Nature of capital, long-run expectations and path dependence in the General Theory: some epistemological observations.

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Keynes (...) was extremely skeptical of the traditional view that one could identify something called a quantity of capital independent of values. Surely, under the influence of Sraffa (….), Keynes went so far as to rule out the logical possibility of the phrase marginal productivity of capital.

Rotheim Roy J., Keynes and the marginalist theory of distribution, *Journal of Post Keynesian Economics*, 1998, Vol. 20, N.3

This papers aims to develop the methodological and epistemological implications of Pasinetti (1997) and Rotheim's (1998) works with regard to Keynes´s conception of the nature of capital, as expressed in the General Theory (GT).

Such conception is contradictory to the neoclassical framework: Keynes refutes the neoclassical theory of distribution by refuting the second postulate of the "classical" theory and the loanable funds theory (GT, chapter XIV); he demonstrates why the determination of the interest rate must be exogenous and not determined by real variables. It is possible to affirm that Keynes refutes the existence of a labor market and of a capital market, in the way they are defined by the neoclassical school[1].

Anticipating the Cambridge Controversy, Keynes shows why an aggregate quantity of capital cannot be evaluated independently from the value of these distributive variables. Finally, it is possible to demonstrate why such conception of the capital implies structural instability of the system, in the mode defined by Vercelli (1985).

The modalities of aggregation of heterogeneous capitals used by Keynes provide the elements with which to construct an endogenous analysis of the cycle, i.e. the switching between expansion and recession. I will demonstrate how the specific concept of scarcity (or abundance) of capital used by Keynes, as well as the modification of long-run expectations, explains the cyclical movement.

In the first section, I will study the modalities used by Keynes to construct the aggregate Investment function. For such purposes, I will define the investment function and its components and I will analyze the determinants of the interest rate and the role as well as the determinants of the long-run expectations. I will explicate the method used by Keynes to aggregate different vintages of capital. In the second section, I will explicate the implications linked to this conception of capital, and will highlight the similarities between this approach and the classical approach (principally from Smith, Ricardo and Marx). Then I will demonstrate why there is no stability of the aggregate equilibrium, and how it is possible to build simple mechanisms which produce endogenous fluctuations. In relation to this aspect, I will highlight the convergences and the complementarities between Keynes´ and the neo-Ricardian approach.

I) The aggregate investment function

1) *The different components*

1.1 *The marginal efficiency of capital*

Keynes initially defines three concepts: Z, the aggregate supply price function; D, the aggregate demand function; and *e*, the marginal efficiency of capital.

The supply price of the capital asset is "(….) the price which would just induce a manufacturer newly to produce an additional unit of such assets. i.e., what is sometimes called its replacement cost" (GT, p. 112) (*Proposition 1*). The demand price is "(…) the proceeds which entrepreneurs expect to receive from the employment of N men (…)" (GT, p. 23).

The marginal efficiency of capital is defined as " (….) that rate of discount which would make the present value of the series of annuities given by the return expected from the capital-asset during its life just equal to its supply price" (GT,. P. 112) (*Proposition 2*). Finally, the supply

price is related to the current value of the capital, and not to the value at which it was bought by the entrepreneur (*Proposition 3*).

From proposition 1, it is possible to deduce that the supply price corresponds to the maximization of the expected profit of the entrepreneur who produces such assets. From propositions 2 and 3, we can deduce that there is an *update* of the capital asset, in regard to the period considered; *such update is relative to the value of the capital asset and to its prospective yields.*

From proposition 2, we can write:

$$Po = \frac{\Sigma Qi}{(1 + e)^{n}} \quad (1)$$

(Σ Qi / (1 + e) ^{n}) represents the updated value of the prospective yield during its life, with Po being the supply price, ΣQi the long-term expected proceeds and *e* the marginal efficiency of the capital.

From (1), we can deduce that the marginal efficiency of capital depends on two variables: the long-run expectations of the prospective yield on capital assets and the supply price of those capital assets. The higher the long-run expectations, the higher the marginal efficiency of capital, for Po constant; the higher the supply price, the lower the marginal efficiency, for Σ *Qi* constant.

The demand price of the investment is the current value of a financial asset updated to the current interest rate (GT, p. 113):

$$Pd = \frac{\Sigma Ri}{(1 + r)^{n}} \quad (2)$$

($\Sigma Ri / (1 + r)^{n}$ represents the updated value of the prospective yield, *r* the interest rate, and Pd the demand price (GT, p. 113).

