as pre-determined. The relation between pre-determined factors and causality is dealt with in the next paragraph.

3.3 The role of causality: Key post Keynesian authors such as Pasinetti (1964/1965, pp. 243-245), Robinson[27] (1962 and 1975), or Eichner (1991, pp. 18-29) have argued that a fundamental difference between neo-classical and post Keynesian analysis is that the latter admits a causal structure, whereas the former does not[28]. Indeed, with reference to the discussion in paragraph 1 above, Allais (1943, pp. 542-543) noted that simultaneity is a property of equilibrium, whereas causality is a property of disequilibrium.[29]

To clarify the discussion and before entering into more detail about the implications of these ideas, it is suitable to define better the meaning of simultaneity, causality and exogeneity with reference to the equilibrium definition proposed in paragraph 3.1.

When there is simultaneity, two variables are determined together, whereas as emphasized by Simon (1953), causality is typically associated with an asymmetric relation: if variable A causes variable B, the converse is not true.

To appreciate the difference between causality and exogeneity, one can refer to linear analysis and the distinction that is made between systems that are undetermined, where the number of variables, a priori all unknown, exceeds the number of equations, and systems that are exactly determined, i.e. where the number of equations of the *final form*[30] is equal to the number of unknowns.

If a linear system that it is undetermined is solved by, say, the method of Gauss, some variables, that can be labeled *endogenous*, can be expressed as a function of some others, which can be labeled *exogenous*. Endogenous variables are thus those that are determined by the system itself (are on the left of the equal sign of one of the equations of the so-called "final form" of the system), whereas exogenous variables are determined outside the system and are thus on the right of the equal sign of its final form. Exogeneity implies a form of causality, which is usually quantified by the *multiplier*, i.e. the response of an endogenous variable to a unit change in an exogenous variable.

Causality can also be found in non-homogenous systems that are exactly determined, where there are no exogenous variables, if the associated matrix can be made triangular or block triangular. In the extreme case of a completely recursive system, there is only one endogenous variable that, once set at a certain constant level, determines the whole system. In other terms, reasoning in a fully determined linear context, in a post Keynesian model one variable would set the second, which in turn could determine the next one and so on for the whole system, whereas in a neo-classical model all variables simultaneously impact on all variables and no causality can

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[27] Quoted in Harcourt (1975-2001, p 30), reference is to the 2001 edition.

[28] Arena and Maricic (1988) noted that the dynamic causality of the Keynesian system versus the static interdependency of the neoclassical one was clearly perceived by Barrère (1952) and before that Perroux (1950) and Massé (1948). Causality has been a much debated concept in economics cf. for instance: Simon (1953), Strotz and Wold (1960), Demaria (1974, 1996) and Hicks (1979).

[29] "La notion d'interdépendance fonctionnelle ne s'applique rigoureusement que dans la Dynamique de l'équilibre et elle ne saurait être généralisée sans précaution à la Dynamique du déséquilibre. En fait, dans cette Dynamique, les phénomènes se succèdent dans un ordre bien déterminé, qui fait intervenir sans aucune contestation possible des liens de causalité. En réalité, causalité et interdépendance ne sont nullement contradictoires, mais ces notions s'appliquent à des ordres de phénomènes différents: la première est relative au déséquilibre, la seconde à l'équilibre. La notion d'interdépendance ne peut s'appliquer à la Dynamique du déséquilibre que dans la mesure même où cette dynamique peut être représentée en première approximation par une dynamique de l'équilibre.", Allais (1943, pp. 542-543).

[30] The final form corresponds to a "complete solution" of the system. For a mathematical derivation and the associated definition of the multiplier as a measure of the causal relation between an exogenous shock and the endogenous response of the system, see Artus, Deleau, Malgrange (1986, pp. 123-130). See also Klein Welfe and Welfe (1999, pp. 286-297).

be identified (given technology, resources and preferences), in particular for the variables under the influence of economic policy (interest rate, budget deficit).

In conclusion, the identification of the possible causal links is important to distinguish different theories. While in equilibrium in each of the theories it is expected to have simultaneity between the endogenous variables (in the linear and undetermined case, "up to the fulfillment of the rank condition"), out of equilibrium causality prevails.

The reference to linear algebra allows clarifying that to have causality one must have either an undetermined system or an exactly determined one that can be reduced to a triangular structure[31]. In both cases, equilibrium can be defined as the point of rest of a process originated by an external cause,[32] i.e. the terminal point of a chain of causes and effects. However, exogeneity strictly applies only to the first case, when the model "explains" only some of its variables (partial equilibrium), whereas in the second case the model can explain all of its variables (general equilibrium) and there are no exogenous ones. If the system is time dated, it describes the motion in time of the endogenous variables based on the value set for the exogenous ones.[33]

3.4 The role of time: Since disequilibrium and the associated causality are an important factor in discriminating neoclassical from post Keynesian models, it is important to clarify the role of time for the adjustment process that brings to this equilibrium in each of these theories. This time is either "logical": in which case it never really starts nor finishes, or "dynamic" (or "historical"), in which case it develops sequentially in periods that have a start and an end.

In the neoclassical model time is purely logical: not only it doesn't have any relation with calendar time, but in general it can be neglected from the analysis, either because the focus is put on a stationary state (where endogenous variables are constant) or on a steady state (where the endogenous variables grow at a constant rate) [34] or because adjustments to equilibrium are assumed to be instantaneous. This static dimension results notably from the assumption of given resources. A typical illustration is provided by the model of Walras, where prices and quantities adjust instantaneously to equate supplies and demands in different markets and where the analysis remains static even after the introduction of capital goods. [35] In logical time, equilibrium can either be *intertemporal*, in the sense that present and future are collapsed into a single unit of time where it is admitted that a system of prices exists and can be found that clears all present and future market supply-demand balances, or *temporary*. In this case equilibrium involves only the clearing of current demand and supplies. *Temporary equilibrium* will coincide with the neoclassical one when it can be assumed that the given resources of capital available for optimization are the equilibrium ones (Schefold, 1997, p. 440, see also Petri, 1999, 2003 and 2004 and Garegnani, 2003). This assumption is in fact implicitly retained in this literature, something possible only in a "static" or "stationary" model, i.e. a model where time is irrelevant.[36]

In the post Keynesian approach, apart from natural resources, there are no fixed "factors of production" as all commodities can be produced and reproduced provided that the price system allows generating the surplus necessary to that effect (Gram and Walsh, 1980). The analysis is intrinsically dynamic: the existence of a positive surplus is the condition for the system to be viable and grow (Sylos Labini, 2004). In such a model, the fact that either interest rates or real

[31] To the extent that any nonlinear system can be locally approximated by a linear one, this definition can be considered sufficiently general.
[32] This definition of equilibrium is also retained as a possible one by Vercelli (1994).
[33] In this context, the definition of equilibrium given by Machlup, refers to the static balance of forces that prevails initially and that is reached again later in time, after all effects of a change originated by moving some of the exogenous variables have made their effects felt through given the structure (taking into account the lags involved and their distribution).
[34] In both cases the value of the endogenous variables does not depend on time.
[35] This point can be best understood in a multisectoral framework as for instance the one proposed by Graziani (1965).
[36] Another implication of temporary equilibrium is that expectations have to be introduced for agents to be able to make their choice on the future. These expectations must be rational in order to reach the neoclassical equilibrium (see 3.5).

wages are exogenous implies a causality that goes from distribution to allocation (see par. 4.1 below), contrary to the neo-classical model where in equilibrium both are determined simultaneously.

Post Keynesians analysis relies on description of the economy where production takes place in sequential time. "Production prices" are defined at the beginning of the production period. These are the prices that allow the economic system to reproduce itself either identically in each period or on an expanding path from one period to another.[37] The equilibrium concept associated with "production prices" is based on the uniformity between the rates of profit in different sectors: prices stop changing when all sectors in the economy generate the same rate of profit, in whatever way this common rate of profit is determined[38].

A mentioned above, in the post Keynesian model, time is "historical" or dynamic, an idea that was put forward by Joan Robinson[39], and was developed and expanded notably by Henry (1982a, 1991) who developed a reflection on equilibrium, causality and time and applied it in the field of international trade theory. Looking at the dynamic interaction between prices and quantities, starting from a model similar to the original one of Walras, Henry argued that in the post Keynesian model prices and quantities are set separately in time, with the causality running from quantities to prices[40], or, what is the same, from investment to savings (Henry, 1982b).

The above discussion on the role of logical versus historical time can be illustrated with reference to Samuelson (1948, p. 315) typology of dynamic models, which distinguishes 6 categories. If Y_t is the endogenous variable, X_t the exogenous one and t is time, the 6 categories are outlined in the table below:

i)	static and stationary models:	$Y = f(X) \quad or \quad y = f(x) \quad with \quad y = \frac{dY}{Y} \quad x = \frac{dX}{X}$
ii)	static and historical models	$Y_t = f(X_t, t) \quad or \quad y_t = f(x_t, t) \quad with \quad y_t = \frac{dY_t}{dt}\frac{1}{Y_t} \quad x_t = \frac{dX_t}{dt}\frac{1}{X_t}$
iii)	dynamic and causal models (non historical)	$Y_t = f(t - t_0, Y_0, X_0,) \; or \; y_t = f(t - t_0, y_0, x_0,)$ *with* Y_0, X_0, y_0, x_0 *as initial conditions*
iv)	dynamic and historical models	$Y_t = f(t, t_0, X_t, Y_0, X_0,) \quad or \quad y_t = f(t, t_0, x_t, y_0, x_0)$ *with* Y_0, X_0, y_0, x_0 *as initial conditions*
v)	Stochastical and non historical models	$Y_{t+1} = f(Y_t, X_t) + \{h_t\}$
vi)	Stochastical and historical models	$Y_{t+1} = f(t, Y_t, X_t) + \{m_t\}$

The first category covers purely static or stationary systems where the endogenous variable is either constant in level or in its rate of change. The second category covers a static model where exogenous variables are allowed to move, and thus the endogenous variable depends on time. In the third category the behaviour of the system depends only upon the initial conditions and the

[37] Instead, in the neoclassical model prices are parametric and are used as signals for agents to optimise, but they are in fact determined simultaneously with quantities in equilibrium, where profits vanish.

[38] One can note that since the 1930's, a tradition of empirical investigations on the price setting behaviour of firms developed, which is based on the principle of the "full cost" (Hall and Hitch, 1939). This asserts that enterprises do not equate price to marginal cost but fix cost with a margin above their average costs, generating an extra-profit that under pure competitive conditions would not exist. This tradition has been fully integrated in post Keynesian analysis (cf. Weintraub, 1958; Eichner, 1973 and 1976; Sylos Labini, 1967), and forms part of the price block of most macroeconomic models (Eckstein and Fromm, 1968; Artus, Deleau et Malgrange, 1986, pp. 91-95). One may view a model where extra-profits can be generated as being more general than a model where these extra-profits should vanish when equilibrium is reached.

[39] Joan Robinson (1978, p.12) defined the term post-Keynesian as relating to "an economic theory or method of analysis which takes into account of the difference between the future and the past".

[40] Prices are set based on a Sraffian model, whereas quantities follow a Keynesian model and both intervene at different point in historical time, which shows how the dynamic can integrate both models.

time that has elapsed since the establishment of these conditions, which defines completely causally determinate models. In the fourth category, calendar time enters in the solution. In the fifth category, the random variable $\{h_t\}$ is drawn from an unchanging universe, whereas in the latter category the random variable $\{m_t\}$ is drawn from a universe changing at each instant of time[41]. One can also characterise the first, third and fifth categories as "closed models" not depending on exogenous time, whereas the second, fourth and sixth category could be seen as "open models" with respect to exogenous time. One could thus conclude that the post Keynesian model differs from the neoclassical one in that it is essentially an open dynamic model, as noted by both Chick (2004)[42] and Parguez (1996, p. 159). In this sense it provides the elements for a dynamic generalisation of the neo-classical model as discussed notably by Arena (1987) and Henry (1982a).

3.5 Implications for economic policy and public investment: The discussion above has brought three main arguments in favour of the idea that the Keynesian equilibria generalise the neo-classical ones:

i) it refers to situations that in the neo-classical approach are qualified as disequilibrium, where for instance underutilisation of capacity and unemployment prevail or distribution does not comply with marginalistic rules;
ii) it integrates the fact that profits are different from zero and they must therefore enter in the pricing decision that, in historical time, is taken at a different moment and separately from the determination of quantities;
iii) it rejects the simultaneous determination of prices and quantities, which, in a dynamic approach, are determined in sequence in different periods of time and not simultaneously at the equilibrium. It thus opens the way for a causal analysis, which is interesting in an economic policy setting[43].

Out of a neo-classical equilibrium examined in historical time there is a main causal relation between investment and savings, which is relevant for economic policy.

For neoclassic analysis, out of equilibrium this causality goes from savings to investment: in order to achieve a higher level of economic activity, first savings should increase and then higher investment would follow. This mechanism applies also to the public sector and it underlies the fiscal policy arguments in favour of budget surpluses that have dominated EU policy since the beginning of the eighties.[44] However, the argument is not entirely consistent, as it tends to confuse equilibrium, when investment and savings are equalized by the interest rate, the resource constraint is binding and thus crowding out can in principle prevail, but there is no causality possible due to simultaneity, and thus no *a priori* presumption that increased savings will lead anywhere, with disequilibrium, where exogenous households tastes or Government decisions can change and impact on savings independently from investment, but where the rationale for the causal link between savings and investment cannot be supported by neoclassical arguments. In both cases post Keynesian authors have demonstrated the neoclassical analysis runs into major logical contradictions (see for instance Graziani, 1994; Hahn and Petri, 2003 and 2004). Moreover a body of empirical analysis found that causality runs the other way round, from investment to savings (see for instance Gordon 1995). [45]

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[41] This corresponds to the "non-ergotic" case. See discussion on rational expectations in paragraph 3.5. For most of the arguments developed in par 3.2 to 3.4, a rigorous treatment at more advanced level can be found in Artus, Deleau, Malgrange (1996, chapter 6).

[42] In arguing that Keynesian models are open systems, Chick (2004) intends something broader than the simple "indeterminacy" of the solutions that arises when the number of exogenous variables exceeds the number of endogenous variables in the final form of the system, but covers also cases where the model is non stationary and therefore its specification can vary with time.

[43] The possibility of a causality out of the neoclassical equilibrium implies that, contrary to what happens in the pure neo-classical scheme, economic policy can influence the economy in a positive sense.

[44] Parguez (2000), in commenting on the causes of the Asian crisis, noted that this trend was a world-wide one.

[45] Gordon (1995, p. 98) notes: "It is reasonable to argue, in short, that neoclassical policy analysts are wrong on two out of two counts. First, promoting saving by itself is unlikely to stimulate investment. Second, public policies promoting productivity growth, with the corollary objective of stimulating investment, can work and should be pursued much more

In the post Keynesian literature in the tradition of Kaldor (1955-56) and Pasinetti (1962), the assumption of full utilization of capacity and full employment are retained. In this deterministic framework, "the adjustment of saving to investment is envisaged to be effected via price changing relative to money wages and thus a redistribution of income between wages and profits or classes of income recipients", see Kurz and Salvadori (2008, p.1). The Keynesian causality of investment on savings under a steady state of full employment takes the form of a causality from the rate of growth of economic activity, which coincides with that of investment, to the rate of profit (corporate savings), the rate of growth being exogenously determined by technological progress and labour supply growth (Harrod, 1948)[46].

However, as noted by Panico (1997), this is not the whole story: the rate of profit could be influenced not only by the rate of growth, but also by the rate of interest, which in the endogenous money approaches is exogenously set by the monetary authority[47]. From this point of view, Sraffa's (1960) model of production prices can be interpreted as a block of a larger model determining distribution for a given level of expected output as done notably by Henry (1990). When this block is inserted in historical time before the determination of actual output, results similar to those of the monetary circuit obtain (see below section 5), where authorities can influence the path of growth of an economy through both interest rates, which impact distribution and inflation, and public expenditure, which affects mainly effective demand. [48]

In a stochastic framework of analysis, causality from investment to savings becomes a causality between exogenous output expectations of producers and effective demand as determined by the expectations of households implicit in their decisions on savings. If the model is "non-ergotic" (category vi in the typology of Samuelson presented above), expectations must necessarily be exogenous, since there is no way to render them meaningfully endogenous (Davidson, 1982-3). This implies that when the parameters of the model are not stationary, rational expectations (Muth, 1960) are impossible. Since rational expectations are a necessary condition for a temporary neoclassical equilibrium and are implicit in the definition of logical time used in the intertemporal version of the neoclassical model developed by Arrow-Debreu, this implies that in a fully dynamic setup such as the non-ergotic one, there can be no neoclassical equilibrium with endogenous expectations but, on the contrary, expectations must be assumed to be exogenous and concur in the determination of equilibrium[49]. This is an important point to the extent that authors working along the lines of Lucas (1980) and other macro-monetarists associated with the Chicago school, claim that the wider generality of the neo-classical model rests on the fact that, thanks to the hypothesis of rational expectations, it can integrate as endogenous the formation of

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aggressively. The case for tighter austerity regimes rests on remarkably weak foundations. By contrast, the case for a progressive alternative appears substantially more persuasive".

[46] As a first approximation the rate of interest can be taken as a discount rate as the assumption of full employment is taken for granted.

[47] Panico (1997, p. 83) develops a post Keynesian model that integrates the Government sector in the spirit of Kaldor (1966) which attempts to "… characterise monetary and fiscal policies by assuming: (1) an endogenous money supply; (2) a government expenditure varying to maintain steady-growth conditions in the economy. … by assuming that both g and R_b (respectively the growth rate and the rate of interest, NdA) are exogenous variables" his model is "able to support a theory of income distribution where the rate of profit can be influenced both by the rate of growth of the economy (as underlined by Kaldor, Pasinetti and a large part of post-Keynesian literature) and by the money interest rate, as suggested by Sraffa (1960, p. 33), and by the subsequent elaboration of a monetary theory of distribution." For recent empirical evidence that the US FED controls the yield curve by setting short-run interest rates, see Galbraith, Giovannoni, Russo (2007).

[48] As discussed in section 5.1, the sequence of the circuit in historical time is: 1) determination of expected output by entreprises; 2) pricing decision by entreprises; 3) start of the production process by payment of salaries to households; 4) determination of savings by households; 5) realisation of effective demand on the market.

[49] Davidson (2009, p.184) quoted Samuelson (1969, p.184) in saying that "the 'ergotic hypothesis [axiom]' is a necessary foundation of economic theory if economics is to be a hard science". Davidson also notes that Hicks wrote him in 1983, after having read his piece on rational expectations that: "I missed a chance of labelling my own point of view as non-ergotic" (p. 186). Similarly, Robert Solow wrote to Davidson in 1985: "I have always admired that article of yours on non-ergotic processes and thought it was right on the button". Douglas North also agreed on the importance of non-ergodic processes in his book *Understanding the Process of Economic Change* (North, 2005, p. 19). To the extent that one agrees that economics cannot be a hard science, non-ergodicity explains why and there is no contradiction in the position of these authors.

expectations[50], whereas in fact in the more general dynamic models, that apply for instance in the case where there is technical progress and demand behaviour changes (see section 7.1) the absence of ergodicity is both the cause and the effect of having expectations exogenous. Since in an uncertain environment expectation must be exogenous, they are an explanation for the causality of investment on savings. The latter implies also that public investment creates the savings necessary to finance it.

More generally, if expectations cannot be rational, they must entail systematic errors on average and there is thus an intrinsic market failure associated with the impossibility of having a neo-classical equilibrium in a fully dynamic model, which offers also an a priori argument in favour of policy intervention. This is an example of what Guesnerie (2000, 2005) calls the "expectational market failure" that it is the role of the Government to correct, an idea that he traces back to Massé (1965) and that is also one of the main features of Parguez's (2008) model of the circuit (cf. 5.1.5.2).[51] The post Keynesian literature argues that, because of this expectational failure, effective demand cannot generally be expected to be the full-employment one. In such a disequilibrium setting, public investment can play a stabilising role, independently from the way it is financed, if it contributes to the managing of Keynes' 2/3 of total investment necessary to keep market economies on a stable long-term growth path (Seccareccia, 1995).

4. Causality in post Keynesian models without money

This section presents two models based on the post Keynesian causality to illustrate the fact that in this context, which corresponds to a disequilibrium in the neoclassical model, distribution impacts on allocation and therefore it is not possible to separate the two, contrary to what happens in the neo-classical model where distribution is studied assuming that optimal allocation has already been reached. In these two models distribution affects allocation through prices, which are not based on profit maximization but reflect a variant of the full cost principle. Money is not yet included and the technology is fixed. The models are steady state models.

4.1 The model of production prices: Kurz and Salvadori (2001) present a model inspired from Sraffa (1960) with two commodities "corn" c and "iron" i which are both "basic", meaning that they enter directly into the production of each other[52]. In this model the rate of profit is exogenous, but, as noted by the authors (p. 241), the model is also compatible with the post Keynesian analysis of distribution developed by Kaldor, Robinson, and Pasinetti, that assumes that it is the rate of growth of investment demand that determines the rate of profit based on animal spirits. The technical features of the production processes are summarised in the table below, which presents the technical coefficients of production of a 2 sectors economy:

	Material Inputs		*Labour*		*Outputs*	
	Corn	*Iron*			*Corn*	*iron*
Corn process	a_{cc}	a_{ci}	l_c	→	1	–
Iron process	a_{ic}	a_{ii}	l_i	→	–	1

where a_{cc} (a_{ci}) is the quantity of corn and l_c (l_i) the amount labour necessary to produce a unit of corn (iron) and the arrows represent the production process. Let p_i be the price of one unit of iron in terms of corn (the price of corn in term of corn is 1). If the rate of profit is uniform and the wage is set to 0, the following equations define the unitary value balances of the production process:

$$(1+R)a_{cc} + (1+R)a_{ci}p_i = 1$$
$$(1+R)a_{ic} + (1+R)a_{ii}p_i = p_i$$

[50] With endogenous and rational expectations, "Ricardian equivalence" arguments hold: if the Government increases debt, households will immediately anticipate higher taxes and will reduce consumption accordingly, i.e. the Government deficit will crowd out private expenditure completely.
[51] Cingolani (2009) applies this idea to the analysis of PPPs. On the circuit see below section 5.
[52] Their 1995 book generalises the results obtained in this simple example in several directions.

where R is the maximum rate of profits[53] , $p_i>0$ and $R\geq 0$. It can be shown that the system above has a solution only if the economy is viable, i.e. if the economy is able to reproduce itself, which, defining Y_c and Y_i as the activity levels of the two processes, requires:

$$Y_c \geq Y_c a_{cc} + Y_i a_{ic}$$
$$Y_i \geq Y_c a_{ci} + Y_i a_{ii}$$
$$Y_c \geq 0, \quad Y_i \geq 0, \quad Y_c + Y_i > 0$$

It can also be shown that R>0 if and only if the economy is able to produce a surplus and R=0 if the economy is just viable. When the economy is viable and the rate of profit is less than the maximum rate R, it will set at a lower value $r\leq R$ corresponding to positive wages. The pricing equations become:

$$(1+r)a_{cc} + (1+r)a_{ci}p_i + wl_c = 1$$
$$(1+r)a_{ic} + (1+r)a_{ii}p_i + wl_i = p_i$$

where the wage rate w and the price of iron p_i are measured in terms of corn. For each given profit rate r below the maximum rate R (such that $0 \leq r \leq R$) the two equations above represent a linear system in p_i and w, which can be solved, bringing as solution for w and p_i an expression which is function of the technical coefficients and of the rate of profit r:

$$w = \frac{1-(a_{ii}+a_{cc})(1+r)+(a_{ii}a_{cc}-a_{ci}a_{ic})(1+r)^2}{(1+r)a_{ci}l_c + \left[1-(1+r)a_{ii}\right]l_c}$$

$$p_i = \frac{\left[1-(1+r)a_{cc}\right]l_i + (1+r)a_{ic}l_c}{(1+r)a_{ci}l_c + \left[1-(1+r)a_{ii}\right]l_c}$$

the first equation being known as the wage-profit or w-r relationship. It can be shown that:

i) if the rate of profit is comprised between -1 and the maximum rate R ($-1\leq r\leq R$), wages w and prices p_i will be positive. If the rate of profit sets at its maximal value r=R, prices p_i are positive and wages nil (w=0);
ii) if the rate of profit is below its maximum value R and above -1 ($-1<r<R$), there is a decreasing relation between wages and profits, the w-r relationship, which defines the trade—off between wages and profits once expected output is determined.