Keynes´s theory is based upon a choice of assets mechanism (Cardim, 1992, p. 168). The individuals choose assets: money, financial or productive assets. From such a perspective, the entrepreneur's choice will be made between the money, the prospective yield of the investment and the prospective yield of a financial asset.

With regard to the supply price, Equation (1) may be interpreted as the equalization between the marginal cost of capital and the expected value of the marginal product. However, such interpretation is erroneous: (a) Keynes's mechanism is based upon *expected* and not effective yield. From the strong uncertainty which characterizes the Keynesian universe, it is not possible to equalize marginal costs and effective marginal product, but only marginal costs and expected marginal value product; concretely, it is impossible to maximize a microeconomic function of profit.

1.2 *The investment function: a first approach*

The investment decision may be explained by the comparison between the marginal efficiency of capital and the interest rate: if the marginal efficiency of capital is superior to the interest rate, entrepreneurs will invest in productive capital. They will compare the expected profitability of the investment and the profitability of o financial asset, and will choose the former.

For certain authors (Robinson, 1983, p. 331), the difference between the marginal efficiency of capital and the interest rate must be positive. This difference represents a risk premium with which to compensate the risk investment in productive capital [2]. Such concept is also developed by Barrère, and it corresponds to the monetary incitation necessary to "decide the entrepreneurs to assume the risks of the production" (1990, p. 82).

Keynes initially considers that *each kind of capital* is characterized by a negative correlation between the investment level and the marginal efficiency of capital (GT, p. 113): the marginal efficiency of capital decreases when the investment increases.

In the *short-run*, new investments are realized when Po < Pd, i.e. when the marginal efficiency of capital is higher than the interest rate: "The marginal efficiency of investment is favorable if it is high relative to other returns, particularly the rate of interest on bonds" (Dow, 1985, p. 159). The increase of the demand for capital implies that the supply price increases. When ΣQi is constant (Equation. (1)), the marginal efficiency of capital must decrease; the adjustment towards the equilibrium is realized by the prices variation (Davidson, 1978, p.70).

In the long-run, expectations will change: the output of investment realized today" will have to compete "(….) with the output from equipment produced subsequently (….). Moreover, the entrepreneur´s profit (…) will be reduced, if all output comes to be produced cheaply" (GT, p. 117). *In the long-run*, "the prospective yield will fall as the supply of that type of capital is increased (….)" (Idem), as supply increases and both supply price and demand price decrease. From Equation (1), we can deduce that a decrease in ΣQi corresponds to a decrease in *e*. The adjustment is based upon quantity variation.

We can capture such mechanism from the concepts of stock and flow equilibrium (Asimakopulos, 1999, p. 104 and 105); the former regards long-term equilibrium and the latter short-term equilibrium [3]. Each asset depends on three attributes: *q*, the expected yield, *c* the carrying cost and *l* the liquidity-premium (TG, p.191). If *a* is the expected appreciation of the asset in terms of itself, the return of each asset is equal to (q – c + l + a). If we consider, for example, two physical assets and the money, and if we suppose the carrying costs negligible, the stock equilibrium implies that the return of each asset is equal:

$$q_1 + a_1 = q_2 + a_2 = l_3 \qquad (5)$$

(*qi* as the expected return of the investment and *a* as its supply price). Assets 1 and 2 are productive assets and asset 3 is the money.

The flow equilibrium is realized when the expected return of investment is the same as the one of a financial asset, i.e. when: Po = Pd . (6)

Let us suppose an initial situation with a stock equilibrium and, for example, a decrease of the interest rate: Po becomes inferior to Pd, and such situation corresponds to the realization of productive investment. Po will increase until Po = Pd: but such increase does not allow verifying the stock equilibrium, as *a1* and *a2* increase. The restoration of the stock equilibrium implies that *q1* e *q2* decrease, i.e. that long- term expectations decrease. When

such equilibrium is reached, *q1* and *q2* decrease does not verify any more the conditions of the flow equilibrium.