This model shows that prices and wages depend on the rate of profit, which is set exogenously, but they do not correspond necessarily to the marginal pricing rules, which would imply r=0. This result, which can be extended to economies in which not all goods are basic, means that, once the rate of profit is higher than zero, the distribution between capital and labour will set prices and wages away from neoclassical equilibrium, and thus, if pricing precedes production in historical time, it will impact in the same way on allocation. In models which integrate also fixed capital, a corollary of the above result is that it is impossible to measure the value of the capital stock independently from its price, which breaks down the traditional neo-classical argument for the determination of the rate of interest in terms of marginal productivity of capital. In general, in post Keynesian models (i.e. out of the neo-classical equilibrium), there is no unique inverse relationship between the quantity of capital, whatever measured, and the rate of interest, nor between the quantity of labour and the wage rate. This absence of negatively sloped factor demand functions prevents determining factor prices according to neoclassical rules.

4.2 Causality in Kaleckian models:[54] The simple Keynes-Kalecki macroeconomic model presented in this paragraph illustrates the causality between investment and savings in a post

[53] In these models, inspired also by von Neumann (1945), the maximum rate of profit is equal to the maximum rate of growth and they are both determined by the conditions of production. When production is viable as defined in the text, the largest eigenvalue λ of the matrix of production coefficients is not larger than 1 and the maximum rate of profit is $R=(1-\lambda/)\lambda$, see for instance Kurz and Salvadori (1995, p. 98).

Keynesian model without money. It serves also to introduce the Kalecki identity of par. 6.2. Consider a simplified Keynesian model completed with Kalecki's saving identity and price equation as the one presented below.

$$X = C + I \quad (1)$$
$$C = cX \quad (2)$$
$$I = \bar{I} \quad (3)$$
$$N = \frac{X}{\pi} \quad (4)$$
$$p = \frac{w}{\pi}(1+q) \quad (5)$$
$$\frac{I}{X} = \frac{q}{1+q} \quad (6)$$
$$W = wN \quad (7)$$
$$\mathrm{P} = pX - W \quad (8)$$
$$U = L - E \quad (9)$$

Endogenous	Exogenous
C = Consumption	$\bar{I}$ = Exogenous level of Investment I
X = output	c = Propensity to consume
N = employment	π = average labour productivity
p = price of output	w = wage
q = mark – up	L = Labour force
W = wage bill	
P = profits	
U = Unemployment	

The exogenous variables of the model are: $\bar{I}$, the quantity of investment; c, the propensity to consume; π, the average productivity and w, the wage rate. The model determines 8 endogenous variables: output X; consumption c; investment I; employment N; prices p; the mark-up q; the wage bill W and total profits P.

The Keynesian relations (1-3) allow obtaining the familiar expression of the traditional multiplier:

$$\begin{cases} X = C + I \\ C = cX \\ I = \bar{I} \end{cases} \rightarrow X = \frac{1}{1-c}\bar{I} \quad (10)$$

For the sector of enterprises as an aggregate costs are equal to the wage bill, because payments between firms cancel out. Average cost is obtained by dividing the wage bill by output, expressed by the simple linear production function (4). Average costs are thus equal to the ratio of wages to productivity.

$$Average\ cost = \frac{wN}{\pi N} = \frac{w}{\pi} \quad (11)$$

Relation (5) represents the price mark-up equation, where q is the mark-up in percentage over average costs w/π and reflects the assumption that out of equilibrium enterprises can realise positive profits, which they integrate in their pricing[55]. It implies that the wage share in national income is:

$$\frac{W}{pX} = \frac{wN}{p\pi N} = \frac{w}{p\pi} = \frac{1}{1+q} \quad (12)$$

From which the share of profits is:

$$\frac{P}{pX} = 1 - \frac{1}{1+q} = \frac{q}{1+q} \quad (13)$$

Relation (6) expresses Kalecki's identity in a model that assumes that investments are financed out of profits only, hence capitalists own fully the capital goods they use[56]. It expresses that,

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[54] This section is mainly inspired from Graziani (1993 pp. 692-699) and Graziani (2001, pp. 116-119), but also combines ideas from Graziani (2003, pp.100-105), Parguez (2008 p. 56, relation 11) and Parguez (2009, p. 13, relation 8).

[55] Profit maximisation under constraint of given technology (or cost minimisation under constraint of given output) looses its relevance for determining the level of output and factor demand in a context where the average cost function is constant and coincides with the marginal cost curve, as was assumed by Kalecki (1938), and retained in this model, as in the one in the previous section. See also Sylos Labini (1988, pp. 269-271).

[56] The identity must be read here in gross terms, i.e. before investment (see section 6.2). In this context, where households do not save, it is correct to say that producer earn what they spend while workers spend what they earn, a

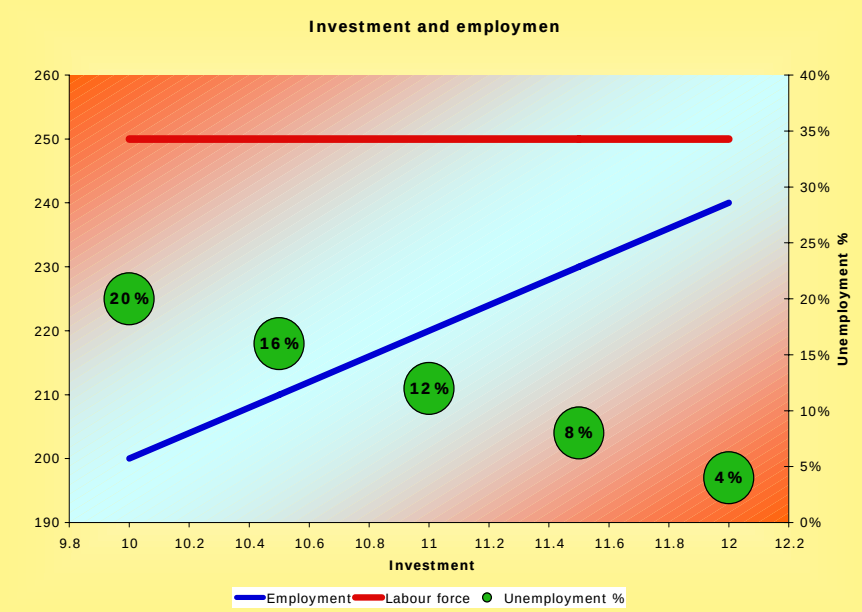
having decided to invest an amount $\bar{I}$, firms also fix the mark-up in order to create enough profits to finance investment. From (12) and (13) one gets:

$$W = wN = \frac{pX}{1+q} = \frac{P^*}{q} \qquad (14)$$

Relation (14) links the wage bill to profits, which, in the post Keynesian equilibrium, will have to be set to a value P* that covers investment. It shows the role of the inverse of the mark-up, which is Parguez (2008, 2009) version's of the multiplier of profits on employment given the wage rate. This is seen more clearly when (14) is solved for employment:

$$N = \frac{W}{w} = \frac{P^*}{wq} \qquad (15)$$

which shows that by deciding the breakdown of total output between consumption and investment and thus targeting the necessary level of profits, producers define also the level of employment that, given exogenous wages and a target rate of return, cannot be expected to be the full-employment level N=L, generally being below and generating an unemployment of U given by (9).[57]



$\bar{I}$	=	10
$\bar{N}$	=	250
c	=	0.8
π	=	0.25
w	=	0.4

X	=	50	I/(1-c)
C	=	40	cX
X	=	50	C+I
q	=	0.250	I/C
I/X	=	0.20	q/(1+q)
I/X	=	0.20	I/X
N	=	200	X/π
W/pX	=	0.8	1/(1+q)
Π/pX	=	0.2	q/(1+q)
w/π	=	1.6	w/π
p	=	2.00	(w/π)*(1+q)
W	=	80.0	(W/pX)*pX
Π	=	20.0	(Π/pX)*pX
pX	=	100.0	W+Π
E%	=	80%	$N/\bar{N}$
U%	=	20%	$(\bar{N}-N)/\bar{N}$

Source: simulation and illustration based on the model above taken from Graziani (1993 and 2001, cf. footnote 54).

A numerical illustration is offered in the chart above to fix ideas. Assume an economy where active population is 250 people. Technology is such that 4 people are needed to produce one unit of output. Wage is at its exogenous subsistence level of 0.4. The share of output consumed (propensity to consume) is 0.80. In this economy if producers target a level of nominal investment of 20, equal to profits, they must set the mark-up in real terms at 25%. For this level of investment, output is at 50, GDP at 100 and the level of employment at 200, leaving 50 people (20% of the labour force) unemployed. By increasing investment progressively to 12, unemployment can be reduced to 4%. This "comparative dynamics" result, which emerges from the comparison of two steady states, shows that where the causality from private investment to corporate profits prevails, as it is the case in the Kaleckian variant of the post Keynesian model (and thus out of the neoclassical equilibrium), more investment would generate more employment. This cannot happen in the neoclassical model, which assumes full employment from the start and where therefore more investment means less consumption and thus less

sentence attributed to Kalecki but that Kaldor says Kalecki never wrote and was apparently only transmitted in the oral tradition referred to by Robinson (1962), quoted by Harcourt (1975).

[57] Relation (15) illustrates the analogy between the multiplier and the process of distribution already noted by Kaldor (1955-56): "The principle of the Multiplier … could alternatively be applied to a determination of the relation between prices and wages, if the level of output and employment is taken as given, or to the determination of the level of employment, if distribution (i.e. the relation between prices and wages is taken as given)."

employment. In this context, the starting unemployment rate of 20% would be considered as the "natural" one and, by definition, an economic profitability calculation based on market prices would result in no further investment, failing to take into account the welfare gain associated with a decrease of the unemployment rate from 20% to 4%. The latter corresponds to an increase in employment from 200 to 240, the welfare value of which, valued at the starting wage rate of 0.4, is 16, i.e. 4 times the necessary increase in investment. If an external actor such as the State would intervene to realise this increase in investment of 4, this could be paid entirely out of a tax on profits, with the latter still increasing by a net amount of 12.[58]

The model above illustrates Kalecki's identity in its simplest form, where investment is equal to profits and it is entirely realised by the private sector[59]. It provides an introduction to the generalisation of this identity to situations where both the State and the external sectors exist presented in section 6.2.

5. Monetary equilibria in the approach of the circuit

Monetary equilibria will be illustrated below with two models that introduce credit money, while keeping technology fixed.

Frank Hahn noted the inconsistencies in the neoclassical treatment of money in a book he edited in 1965, which contained also the famous article of Clower quoted above. But it was Parguez (1975)[60] who developed thoroughly the argument that the introduction of money necessarily breaks down the neoclassical equilibrium, in which, when it exists, money is a veil spread out on a barter equilibrium[61]. True monetary equilibria correspond to what in neoclassical analysis is a disequilibrium, and are thus of a more general nature. Indeed, as Parguez came to assert more recently, money is the instrument that, by transferring liquidity and purchasing power from one period to another, allows disequilibria to be sustainable as long as producer's expectations are validated by the banking sector[62]. It is thus an essential macroeconomic condition for economic agents to realise their expectations.

The macroeconomic aspect of money derives from its definition as a liability issued by a third party (see below 5.1), which implies the rejection of the neoclassical individualism.[63] Money is thus one of the main reasons for a *fallacy of composition*: [64] its presence implies the economy is always out of neo-classical equilibrium, where there is no aggregation of microeconomic behaviour that allows independent and decentralized decisions to reach the optimum. The presence of money and the associated disequilibrium break one or several of the conditions necessary for the aggregation of neoclassical equilibria (cf. Malinvaud, 1956). It is possibly in view of this aspect that Hahn (2003) came to suggest that there could be "macroeconomic foundations for microeconomics", paradoxically taking a position not far from a circuitist like Cencini (2006).

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[58] It may however be difficult to obtain political support for an infinite percentage increase in taxes on corporate profits (from 0 to 4), against a mere increase of 20% in profits (from 80 to 96), despite the fact that in real terms in these models taxes are only paid by wage earners, as shown in Graziani (1985, p. 224).

[59] Sector is used here in the sense of "institutional sector" retained by national accounting, for which what is usually called "sector" in ordinary language (like the agricultural sector) is called a branch.

[60] In this rather difficult book, Parguez showed also why Clower (1965) was wrong, a point which the latter recognised later in a private exchange (cf. oral communication by Prof. Parguez).

[61] Grandmont (1983) discussed from a "rationing" perspective several shortcomings of the neoclassical model when money is introduced.

[62] As discussed below, in sections 5.2 and 6.1, this also implies that in general the economy will not remain on the full employment path.

[63] On the circuit definition of money as a third part liability, see Parguez and Seccareccia (2000). Graziani notes that: "… any theory based on the individualistic approach is necessarily confined to microeconomics and is unable to build a true macroeconomic analysis. … In the perspective of the circuit theory, a simple aggregation of the individual behaviour functions doesn't turn a microeconomic model into a true macroeconomic theory", (Graziani, 2003 pp. 18-19). Guerrien (1992) elaborates on the limits of methodological individualism from a microeconomic perspective.

[64] This fallacy of composition has been underlined in particular by post Keynesian writers: "The Cambridge School proposed an analysis in which the macroeconomic dimension always came first with respect to the microeconomic dimension." Pasinetti (2005, p. 843)

5.1 The main ideas of the monetary circuit: The theory of the monetary circuit integrates in sequential time[65] the theory of distribution of Kalecki (1942), which gives an important role to the mark-up in the pricing decision, with the monetary analysis developed by Keynes in the Treatise (1930)[66]. As such it can be seen as illustrating a monetary variant of Post Keynesian analysis that retains the essential aspect of money endogeneity underlined by Kaldor and Trevithick (1981). The links between the circuit and post Keynesian theory are developed in Lavoie (1992, ch. 4), Deleplace and Nell (1996) and Rochon (1999).

In the circuit money is a flow and not a stock, as it is in the monetarist and in most the neo-Keynesian approaches. It is defined, as a liability created by the banking system in favour of a borrower in exchange for his promise to repay back a loan. The liability issued by a third party is more liquid and generally accepted by the public than the original promise to pay back the loan by the borrower himself, which does not circulate and is not accepted by parties external to the original transaction as a mean of payment[67]. The analysis focuses on how money is created and destroyed. Given the rejection of micro-based approaches, the conditions of its creation and its destruction are analysed at the level of macro-sectors[68]. Not all sectors have equal access to money newly created: there is a hierarchy amongst them, which, in a closed economy with a separate central bank, is as follows:

i) the Central Bank, creates "external money", it can provide any amount of it that is requested by the Central State or by the private banking sector by extending them advances;
ii) the commercial banking sector is the supplier of "internal money". It gets "external money" from the Central Bank and can supply any quantity of money requested by non financial producers' sector (corporate sector or "firms")[69] once it accepts to validate their bets on the future;
iii) non financial entreprises establish their production and employment plans as a function of their perception of the future and, given banking sector's readiness to share this vision, they fix consequently their demand for credit money, which creates the deposits used to pay revenues (salaries and profits);
iv) households supply labour and receive revenues, which they consume or save.

Whereas the State and commercial banks capacity to issue new money is in principle unrestricted (at least at the level of the consolidated banking system), the possibility for enterprises to create

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[65] In a monetary production economy, fundamental uncertainty prevails (cf. 3.4 and 3.5). Contrary to risk, this uncertainty cannot be addressed by probability calculus. In this context, money is the unit of account that allows making bets on the future: "La monnaie se définit sans aucune ambiguïté en dehors de tout calcul subjectif des agents: c'est l'ensemble des signes des dettes émises pour anticiper les surplus de l'avenir" (Parguez, 1984, p. 98). In such a monetary production economy, time is sequential and is the support of agents' bets on the future. These bets become a causality factor for the variables endogenous to the model, both present and future. This differs from monetarist and the neoclassical analyses, where causality is only a static one within the period (Hicks, 1979). For Parguez (1980, pp. 436-437), this sequential or historical time could also be a logical time, i.e. different from calendar time: "Le *temps de la monnaie* (période du flux monétaire), le *temps du revenu* (période revenu) et le *temps des prix* (période prix) sont donc *identiques* (*temps du circuit*). La période du circuit est donc parfaitement définie dans l'ordre des temps logiques." Later Parguez (1984, p. 94) noted also that in the circuit "Le temps n'est ni vide ni neutre", whereas in non-monetary economies everything happens "dans un éternel Présent. *Le temps est neutre quand la monnaie est inutile* dans les deux variantes du monde classique, le modèle Hayekien et le modèle de l'accumulation classico-marxiste" (pp. 88-89). In this respect, Parguez also makes reference to Henry (1987) and the humoristic parallel he drew between static causality, steady states and the afterlife.

[66] It is in fact also consistent with most of the General Theory (1936) once the different background assumptions are taken into account.

[67] C. Zellner noted the sad irony that in the light of this definition the subprime mortgage crisis can be interpreted as resulting from the wrong belief that a secondary market for residential loans could become a substitute for money, i.e. a confusion between banks' assets and liabilities.

[68] Used in the sense of *Institutional Sectors*. The European ESA system distinguishes the following Institutional Sectors: Non-financial Corporations (S11); Financial Corporations (S12), of which the sub-sector S121 is the Central Bank; General Government (S13); Households (S14) and Non-profit Institutions Serving Households (S15); Rest of the World (S2). See: http://circa.europa.eu/irc/dsis/nfaccount/info/data/esa95/en/een00069.htm.

[69] Assuming that the Central Bank will refinance all negative cash positions of the commercial banking sector, which it will do in an endogenous money perspective.

money is subordinated to the validation by banks of their production plans, whereas households revenues are limited by the decisions of banks and firms. To the extent that households keep part of their savings in cash, firms cannot recover all revenues they have put into circulation and in general cannot repay in full the loan they have taken from banks, which must thus provide them with new credits. There is an infinity of possible equilibria corresponding to the various conditions at which banks accept to revalidate the enterprises' bets, the most simple being that where entreprises' debt is constant, either in absolute terms or in proportion of their revenues.

The triangular definition of money requires considering at least three macro-sectors: producers, consumers and the banking sector[70], a framework corresponding to the so-called *pure credit economy* of Wicksell, where there is no State and the banking sector is consolidated in a single bank which, to simplify further, is assumed to make no profits. This simplified framework will be used below to illustrate the functioning of the circuit.

5.1.1 Initial finance: The balance sheets of the three sectors of this economy (Entreprises, Households and Banks) show their assets, liabilities and net worth at a given moment in historical time. The circuit starts at the time t=0 when enterprises ask to the banks a loan L_0 to finance the purchase of fixed and circulating capital necessary to start production. To underline the role of money in production, it is assumed that before that, at time -1, all sectors had zero balance sheets, as shown in BS Chart 1[71]. The consolidated banking sector[72] finances the loan by issuing deposits D_0 in an amount that matches the credit granted. Obviously, as a counterpart, Entreprises have deposits D_0 in their assets that are matched by a liability L_0 towards the banking sector[73].

BS Chart 1

Sequential Time	Entreprises		Banks		Households	
	Assets	Liabilities & NW	Assets	Liabilities & NW	Assets	Liabilities & NW
-(1)	0	0	0	0	0	0
	Assets	Liabilities & NW	Assets	Liabilities & NW	Assets	Liabilities & NW
(0)	+ D0 Deposit	+ L0 Bank Debt	+ L0 Loan to E	+ D0 Deposit to E *(initial finance is the endogenous flow of money needed to pre-finance production)*		

Initially the transaction is purely financial. Money is created by banks at the request of firms to start production ("endogenously") but no production has started yet and no real wealth has been created.

5.1.2 Revenue formation: Real value creation takes place in a second step of the circuit, when revenues (salaries and profits) are created for the payment of the services of labour and capital. In the jargon of the circuit it is at this time that money acquires value as it was previously a pure number in the balance sheet of the banking sector. By assumption, the payment of revenues takes place at the beginning of the production period, when enterprises decide also the distribution of the new money between wages and profits through their pricing decision, which fixes the level of the mark-up.

5.1.2.1: Salaries: Graziani (1994) noted that in the classical tradition, in which money is absent, the payment of salaries in kind takes place at the beginning of the production period and is financed out of previously accumulated real savings. This explains the classical causality

[70] The explicit recognition of the banking sector as a producer of money is an original feature of the monetary circuit, which allows for a full integration of banks in macro-policy analyses.
[71] BS stands for Balance Sheet.
[72] There is no issue of primary versus secondary money emission since there is no separate central bank. Also, since there is no competition between different private banks, there is no limit to the capacity of the banking sector as a whole to create all the money requested, see Graziani (1990).
[73] The recording of this transaction illustrates the "quadruple entry" principle of national accounting (without matrices).

between savings and investment (in fixed and circulating capital). On the contrary, in the neoclassical model salaries are paid at the end of the production period (except in the variant of Wicksell), because only at that time it is possible to determine the marginal productivity of labour, to which they must be brought equal. Hence in the neoclassical model there is no explanation for the causality from savings to investment, which in general is presumed to hold, at least out of equilibrium[74]. By retaining the classical hypothesis that salaries are paid at the beginning of the production period, but introducing the finance motive as a determinant of money demand by enterprises, the circuit offers an explanation of the Keynesian causality from investment to savings that is exactly symmetrical to the causality from loans to deposits retained by the Banking School. [75]

5.1.2.2 Profits: If enterprises do not spend for salaries the entire amount of money that they have borrowed (D_0), a part of this liquidity will remain in their accounts as an anticipated financing of investment and profits. In connection in particular with the payment of interest (Segura 1995), there has been a debate in the circuit literature on whether profits give rise to a monetary creation, are realized in money at a later stage of the circuit or represent an accumulation of real assets. If money newly created finances only salaries, profits can potentially never be transformed into money and the monetary circuit can provide support to a labour theory of value. In particular Bellofiore (1989) argued that this reading of the circuit can solve the problem of transformation of value into prices, and thus provide an explanation for exploitation, an unresolved issue in Marxian economic theory. Parguez (2004) has considered sympathetically the subtle argument of Lavoie (1987) against the monetisation of profits, but finally took position against what he calls the "wage postulate". His position will be followed here that profits are financed, at least partially, from new money creation[76].

5.1.2.3 Changes in assets and liabilities: Revenue formation can be described by looking at the variation of assets and liabilities between instant 0 and instant 1, a period of time noted "0-1" on the left of the T Chart 1 below. [77]

The payment of salaries (W_1) decreases liquid holdings of enterprises and increases those of the households. This is matched by a real liability of households for the working time to be provided in the course of the period (ΔRL_{1h}), which corresponds to a real working capital claim in the assets for enterprises (ΔWK_{1e}). For the same reason and to be consistent with what said above on the anticipated payment of profits, some entreprises accumulate a work in progress capital asset (ΔWIP_{1e}) paid for an amount INV1, whereas others receive this payment and have as a real liability the obligation to deliver this asset. As shown below in chart BS Chart 2, after the payment of revenues, enterprises keep a net liquid holding of D_{e1}, which corresponds to money initially

[74] In equilibrium investment would be brought equal with savings through adjustments of the rate of interest.

[75] The Banking School's claim that loans create deposits was endorsed by Schumpeter, see Graziani (2003, pp. 82-88). In XIX century's England, the *Banking School* opposed the *Currency School*, of which the quantity theory of money is the modern successor. For an exhaustive historical review of the debate of the period 1900-40, see Realfonzo (1996). On the link between Keynes and the banking school see Mondello (1985). Kaldor and Trevithick (1981, p. 8) claim that Adam Smith can be regarded as a follower of the Banking School: "He cited the example of numerous towns in which after the opening of a bank, or a local branch of a bank, was quickly followed by increased production and employment in the activity".

[76] The position of Graziani is that at the macroeconomic level payments internal to the enterprise sector cancel out, thus de facto in net terms new credit money is created only for salaries. However, given that in reality enterprise self-finance the majority of their investments (or in any model where households do not save), this precludes the initial monetary financing of real capital accumulation, which Graziani accepts (2003, p.69). Graziani's position is in agreement with that of Schmitt (1966, 1984) and is also supported by Gnos (2003). A good review of the debate is offered by Rochon (2005), who concludes in line with Parguez (2004).

[77] The recordings shown in T Chart 1 are consistent with the principle of quadruple entry. The latter was integrated in the last revision of the national accounts (SNA 1993) and foresees that for each monetary transaction four entries are booked (two for each party in the transaction), see Gorter (2004). The graphical format of this chart is inspired from the "T accounts" used by accountants, hence the "T" in the title, but here each sector is aggregated into a single "net worth account" and real flows are also reported to underline the production aspect behind the monetary flow. In accounting practice T accounts are closer to the presentation of the Journal in terms of debits and credits and there is a different T account for each position of the balance sheet. The conventions followed here are thus closer to those of the "fundamental accounting equation", which is: Assets=Liabilities + Net Worth, see Pratt (2003, pp. 114-116).

created less that paid for salaries (D_0-W_1), whereas some enterprises have a work in progress claim and others a corresponding liability.