From such mechanism, we can conclude that (a) it is impossible to verify, simultaneously, the flow and the stock equilibrium; such system is intrinsically unstable; and (b) long-run expectations (q_1 and q_2) are determined by the short term adjustment process, the Po variation. Consequently, such process *is path dependent.*

Table I Stock and flow equilibrium

Short- run equilibrium Pd > Po $\Rightarrow$ ↗ Dk $\Rightarrow$ ↗a_1 e ↗a_2 $\Rightarrow$ ↗ Po; The flow equilibrium is reached when Pd = Po The stock equilibrium is not reached: $a_1 + q_1 \neq a_2 + q_2 \neq l_3$ ↘ e is explained by ↗ Po, with Σ Qi constant. (Equ. (1)).
Long-run equilibrium The realization of the stock equilibrium implies that: ↘q_1 e ↘q_2 $\Rightarrow$ $a_1 + q_1 = a_2 + q_2 = l_3$ But the flow equilibrium is not any more realized: ↘q_1 e ↘q_2 $\Rightarrow$ ↘e_1 e ↘e_2 ↘ e is explained by ↘ Σ Qi, with Po constant (Equ. (1))

This is an important feature for three main reasons:

i) The equilibrium of the effective demand as it is determined in the GT is a stationary model (Chick, 1991, p. 24, Kregel, 1976) characterized by stable and exogenous long-run expectations. The method used in the GT is static (Chick, 1991, p. 16), and it is the reason why the macroeconomic equilibrium is stable (Asimakopulos, 1991, p. 39). When we relax the hypothesis of stable and exogenous long-run expectations, equilibrium is not stable any more: it is a shifting equilibrium.

Such equilibrium has been described by Keynes as a "complete dynamic model" (Kregel, 1976, p. 215): (a) there is not a predetermined equilibrium, it means no immutable reality (Davidson, 1996) (b) such explanation is more complete than the one based on the exogenous animal spirit of the entrepreneurs. In a post-Keynesian tradition, other authors (Setterfield, 1999) reach the same kind of results.

ii) It is an important feature for the argument developed in this paper: as an aggregate quantity of capital is evaluated from the long-run expectations, a change in such expectations implies a change in the expected value of such quantity of aggregate capital.

iii) Finally, this is a fundamental difference in regard to the mainstream, which considers that the cause of the fluctuations is intrinsically exogenous (Davidson, 1996): monetary shock for the Rational Expectations Theory, productivity shock (or technological) for the Real Business Cycles Theory, demand shock for the New-Keynesian. This kind of approach consists of analyzing the impact of a shock on the system. On the contrary, in the Keynesian framework, fluctuations are explained from endogenous variables, which allow us to explain the structural instability of the system (Vercelli,1985, 1991). The mainstream approach consists in analyzing the impact of a shock upon the system, and more specifically, upon the supply components. Keynesian approach is radically different: economic fluctuations are explained from endogenous variables, i. e., are produced by the system itself.

2) *Specificities of Keynes' analysis*

2.1 *The refutation of the loanable funds theory*

Such refutation is realized in Keynes's critique of "The Classical Theory of the Rate of Interest," in Chapter XIV of the GT. It may be synthesized in the following way:

$I = \varphi_1 [e - r]$ (3)

$\varphi'_1 > 0$

$S = \varphi_3 (Y)$ (4)

$\varphi'_3 > 0.$

(*r* as the interest rate, I e and S as Investment and Saving, and Y as the product)

We have two equations and three unknowns, *e*, *r* and *Y*; it is not possible to resolve this system; it is not possible to determinate simultaneously *r, Y, and e.* The classical consideration is that Y is exogenous: *r* and *e* are determined endogenously and *Y is* determined exogenously in the "real" sphere, by "real" variables.

On the contrary, Keynes considers *r* as exogenous: "The rate of interest (contrary to what orthodox theory was claiming) must be determined elsewhere by a mechanism which is working (….) *independently*" (Pasinetti, 1997, p. 206, italics added). Consequently, Y and *e* are determined in an endogenous way. *The endogenous determination of e implies that Σ i Qi, i.e. the long-run expectations, are partially determined endogenously:* from Equation (1), we can deduce that, in the long-run, change in *e* is explained by change in *Σ Qi* (see Table I).

As I will demonstrate in this paper, economic fluctuations may be explained by fluctuations of the interest rate, through the investment multiplier. Does this mean that these fluctuations are the result of an exogenous shock of the interest rate? Does it mean that the Keynesian analysis consists of studying the impact of a shock, by nature exogenous, on the system?