T Chart 1

Sequential Time	Entreprises		Banks		Households	
	Δ assets	Δ Liabilities & NW	Δ assets	Δ Liabilities & NW	Δ assets	Δ Liabilities & NW
	- W1 deposits			- W1 Deposit of E	+W1 deposit	+ ΔRL1h due to E
	+ ΔWK1e due from H			+ W1 deposit of H		
(0-1)	- INV1 deposits					
	+ ΔWIP1e due from E					
	+ INV1 deposits	+ ΔWIP1e due to E				

The payment of salaries does not change the quantity of money in circulation, i.e. the liquid liabilities of the banking sector (D_0), for which only payments between sectors are shown. It only moves part of it (W_1) from the account of entreprises to that of households. For households deposits of W_1 are compensated by a real liability towards enterprises (R_{L1h}).

BS Chart 2

Sequential Time	Entreprises		Banks		Households	
	Assets	Liabilities & NW	Assets	Liabilities & NW	Assets	Liabilities & NW
	WK1e (=ΔWK1e)	L0 Bank Debt	+ L0 loan to E	De1 deposits to E (= De0-W1)	+W1 deposit	RL1h (= ΔRL1h)
(1)	WIP1e (=ΔWIP1e)	WIP1e (=ΔWIP1e)		Dh1 deposits to H (= W1)		
	De1 deposits (=D0-W1)			**Σ = D0 deposits**		

5.1.3 Production and consumption: In the next stage of the circuit production takes place. As shown in T Chart 2, which covers the period between instants 1 and 2, for investing enterprises the Work In Progress claim ΔWIP_{2e} disappears and becomes a real capital accumulation ΔFA_2, which corresponds to the amount of investment I realized in the period. At the same time, for capital goods suppliers, the real obligation to deliver capital goods leaves room to the realisation of a profit in the form of an increase in net worth ΔNW_{e2}.

T Chart 2

Sequential Time	Entreprises		Banks		Households	
	Δ assets	Δ Liabilities & NW	Δ assets	Δ Liabilities & NW	Δ assets	Δ Liabilities & NW
	- ΔWIP2e	- ΔWIP2e				- ΔRL2h
	+ΔFA2 (=I)	+ ΔNWe2				
	- ΔWke1					
	+ ΔWke2					
(1-2)	-ΔWKe2					
	+ ΔDh2 deposit			- ΔDh2 deposit to H	- ΔDh2 deposit	
				+ ΔDh2 deposit to E		

The claim on households for working hours due (WK_{1e}) is replaced by the accumulation of a stock of finished consumption goods (WK_{e2}). These are sold to households for a money amount D_{h2}. This payment is the only movement in the account of the banking sector and it is compensated in the accounts of household by the reduction of their real liabilities towards enterprises ΔRL_{2h}.

At the end of the production and consumption stage, the resulting balance sheets are shown in the BS Chart 3. Enterprises have liquid assets in an amount D_{e2}, which have increased by the

amount of sales of consumption goods to households ΔD_{h2} compared to BS Chart 2. They have also accumulated real capital goods assets for an amount I, which corresponds to their net worth, and they keep all their debt to the banking sector. Households have paid ΔD_{h2} deposits for buying the consumption goods and retain an amount of deposits D_{h2}, which is equal to the part of their wages they have not used for consumption ($=W_1-\Delta D_{h2}$), and thus corresponds to savings, supposed initially to be kept in liquid form. The amount of money in circulation is still the same (D_0), as shown by the liability side of the banking sector balance sheet, but it has now come back in majority in the assets of enterprises.

BS Chart 3

Sequential Time	Entreprises		Banks		Households	
	Assets	Liabilities & NW	Assets	Liabilities & NW	Assets	Liabilities & NW
(2)	De2 deposits (=De1+ΔDh2) I fixed Assets	NWe2 (=ΔNWe2) L0 Bank Debt	+ L0 loan to E	De2 deposits to E Dh2 to H Σ = D0 deposits	Dh2 deposits (=W1-ΔDh2)	S2 savings

However, due to the savings kept in liquid form by households, enterprises have not recovered all the money they have initially borrowed from banks and put into circulation: there is thus a leakage from the circuit corresponding to the savings of households.

5.1.4 Final finance: As shown in T Chart 3, in the third and final phase of the circuit entreprises attempt to recover households savings by issuing bonds for an amount B_e, which they sell to household against an amount D_{h3} of deposits. All money recovered by entreprises through sales (D_{e2}) or through the capital market (D_{h3}) is used to repay the loan back to the banks, which destroys an equal amount of money ($D_{e2} + D_{h3}$). To the extent that household do not spend all their savings in the acquisition of the bond issues by enterprises, they keep a part of these in liquid form.

T Chart 3

Sequential Time	Entreprises		Banks		Households	
	Δ assets	Δ Liabilities & NW	Δ assets	Δ Liabilities & NW	Δ assets	Δ Liabilities & NW
(2-3)	- De2 deposits + Dh3 deposits - Dh3 deposits	- De2 Bank Debt + Be bond to H - Dh3 Bank debt	-De2 -Dh3 Loan	- Dh3 deposits to H + Dh3 deposits to E -De2 - Dh3 deposits *(money destruction)*	-Dh3 deposits + Be Bond from E	

As shown by the final balance sheet position of the three sectors in BS Chart 4, at the end of the circuit, enterprises have increased their real assets of I. They remain indebted towards banks for an amount L_3 ($=L_0-D_{e2}-D_{h3}$), while they also have a debt towards households of B_e. To the extent that the value of their assets exceeds these cumulated debts, they have accumulated profits, which have in the end created a net worth NW_e. Households remain with liquid holdings of D_{h4} and financial assets of B_e, corresponding to the net worth created. The liability side of the banking sector balance sheet shows that the amount of money in circulation is now reduced to the cash holdings of households D_{h4}, which Banks are supposed to immediately lend again to enterprises (L_3) and that is transferred to the following period.

BS Chart 4

Sequential Time	Entreprises		Banks		Households	
	Assets	Liabilities & NW	Assets	Liabilities & NW	Assets	Liabilities & NW
(3)	I Fixed assets	L3 Debt to B (=L0-De2-Dh3) Be Bond to H NWE Net worth	L3 loan to E (=L0-De2-Dh3)	Dh4 deposits to H (=D0-De2-Dh3) *(Stock of money transferred to next period)*	DH4 deposits (=W1-Dh2-Dh3) Be Bond	NWh3 Net Worth of H (DH4+Be)

I=S=Profits + HH savings

The Kalecki's identity[78] is fulfilled: the accumulation of fixed assets is balanced by entreprises' profits and households savings (final finance), which are in part held as securities (B_e) and in part as deposits (D_{h4}). The latter corresponds to a debt of enterprises towards banks which is transferred to the next period.

5.1.5 Comments: **5.1.5.1** Causality from investment to savings: At the start of the circuit, money is created at the request of entreprises based on their production objectives and the associated needs of fixed and circulating capital. The money that is not destroyed by loan repayment after consumptions and bond issuance by producers remains in the system and "creates" the savings necessary to complete the final financing of investment in fixed capital (accumulation of real assets).

The various steps of the circuit thus provide a monetary explanation for the post Keynesian causality of investment on savings or, as Kregel and Eichner (1975, p. 1301) have put it, between discretionary expenditures and discretionary income:

> " … if the level of economic activity or – shifting into a post-Keynesian framework – the rate of economic expansion is to be increased, it can only be accomplished by increasing the rate at which discretionary expenditures are being undertaken. A corollary proposition is that when, as a result of any such change in the rate of discretionary spending, there develops an *ex ante* imbalance between the two flows, it is the discretionary income (savings) that will necessarily have to adjust to the level of discretionary expenditures (investment) and not *vice versa*."

5.1.5.2 Dynamic effects of diverging private sector expectations: Households' decision to save part of their salaries prevents enterprises to recover from their sales all money initially put into circulation. To the extent that even after issuing bonds, part of these savings remain in households' account deposits, enterprises will remain indebted towards banks for the corresponding amounts. This provides a circuit explanation for the divergence of the expectations of the private sector mentioned above in par. 3.5: to the extent that enterprises failed to anticipate the amount of actual households' savings, they will sell less than expected and will thus revise downwards their sales' expectations for the following periods. This will in turn reduce effective demand in the next round of the circuit, when employment will be possibly reduced as well, causing increased unemployment and therefore increased risk aversion of households. The latter will increase their savings accordingly and particularly their demand for liquidity, which in the end increases the savings leakage from the circuit. In these circumstances only an external intervention, in the form of increased expenditures from the State or the foreign sector, could stop this depressionary spiral and reestablish a positive business climate.

5.1.5.3 Monetary and barter economy equilibria: Any configuration of private (or public) sector expectations, reflected in the amount of money requested for financing private (or public) investment, is causal and thus exogenous in determining the resulting level of economic activity and thus of employment in the monetary circuit as long as it is validated by the banking sector through new loans. As discussed with reference to a more formal model of the circuit in the following section, there is no obvious way to define monetary equilibria in the circuit. Since there are no profit maximization, zero profit conditions, marginal distribution relations etc, this monetary equilibrium is different from the neoclassical one that would prevail in a barter economy and thus corresponds to what neoclassical analysis would call a disequilibrium. Moreover, as discussed in the next section, there is no reason to presume that the monetary equilibrium obtained should be a full employment one.

5.1.5.4 Integration of the public sector: The illustration of the monetary circuit based on the pure credit economy given above can be easily adapted to an economy where the State is present[79]. If

[78] Relation (39) of section 6.2 presents Kalecki's identity in terms of net financial balances after investment, whereas above the identity is expressed in gross terms, like in relation 13 in section 4.1, which corresponds however to the case where households do not save.

[79] The introduction of public finance in the circuit is addressed by Graziani (1985), Parguez (2002) and Bougrine and Seccareccia (2002). These contributions can be viewed as building blocks of a unified post Keynesian theory of public finance which, to the knowledge of the author, remains to be completed. This could be one of the reasons why this

enterprises are replaced by the State and the consolidated banking sector by the Central Bank, the same argument can be developed: money is created at the request of the State by the Central Bank, represents the liquidity necessary to finance public expenditure and it is destroyed when taxes are paid. The idea was already clearly expressed in the following passage of Kalecki (1935, pp. 193-195, reference to 1990 edition):

> "Let us assume that the Government issues treasury bills and sells them to banks. The Government spends the money, e.g. on the construction of railways. As in the cases described above, employment in investment goods industries increases, and subsequently, as a result of the higher purchasing power of workers, in consumer goods as well. The amounts spent by the Government flow as profits directly or through spending of the workers into the pockets of capitalists, and return to the banks as their deposits. On the side of bank assets, the government debt accrues in the form of discounted bills; on the side of liabilities, there is an increase in deposits equal to the additional profits. Thus the Government becomes indebted, via banks, to the private capitalists by an amount equal to the investment effected." … " It should be emphasized that the pattern of public investment taken up is not essential for the effect of government intervention; what matters is that investment should be financed by additional purchasing power."

An empirical confirmation of the causality between public expenditure and growth can be found in Giovannoni (2006) and Parguez-Giovannoni (2007) who investigated econometrically the macroeconomic identities of the national accounts for the US and concluded that government expenditures are strongly exogenous, i.e. they are the drivers of the American business cycle.

5.1.5.5 Nominal or real wealth creation (good or bad credits): As noted, money initially created by banks at the request of enterprises only becomes real wealth once it is transformed into revenues (salaries and profits), which, under the assumptions retained, are here real revenues and are thus either consumed or saved (accumulated). If the sector of entreprises, which got initially indebted towards banks to start production, does not recover through sales or on the capital market the entire amount of money put initially into circulation, it cannot repay the loan entirely and must therefore remain indebted towards the baking sector for that part of real asset accumulation that is not self-financed by profits nor by debt hold by households. When the banks confirm that the value of the asset created has sufficient profitability, they validate the solvability of the borrower with a new loan that will be repaid back in the future. The good credit is thus the one that creates liquidity having as counterpart the creation of a real wealth (in the form of present or future consumption). The bad credit is the one that creates liquidity without having a real counterpart and that one day the banking system will be no longer able to refinance. This argument provides a circuit explanation of the way the current financial crisis developed in the beginning of 2007-8 in the US residential sector. It also implies that, to be successful, Keynesian policies should be oriented towards real wealth creation.

5.2 Financial and labour markets equilibrium in the monetary circuit: The model described in this section is taken from Graziani (2003 ch. 6) and it formalizes a certain number of basic properties of monetary equilibria in the circuit[80]. The notations for the monetary variables of the model are:

Z	=	*total monetary base*	w	=	*money wage rate*
Z_B	=	*legal tender held by banks*	c,s	=	*propensities to consume and save*
Z_P	=	*legal tender held by the public*	N	=	*employment*
D	=	*deposits*	i_D	=	*interest on bank deposits*
r	=	*reserve ratio of commercial banks*	i_L	=	*interest on bank loans*
			i_B	=	*interest rate on securities*

approach is ignored by the Public Choice literature. Other relevant post Keynesian contributions in this field are Panico (1997), Bougrine (2000), Sardini and Palazzi (2000), Mitchell and Muysken (2008, pp. 209-11) and Tchernava (2008).

[80] The model reflects the assumptions of Graziani that interest is paid in kind (Graziani, 2003, p. 118), in line also with the assumptions retained by Bossone (2001). As discussed in par. 5.1.2.2, this position differs form that of Parguez (2004) and Rochon (2005), but it does not have major consequences for the policy conclusions of the model. For a more general presentation of the monetary approach of Graziani, see Graziani (2001, ch. 7) and Graziani (1987) for a discussion of efficiency in a monetary economy.

As in the previous section, households have only the choice between investing their financial savings in banks' deposits D or in firms securities B. In the money market banks pay an interest i_D to households for their deposits. In the financial market firms pay interest i_b on securities to savers and in the loan market firms pay interest i_L to banks. The monetary base (sometimes called M0 or high powered money) is made of the legal money (coins and currency) held by households plus the credits of the banking sector towards the central bank[81]. It is assumed that the legal tender held by the public and deposits are demanded in a constant ratio β. Therefore, since legal tender held by banks is defined by the compulsory reserve ratio r:

$$Z_P = \beta D \quad (16)$$

$$Z_B = rD \quad (17)$$

$$Z = Z_P + Z_B = (\beta + r)D = \left(1 + \frac{\beta}{r}\right)Z_B \quad (18)$$

The liquid balances of the public (legal tender plus deposits) are:

$$Z_p + D = (1 + \beta)D = \frac{1+\beta}{r}Z_B \quad (19)$$

Assume that at the beginning of the period producers as a whole request loans $L_{(1)}$ only to finance wages and their residual debt M^0, which corresponds to the pre-existing money stock. Then: [82]

$$L_{(1)} = M^0 + wN_{(1)} \quad (20)$$

The balance sheet identity of the banking sector requires that new loans refinance old ones plus the new liquidity needs arising from production:

$$Z_{P(1)} + D_{(1)} = \frac{1+\beta}{r}Z_{B(1)} = M^0 + wN_{(1)} \quad (21)$$

from which:

$$Z_{B(1)} = \frac{r}{1+\beta}\left(M^0 + wN_{(1)}\right) \quad (22)$$

replacing in (18) gives:

$$Z_{(1)} = \left(1 + \frac{\beta}{r}\right)\frac{r}{1+\beta}\left(M^0 + wN_{(1)}\right) = \frac{r+\beta}{1+\beta}\left(M^0 + wN_{(1)}\right) \quad (23)$$

which shows that the liquidity in existence immediately after the wage bill has been paid and before households take their expenditure and saving decisions depends strictly on the wage bill and therefore on the decisions of producers on the level of output[83].

In an economy without State, as the one considered here, money in existence cannot be a debt of the State to the central bank[84], but only a debt of firms to the banking system. However, the existence of this debt implies that enterprises can spend more than what they earn, something which in a strict neoclassical framework would be indicative of a disequilibrium. At the same time, once debt is allowed, there is no obvious equilibrium amount of it. Even in a stationary economy, constancy of firm debt is not necessarily a requirement for equilibrium since for instance in the

[81] When currency in circulation (legal tender held by the public) and current deposits are added one obtains the aggregate called M1.

[82] M^0 represents households' liquid balances coming from previous periods and is also equal to debt of the producers at the beginning of the new period. It is not the monetary base M0. With reference to section 5.1, relation (20) corresponds to the case where, starting from BS Chart 4 with some debt to banks in the balance sheet of entreprises, in the following round of the circuit a new loan is extended by banks to refinance the previous one and pay salaries corresponding to the new production period (at the exclusion of profits, see footnote 80 above). Apart from pre-existing debt, the situation corresponds to BS Chart 1 in the previous section.

[83] Apart from pre-existing debt, and the explicit introduction of a central bank, the situation corresponds to BS Chart 2 in the previous section.

[84] As money is usually defined in neoclassical and neo-Keynesian monetary approaches.

case of an increase in liquidity preference of the public β the money stock and debts of firms towards banks must increase. The equilibrium thus depends on the banks' willingness to provide firms with the required lending and on the possible reaction of firms to an increase in interest to be paid on loans.

Banks and firms compete in attracting the savings of households through interest rates they pay respectively on deposits and firms securities. Once they have taken the consumption decision, households divide their savings between an increase in liquid holdings dM^d and an increase in holding of securities issued by firms dB^d. It is assumed that the purchase of new securities is a fraction b^d of total savings that is an increasing function of the interest paid on securities and a decreasing function of the interest paid on deposits. Then:

$$S = (1-c)wN = dM^d + dB^d \qquad (24)$$

$$dM^d = (1-b^d)(1-c)wN \qquad (25)$$

$$b^d = b^d(i_B/i_D) \qquad (26)$$

The demand for securities at the end of the period (indicated by the subscript (2)), which includes the amount of securities B^0 held at the beginning of the period, can thus be defined as:

$$B^d_{(2)} = B^0 + b^d(i_B/i_D)(1-c)wN \quad (27)$$

On the other hand, the supply of securities at the end of the period will be a fraction b^s of total savings that is a decreasing function of the interest paid on securities i_B and an increasing function of the interest paid on bank loans i_L:

$$B^s_{(2)} = B^0 + b^s(i_L/i_B)(1-c)wN \quad (28)$$

The equilibrium value of the fraction of savings placed in securities will be determined by the condition:

$$b^d(i_B/i_D) = b^s(i_L/i_B) = b \qquad (29)$$

Since there are 3 unknowns the equilibrium condition can only determine one of the 3 as a function of the two others. The bank debt of producers outstanding at the end of the period will equal the debt at the beginning of the period minus the amount of new securities issued by producers and sold to savers:

$$L_{(2)} = M^0 + wN - b(1-c)wN = M^0 + [1-b(1-c)]wN \quad (30)$$

If producers considers themselves in equilibrium only once their debt is constant, this means that the money stock is also constant. In this case, enterprises capture all savings through bonds and:

$$b^d(i_B/i_D) = b^s(i_L/i_B) = 1 \qquad (30)$$

If, for example it is assumed that the rate on deposits i_D is known (say =0), than the ratio i_L/i_B determines the constancy of the money stock.

Let us assume that:

$$b^d(i_B/i_D) = \frac{i_B}{\beta^2 i_D^2} \qquad (31)$$

$$b^s(i_L/i_B) = \frac{i_L^2}{\mu^2 i_B} \qquad (32)$$

where β measures as before the liquidity preference of savers and the newly introduced parameter μ reflects the preference of producers for bank credit with respect to issuing of securities. The equilibrium condition $b^d=b^s$ gives as solution:

$$b^d(i_B/i_D) = b^s(i_L/i_B) \rightarrow \frac{i_B}{\beta^2 i_D^2} = \frac{i_L^2}{\mu^2 i_B} \rightarrow i_B{}^2 = \frac{\beta^2}{\mu^2} i_D^2 i_L^2 \quad (33)$$

$$i_B = \sqrt{\frac{\beta^2}{\mu^2} i_D^2 i_L^2} = \frac{\beta}{\mu} i_D i_L \quad (34)$$

$$b = \frac{i_B}{\beta^2 i_D^2} \quad (35)$$

As a special case, if the interest rate on securities is set at $i_B = \beta^2 i_D^2$, b^d equals unity and the entire savings are spent in the financial market. Similarly, if by any chance the interest on bank loans is such that $i_L^2 = \mu^2 i_B$, b^s equals unity and producers issue securities in an amount equivalent to savings. In general, in case the money stock is constant, the equilibrium condition requires $b=b_s=b_d=1$ and:

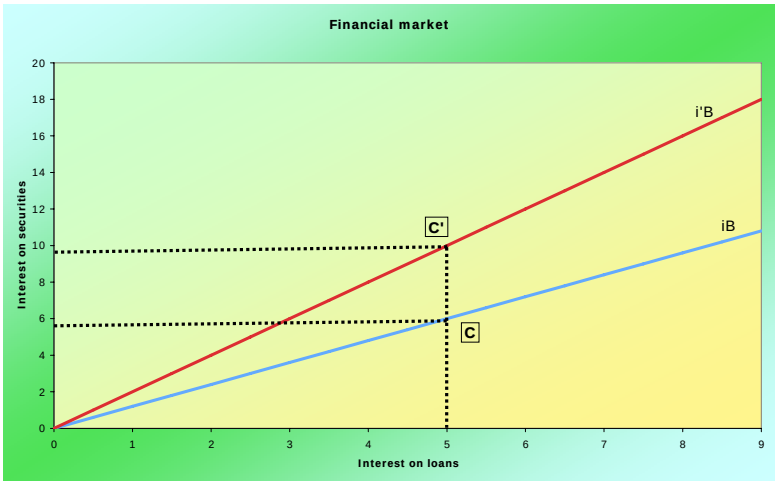
$$\frac{i_B}{\beta^2 i_D^2} = \frac{i_L^2}{\mu^2 i_B} = 1 \quad (36)$$

Therefore as before:

$$i_B = \frac{\beta}{\mu} i_D i_L \quad (35)$$

The latter can be illustrated graphically, as done in the chart below, where it is assumed that households want to keep 30% of their savings in liquid form (β=0.3) , whereas producers want to keep 25% of the credit from banks (μ=.25).

	i_B	i'_B
i_B	6	10
β	30%	50%
μ	25%	25%
i_D	1	1
i_L	5	5



Source: Reproduction of the model and illustration of Graziani (2003, p. 127).

Then if the interest on deposits is fixed exogenously at 1%, relation (35) is given by the schedule i_B, which represents all equilibria with constant money supply. Amongst these there will be one, say C where interest on loans is at 5% and interest on securities issued by firm is at 6%, that is also a full employment equilibrium. If now liquidity preference is increased to β=50% the new financial market equilibrium schedule with constant money supply is given by i_B'. If interest on loans remains at the same level of 5%, interest from securities increases from 6% to 10%, which implies a lower level of activity, and therefore higher unemployment. This illustrates the important fact that results from introduction of money into the model: there can be a financial equilibrium between bank and firms that is not an equilibrium in the labour market. As commented by Graziani (2003, p. 128):

> "The condition of full equilibrium is therefore twofold: the rate of interest must be low enough for investment to rise to the full employment level and current savings must be fully invested in the purchase of new bonds. The result has a specific weight in that it points out that for full equilibrium to be attained, two different conditions must be satisfied. The first is the usual Keynesian condition that the interest rate and the corresponding level of investment be such as to generate a full-employment level of activity. The second is that a financial equilibrium between banks and firms prevail. The second condition is often neglected in macroeconomic analysis since, as already remarked, in most macroeconomic models, banks and firms are merged in one single sector."

When technology is given, section 4 has shown that out of the neoclassical equilibrium, where unemployment tend to prevail, a causality from investment to savings exists in the post Keynesian model examined in real terms. This section showed that the introduction of money allows for a simple explanation of the investment to savings causality, symmetrical to the causality of loans to deposits. The emergence of underemployment equilibria is thus likely when money exists. It will be seen in section 6.1 that, once structural change is taken into account in a multi-sectoral model[85], it is very unlikely that full employment will prevail, even without money.

6. Post Keynesian and monetary equilibria with structural change

In sections 2 to 5, the models presented assumed constant technology. In this paragraph two post Keynesian models are presented that apply to situations with technical change.