In my opinion the answer to these questions is no, for the following reasons: *r* is determined exogenously from the subsystem constituted by the Equations (3) and (4). However, with regard to his global framework, Keynes explicitly demonstrates that *r* is determined from the individual´s expectations relative to uncertainty, expressed by their *liquidity preference*. As he writes, the interest rate is "(....) the measure of the unwillingness of those who possess money to part with their liquid control over it" (GT, p. 139). This unwillingness is justified by the existence of strong uncertainty, and by the function of

store of wealth assumed by the money (GT, p. 140): the higher the uncertainty, the higher the interest rate to compensate such unwillingness to part with liquidity.

There is a *monetary determination of the interest rate*; as the interest rate determines the investment, monetary variables determine real variables. This is a patent manifestation of the non neutrality of money.

2.2 *The aggregation process*

Kregel (1980) builds a dynamical approach, from the distinction between capitals with different qualities. Let us consider *n* kinds of capitals, with decreasing marginal efficiencies: $e_{K1} > e_{K2} > .....> e_{Kn}$. The dynamical process may be represented by the following relations:

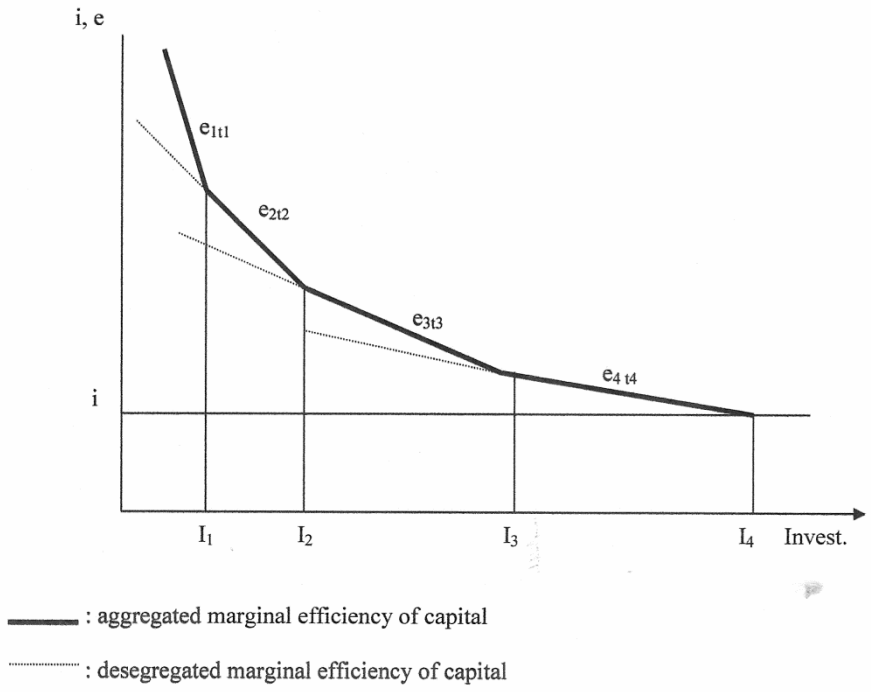
↗Dk1 $\Rightarrow$ ↘ e_{K1} until $e_{K1} = e_{K2}$

↗Dk2 $\Rightarrow$ ↘ e_{K2} until $e_{K2} = e_{K3}$

↗Dkn $\Rightarrow$ ↘e_{Kn} until $e_{Kn} = r$ (Dki as the demand for capital of quality *i*)

The equilibrium position is reached when $e_{Kn} = r$. Keynes considers that, for each kind of capital, it is possible to define a curve of marginal efficiency of capital, and that "The greatest of these marginal efficiencies can then be regarded as the marginal efficiency of capital in general." (GT, p. 112). *This means that, in every moment, capitals with different qualities ,i.e., different vintages of capital, produce the same return*. This process may be represented by Figure 1.

Figure I : the aggregate investment function



In this example, we can consider four qualities of capital, and suppose that its marginal efficiencies are higher than the interest rate. At time t_1, investment in capital with higher quality (K_1 with its corresponding marginal efficiency of capital e_1) will increase, until its marginal efficiency becomes equal to e_2. Likewise, when capital of quality 1 is exhausted, the demand of capital of quality 2 will increase: consequently, e_2 will decrease, until equal to e_3. Such a process will run until the marginal efficiency of the capital of quality 4 is equal to the interest rate.