6.1 The post Keynesian dynamic condition for full-employment: Pasinetti (2007, p. 278) argued that the there is a common "foundational framework" for the works of the Cambridge UK post Keynesian economists (Richard Kahn, Joan Robinson, Nicholas Kaldor and Piero Sraffa). It can be illustrated in its simplest form in the framework of a pure labour economy, i.e. an economy where production requires only labour. In the simplified scheme[86], the economy is portrayed by a linear technology of the input-output type. There are m sectors[85]. Sectoral consumption per capita, labour demand and total population are exogenous and grow at constant exponential rates ρ_i, r_i , different in each sector, and g. These exogenous rates drive the structural dynamics of the model:

	Exogenous factors	
Labour coefficients	$l_i(t) = l_i(0)e^{-\rho_i t}$	i = 1, … , m
Per capita consumption	$c_i(t) = c_i(0)e^{-r_i t}$	i = 1, … , m
Population	$N(t) = N(0)e^{-gt}$	
Structural dynamics	$\rho_i \neq \rho_j \quad , \quad r_i \neq r_j \quad , \quad r_i \neq \rho_j \quad , \quad \begin{matrix}\rho_i \\ r_i \\ g\end{matrix} \Big\} \begin{matrix}\geq \\ < \end{matrix} 0$	

The physical quantity system is given in matrix form by:

$$\begin{bmatrix} 1 & 0 & \dots & 0 & \dots & 0 & -c_1(t) \\ 0 & 1 & \dots & 0 & \dots & 0 & -c_2(t) \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots & \vdots \\ 0 & 0 & \dots & 1 & \dots & 0 & -c_i(t) \\ \vdots & \vdots & & \vdots & & \vdots & \vdots \\ 0 & 0 & \dots & 0 & \dots & 1 & -c_m(t) \\ -l_1(t) & -l_2(t) & \dots & -l_3(t) & \dots & -l_m(t) & \mu(t)\nu(t) \end{bmatrix} \begin{bmatrix} Q_1(t) \\ Q_2(t) \\ \vdots \\ Q_i(t) \\ \vdots \\ Q_m(t) \\ N(t) \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ \vdots \\ 0 \\ \vdots \\ 0 \\ 0 \end{bmatrix}$$

Where:

- N(t) = total population
- $l_i(t)$ = labour coefficients
- $c_i(t)$ = per capita consumption
- m = number of production sectors
- n = m+1

[85] To be consistent with the National Accounting (NA) jargon used before, the term "multi-branch" should be used instead of multi-sectoral, as what in input-output analysis is called a sector is called a branch in NA. For NA a branch is an aggregation of statistical units which are homogenous in terms of activity, a sector being an aggregation of enterprises that could be involved in activities covering several branches (see footnote 68).

[86] Pasinetti (1962, 1965, 1973, 1981, 1988) has enlarged this scheme to economies where materials goods are also used as means of production. See in particular Pasinetti (1981) for the general scheme where capital is also present. Pasinetti (1980) derives the matrix of vertically integrated sectors.

t = time
g = rate of growth of population
ρ_i = rate of growth of labour productivity in sector i
r_i = rate of change of per capita consumption of commodity i

The commodity price system is given by:

$$\begin{bmatrix} 1 & 0 & \dots & 0 & \dots & 0 & -l_1(t) \\ 0 & 1 & \dots & 0 & \dots & 0 & -l_2(t) \\ \vdots & \vdots & \ddots & \vdots & \ddots & \vdots & \vdots \\ 0 & 0 & \dots & 1 & \dots & 0 & -l_i(t) \\ \vdots & \vdots & & \vdots & & \vdots & \vdots \\ 0 & 0 & \dots & 0 & \dots & 1 & -l_m(t) \\ -c_1(t) & -c_2(t) & \dots & -c_3(t) & \dots & -c_m(t) & \mu(t)\nu(t) \end{bmatrix} \begin{bmatrix} p_1(t) \\ p_2(t) \\ \vdots \\ p_i(t) \\ \vdots \\ p_m(t) \\ w(t) \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ \vdots \\ 0 \\ \vdots \\ 0 \\ 0 \end{bmatrix}$$

Where:
$Q_i(t)$ = physical quantities of produced commodities
$Q_n(t)$ = $\mu(t)\,\nu(t)\,N(t)$ = total quantity of labour to be employed
m = number of production sectors
μ = proportion of active to total population
ν = proportion of working time to total time
$p_i(t)$ = natural commodity prices
w(t) = wage rate.

When the exogenous factors are set, the quantity and price closed Leontief models determine the evolution of quantities produced and prices over time. The two systems of equations being linear and homogeneous, a condition for their solution is that the determinant of the relevant matrix is zero. This condition is given by:

$$\frac{1}{\mu(t)\nu(t)}\sum_{i=1}^{m} c_i(t)l_i(t) - 1 = \frac{1}{\mu(t)\nu(t)}\sum_{i=1}^{m} c_0 l_0 e^{(r_i-\rho_i)t} - 1 = 0 \qquad (37)$$

which is also the aggregate condition for full employment and for the full use of expenditure. Each addendum in the condition above ($l_i c_i \frac{1}{\mu\nu}$), expresses at the same time the proportion of total employment in sector i and the proportion of total demand for the outputs of sector i. The sum of all these proportions must be unity to ensure full employment. Condition (37) thus expresses the idea that the totality of national income must be spent as required by Keynes' principle of effective demand in order to reach full employment. Note that in a pure labour model such as the one retained in this simplified presentation, total income (wages) must be spent on consumption goods and there are no aggregate savings.

Condition (37) also shows that nothing ensures that the overall availability of labour and the sum of sectoral employment demands will be kept equal to each other. For any sector two opposite forces are at work in any point of time: technology, which modifies l_i, and effective demand, which changes c_i. In general the two do not match, hence there is constantly a change in the sectoral rate of employment ε_i:

$$\varepsilon_i = g + r_i - \rho_i \gtreqless 0 \qquad (38)$$

implying expulsions or absorptions of labour in the sector depending on the sign of ε_i. These sectoral employment balances do not necessarily compensate at macroeconomic level, even taking into account possible changes in the number of sectors. When the system is out of full employment the first m conditions expressed by the price and quantity system continue to hold,

thus in the end quantity produced is less than at full employment and total expenditure is less than full employment, which is likely to be the most frequent situation most of the time, unless corrective policy action is taken. [87]

6.2 Kalecki's identity: The model in section 4.2 presented Kalecki's saving identity in its most simple variant, which asserts that investment is equal to producer profits (or savings). The identity is central as it defines the balances that are used by the macroeconomic sectors in the acquisition and disposal of financial assets[88]. It is valid independently of any assumption on technology and applies both to a monetary and a non-monetary economy. In a more general case, 5 institutional sectors can be distinguished: households h, domestic producers p, the State g, banks b and the foreign sector f. Therefore taking S as net financial savings and P as net profits, the identity can be written as:

$$P_p = D_g - S_h - S_b - S_f \qquad (39)$$

where: P_p = Net profit of domestic producers (accumulation of financial surplus)
D_g = State deficit (increase in net State financial liabilities)
S_h = Net acquisition (sale) of financial assets by households (opposite of the net increase in households financial liabilities)
S_b = Net interest revenue (profit) of banks (accumulation of financial surplus)
S_f = Net saving of the foreign sector (balance of payments current account deficit on Goods and services with negative sign)

Alternative presentations and more detailed discussions of Kalecki's identity can be found in Parguez (2008, 2009) or Cingolani (2008a, 2008b) and the consequences for full employment are discussed also in Bliek and Parguez (2006 and 2007)[89]. Relation (39) is both an ex post accounting identity and an equilibrium condition. [90] Being fully in line with the analysis of the circuit, It has consequences that run against what is generally considered as received policy wisdom, particularly the fact that, *ceteris paribus* (in comparative statics terms),

i) the state deficit increases domestic producers' profits. Therefore, as developed in Steindl (1979), a consistent policy of deficit reductions can generate long term stagnation;
ii) banks compete with domestic producers in attracting the available savings, and therefore the profits they accumulate are subtracted from the profits of private producers;
iii) assuming that households are in financial balance and abstracting from net interest to banks, if the state generates a surplus, producers can be profitable only if the current account of the balance of payments is in deficit in excess of the State surplus (plus net interest to banks in case the latter are included).

7. Conclusions and policy implications

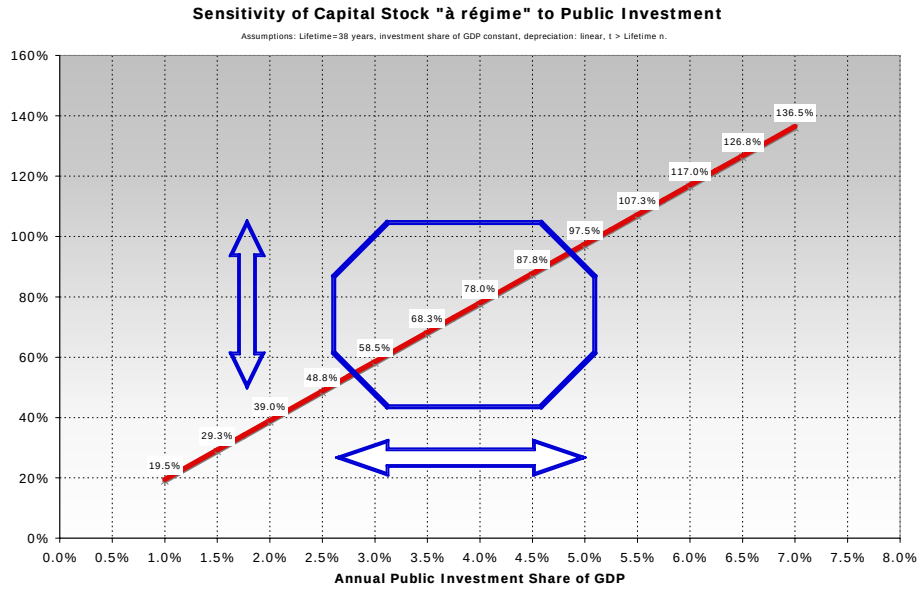
The financial crisis of 2008-09 comes after three decades when economic policy has focused on fiscal consolidations devised to reduce inflationary expectations and provide incentives to savings. During this period, long term interest rates exceeded GDP growth, and salaries tended to grow less than productivity in real terms. In line with mainstream economic theory, all conditions were thus fulfilled to stimulate profits and real investments. At the same time, economic policy neglected the role of effective demand and abandoned the objective of full

[87] Bhaduri (2006) presents an explicit formalisation of the dynamic process that would normally bring to a long-term underemployment equilibrium in a model inspired from classical analysis, where investment causes savings and growth is endogenous. In this model the dynamics are driven by the distributive conflict, in particular the model shows that unless salaries grow in line with productivity, effective demand will become insufficient to guarantee full employment.
[88] Here sector refers again to institutional sectors.
[89] See Taylor (2005 and 2007) for an application of this identity to US macro balances.
[90] One can view Kalecki's identity as the equivalent of the balancing of the "net lending" and "net borrowing" positions (S9) of the various institutional sectors in the UN SNA93 national accounts, basis for the EU ESA95 accounts, where net lending is defined as representing the net amount a unit or a sector has available to finance, directly or indirectly, other units or other sectors after investment. The identity implies that, if investment of domestic enterprises must increase, as it is the case in most of EU 12 (New Member States) as well as in Candidate and Pre-Accession countries, than other sectors in these economies must increase their debts for enterprises to continue accumulating savings (i.e. generating profits) despite accelerated investment.

employment (Mitchell and Muysken, 2008). Whereas this trend was a worldwide one, it was particularly evident in Europe, where the fiscal aspects of this policy mix were codified and inserted into several Treaties.

To appreciate the practical effects of these policies, one can take as particular example the impact of EU fiscal stability parameters on public investment, with particular reference to the so called EU12 (previously New Member States).

As illustrated in the chart below, if one calculates an hypothetical measure of the public capital stock, estimated with the method of the permanent inventory[91], and examines the sensitivity of this variable to the level of public investment necessary to achieve it and keep it constant, under the assumption retained in the chart, the calculation shows that in the range where the public capital stock represents between 50% and 80% of GDP, public investment between 2.5% and 5% of GDP per year is necessary to keep the value of the capital stock constant.



Taking into consideration that, for EU25, only the part of the public capital stock made of roads and motorways is likely to have a net replacement value of the order of 30% of GDP, which implies a gross value of the order of 60%[92], whereas human capital and natural environment have certainly a much higher value than the road network[93], it is clear that it is difficult for Governments, particularly in the EU12, to realise the public investment necessary to maintain intact the value of the public stock of physical, human and natural capital and at the same abide to the fiscal rules, which require in principle to keep the Government deficit and the public debt respectively below 3% and 60% of GDP. This becomes even more difficult (or impossible) if this stock must be developed.

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[91] The public capital stock is calculated with the formula below, where t the index of time , K_{nt} is the capital stock at time t, GINV the constant public investment flow, and n the lifetime of the investment financed:

$$Kn_t = \sum_{i=0}^{Min(n,t)} \frac{n-i}{n} * GINV = \frac{[2*n - Min(n,t)] * [1 + Min(n,t)]}{2*n} * GINV$$

[92] A relatively simple calculation shows that in the year 2000 the gross replacement value of the EU capital stock of roads and motorways can be estimated at close to 60% of GDP in the EU25 and the "old" EU15, whereas this value is close to 100% in the New Member States. In the same year New Member States had 20% of the EU25's network length (5% for motorways), whereas their GDP amounted to 4% of the total GDP of EU25 (current EUR). In other words, the networks have similar lengths (except for motorways, which remain to be built in NMS), but GDP is much lower at current exchange rates (Cingolani, 2006a).

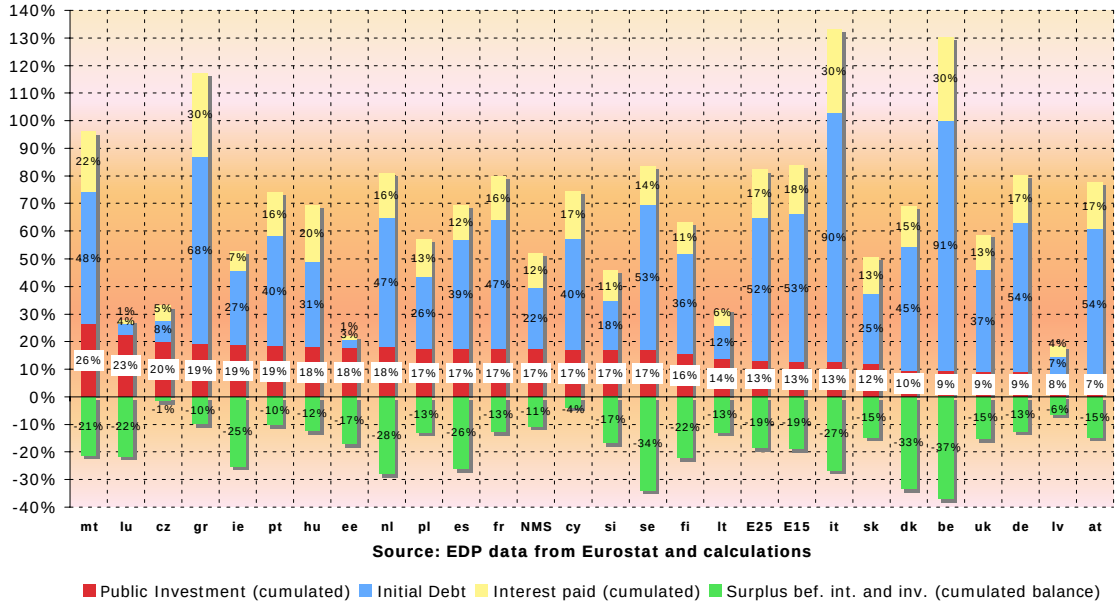
[93] Eisner (1988, Table S.6 pp.46-47) estimated that in 1981 the capital stock of the US Government was USD 2310 billions, that of US Government enterprises USD 476 bn and intangible human capital of households USD 10646 bn. In the same year current Gross National Product was USD 4560 bn (Table 16 pp. 275-277). For the year 1992, Government capital expenditures were estimated by Eisner (1995, Table 3.3 p. 55) at USD 530 bn, of which USD 197 bn for tangible investment and USD 262 bn for education and USD 71.6 bn for research and development (Table 3.2 p. 53), against a GNP of USD 6046 USD (Table 2.1, p. 10), implying a public investment ratio to GNP of 9%.

Budgetary constraints are all the more binding that part of the room for deficit financing must be devoted to the payment of interest on public debt accumulated in the past. This can be appreciated graphically by examining a breakdown of public debt into a component of previously accumulated debt, a component of public investment, a component of interest payments and a balance, which represents the current surplus before interest payments.

$$\frac{DEBT_t}{GDP_t} = \frac{DEBT_0}{GDP_t} + \sum_{i=1}^{t} \frac{\overline{DCAP}}{GDP_t} + \sum_{i=1}^{t} \frac{INT}{GDP_t} + \sum_{i=1}^{t} \frac{\overline{DCURP}}{GDP_t} \qquad (40)$$

In the formula (40) above, the left hand side represents the current public debt to GDP ratio, whereas on the right hand side the first term represent the ratio of initial debt to current GDP, the second represents capital expenditure realised in the period, the third interest paid on existing debt and the last net current expenditure before interest. For these concepts EU comparable official data are readily available, being produced regularly in the context of the EU excessive deficit procedure (Cingolani, 2006b). The chart below presents this decomposition for the period 1999 to 2005.

Decomposition of Public Debt 1999-2005
(ranked by decreasing share of cumulated public investment in 2005 GDP)



Source: (Cingolani, 2006b)

Countries are ranked in decreasing order of cumulated public investment share over GDP. The height of the column on the positive quadrant is the sum of the first three terms of the right hand side of (40), corresponding respectively to public investment (red bar), initial debt (blue bar) and the interest payment (yellow bar) components, all expressed in percentage of current GDP, whereas the green column in the negative quadrant represents the current surplus before interest payments, also as a share of current GDP (the last term in (40)).

The chart shows that some countries with a relatively low initial debt have accumulated debt fast in recent years through increases of public investment, whereas in others public investment has been lower, being constrained by debt inherited from the past. On average in EU25 the surplus before interest and investment (green negative column) covers interest payments (yellow bar).
If public investment (red bar) was estimated correctly, it could be identified with that part of public debt which is “good debt”, because it would correspond to the accumulation of a productive asset[94]. However, as argued notably by Eisner (1995, pp. 89-119), a large part of current public

[94] It is assumed implicitly that the new productive asset is then actually used to produce revenues, which is an acceptable assumption if public investment was chosen on the basis of objective needs (see discussion in 5.1.5.5). This assumption is retained in the development of the argument below also for the rest of public expenditure. It is in fact

expenditures are expenditures on human capital and other intangibles such as education and research and development. Therefore also part of the green bar could in principle be adding to "good debt". As shown in the chart however, the balance of net current expenditures before interest is negative, which means that this part of "good debt" is decreasing, i.e. net public current expenditures before interest have been reduced to realise a current surplus before interest. At the same time, since this process encounters limits in the social sphere, public investment in tangibles and intangibles has been contained as well. This is confirmed by the fact that fiscal consolidation policies were often translated into explicit ceilings set for annual public investment. The lack of investment results in that both the physical and the human public capital stock are being depleted. Kalecki identity (39) makes clear that any reduction in the Government deficit decreases profits of the private producing sector immediately. This negative impulse perpetuates itself and becomes more permanent once, in a second round, it has reached taxes, which are reduced through the fall in economic activity. At that time, the initial stimulus requires a higher current fiscal surplus to be corrected.

Some post Keynesians such as Parguez have linked the emergence of the present crisis to the long-term lack of effective demand generated by the policy mix referred above and particularly the insufficient level of public debt.[95] This interpretation is certainly consistent with the observed facts, particularly in Europe[96].

This raises the question of how to arrive at a change in the direction of European economic policies to avoid repeating the errors that have helped bringing to the present crisis. The implicit position taken in this paper is that this change requires also changing the way economic knowledge is interpreted and used. In this perspective, the paper used a unified "disequilibrium" approach as an instrument for synthetising and discussing different economic theories and their policy prescriptions. With this tool the neoclassical and post Keynesian research programmes have been compared with reference to the question of public investment.

Having recalled that an equilibrium concept is needed in order to discuss the effect of using policy instruments on the economy, the very peculiar characteristics of the neoclassical equilibrium have been reminded, in particular the fact that it doesn't require money, as it applies equally well to a barter economy. It was argued that if technology is constant there is in principle no obstacle to keep this particular equilibrium as a reference for normative analysis. In this case, section 2 suggests that the level of real profits can be used as an inefficiency index in welfare comparisons.[97] It was also argued that while useful for defining a reference point for welfare analysis when the economic environment is sufficiently stable, the neoclassical equilibrium is of little interest for other practical purposes.

Post Keynesian equilibria are less specific, as they do not necessarily respect all optimal neoclassical conditions, such as for instance the equality of the rate of interest and the marginal productivity of capital or the condition on full employment of available resources, even when technology is fixed. They thus correspond to situations that the neoclassical model would qualify as disequilibria and are of a more general nature. They allow addressing more interesting economic policy questions, independently from the fact that they are viewed as bringing to an "equilibrium rest point" or not. By definition, they apply to situations where, as underlined by early neoclassical authors themselves, simultaneity does not hold and must be replaced with some sort of causality. The latter must inevitably take place in historical time and it therefore requires a dynamic approach, otherwise one is back in the atemporal neoclassical equilibrium.

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equivalent to retaining the average rate of inefficiency in public investment selection as a pre-determined or exogenous variable in the context of a particular decision on public expenditure, meaning that, by and large, it cannot be significantly altered during the period when the decision is taken or exerts its effects.

[95] Parguez recently formulated a "Harrodian" principle of debt stability requiring that public debt must grow at the same rate as private debt in order to avoid financial crises (cf. personal exchange).

[96] In the sense of patterns of correlation, the asserted causality is of course an interpretation of these correlations, which is however the most plausible one in terms of the arguments developed in this paper.

[97] A forthcoming paper will apply this idea to the case of Public Private Partnerships.

The main dynamic causality relevant for economic policy out of equilibrium is that between investment and savings. For neo-classical authors, implicitly or explicitly, when it exists, this causality goes from savings to investment. On the contrary, for post Keynesians authors, it goes from investment to savings, as it is easy to illustrate with the model of the monetary circuit.

When endogenous money is introduced, it is because access to liquidity creation removes the scarcity constraint for producers that the model can generate a wider range of equilibria than the pure neoclassical one. Defined as a financial liability issued by the banking sector[98], money is essentially a macroeconomic phenomenon. It explains why, in sequential time, expectations of the Government and the entrepreneurs, embedded in their investment decisions, must be exogenous and thus causal with respect to savings. This implies also that public investment can be used as a macroeconomic tool, because the possibility always exists to finance it out of new State money creation if needed. Public investment thus provides a policy weapon against perverse circles of reduced expectations of the private producers, which, as discussed above, are generally followed by periods of increased risk aversion of the consumers, which feed in turn negative producer's expectations and so on, in a contractionary spiral that keeps the economy on a low growth path, which helps understanding the low growth performance of EU countries in the last two decades.

As shown by post Keynesian analyses in the spirit of Kalecki and confirmed by the closely related model of the monetary circuit, in general post Keynesian equilibria are unlikely to be full-employment ones (see also Gnos, 2005). This can be further ascertained once the assumption of constant technology is removed, as in that case, unless one assumes rational expectations[99] and/or an extremely favourable combination of circumstances that allows abiding to the dynamic condition (37), the economy will not be on the full-employment path. Given such permanent disequilibria, the causality shown in the monetary version of the post Keynesian model confirms that economic policy can have a positive influence on economic activity, notably through the action on macroeconomic instruments such as reduced interest rates or increased public expenditure, including of course investment. Once it is understood that there is no reason to expect, that let to itself, a market economy will converge towards a balanced equilibrium characterized by the reassuring optimality of the neoclassical conditions, not only in the short-term, but also in the long run, it is then clear that public investment can be a strong tool to fight against the permanent underemployment tendency of a monetary production economy with endogenous money (Seccareccia, 1995).

Obviously, the possible favourable effect of using the public investment instrument to attain the full-employment objective should be taken into account in ex ante policy design, since it remains true today as in the 1930s that: "all forms of the 'diversion argument' break down at a time when unemployment prevails" (Kahn, 1935, p. 1). This macroeconomic effect is not always captured by conventional cost-benefit analysis, at least in the way as it is usually practiced in EU countries.

Healthy economic growth can be recovered if action is taken to bring the economy back on the full employment path and the recent crisis confirmed this need. In order to succeed, this effort should be part of a concerted policy change at international level, which would also help stabilising international trade and exchange rate imbalances (Parguez, 2009).[100]

There is no space here to examine in full the implications that the ideas presented in this paper have for other European economic policies and particularly for the financing of public investment in a regional context and for the related issue of the coordination of economic policies in a monetary union, some of which can be guessed from Kalecki's identity (39), from the effect of distribution on allocation out of equilibrium and from the associated fallacy of composition. They

[98] And not as a real asset in a model where banks and firms are merged into a single producing sector, such as it is the case for the standard neoclassical model.
[99] This would be in any case irrelevant in non-ergodic environments of "fundamental" uncertainty (as opposed to risk, see Davidson, 1982-83).
[100] See also the postscript to the paperback edition of Davidson (2007). Many interesting applications of the approach of the circuit, relevant for economic policy can also be found in the recent book of Godley and Lavoie (2007).

give support to the idea of coordinating European fiscal policy at continental level through the collective management of investment and other public expenditure and could be developed as a possible future extension of the present analysis.

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