At each time, the expectations relative to the yields of the investment realized in the past are updated: this is the reason why, during the current period, the marginal efficiency of capital, in general, is determined by the highest efficiency (GT, p. 112). However, this highest efficiency changes each time, thus allowing us to understand why entrepreneurs today choose a capital with inferior quality: *each time, all kinds of capitals are updated from the current expectations and the returns they provide are the same.*

With regard to Ricardo´s theory of differential rent, we can compare the different capitals with the different qualities of the land [4] ; the value of different types of land is updated from the current conditions of profitability: at every time, the capitalist profit on the best quality land is equal to the profit on the other kinds of land. Such analysis corresponds to Rotheim´s

result (1998, p. 370): " (...) recent research (.....) has shown that Keynes understood diminishing marginal productivity to occur only because of a heterogeneous stock of capital, which had constant returns for any vintage, but whose returns diminished as the margin of utilization spreads to less efficient vintage". The only difference is that, from my analysis, the return expected of every vintage of capital is not constant during each period.

Keynes uses the same procedure as Ricardo: *the update of the marginal efficiency of the different kinds of capital fulfills the same function as the differential rent of Ricardo*. In Keynes´ analysis, the updating process allows for the equalization of marginal efficiencies relative to the different qualities of capital. In the same way, the differential rent allows for the equalization of the capitalist´s profits realized on the different qualities of lands. In the two cases, the capitalist will invest in the capital which presents the higher returns, *at this moment*.

II) Keynes´ Economics: structure of the aggregate model, nature of the capital and structural instability

1) *Keynes and the aggregation mechanism*

1.1 *The neo-Ricardian premises*

On one hand, Keynes was conscientious of the theoretical difficulties encountered when evaluating and measuring aggregate quantities, principally the national product and the capital, as well as its evolutions. In this respect, he affirms that a "(...) community´s output of goods and services is a non-homogenous complex which cannot be measured (…) " (GT, p. 33), and that, when we try to measure the net addition to capital equipment, it is logically impossible "(…) to devise any satisfactory formula to evaluate new equipment against old when, owing to changes in technique, the two are not identical" (Idem).

On the other, Keynes "anticipates" the Cambridge Controversy when he highlights the logical incoherency of the neoclassical method, i.e., the logical impossibility to evaluate an aggregate quantity of capital independently of the value of the interest rate: "the attempt to deduce the interest rate from the marginal efficiency of capital is erroneous (…) because the former depends on the scale of the current investment and because we need to know the interest rate to be able to determine this scale" (Keynes, 1973, xiv, p. 477). In this sense, for

Keynes, an amount of aggregate capital cannot be conceived as a constant value (Rotheim, 1998, p. 375). Before Keynes, Marshall was aware of such problem; he defines the profit rate as the ratio in which the profit stands to the capital, and affirms that such definition implies "(…) that the money value of the things which constitute the capital has been estimated: and such an estimate is often found to involve great difficulties" (1920, , p.50).

To solve this problem, Keynes will measure " (…) the changes in current output by reference to the number of hours of labour paid for (whether to satisfy consumers *or to produce fresh capital equipment*) on the existing capital equipment, hours of skilled labour being weighted in proportion to their remuneration" (GT, p. 37, italics added). Such definition remembers Smith´s commanded labor value theory.

From a classical perspective inherited from Smith, Ricardo and Marx, Keynes demonstrates that the labor may be conceived as an homogenous measure unit which allows for the measuring of changes in output and in capital. It is the reason why employment is a proxy for real income (Chick, 1983, p. 69), since the total quantity of labor is homogenized, i.e. expressed in terms of unskilled labor.

In the neoclassical aggregate model, the natural interest rate "(…) corresponds to the expected return of new equipment, (…) and equals demand and supply for saving" (Wicksell, 1997, p. 256). As Wicksell emphasized, the interest rate is determined by real, i.e., not monetary, variables (Idem), in a universe without uncertainty. In such a conception, the value of an aggregate quantity of capital may be calculated independently of the value of the interest rate; there is no updating of the value of the capital. This procedure is different from that put forth by Keynes and can be explained by the fact that the interest rate and the profit rate are defined as real variables.

This problematic remembers the Cambridge Controversy relative to the measurement of an aggregate quantity of capital, and the neo-Ricardian developments[5]: (a) it is not possible to evaluate the value of a quantity of aggregate capital independently of the value of distributive variables (b) every change of the interest rate corresponds to a change in the value of such quantity of capital, which is equivalent to its updating. Such a conception is incompatible with the neoclassical theory of functional distribution of the product, and with growth models, thus automatically leading to a convergence for the steady-state position (Solow, 1956).

1.2 *Economic cycle and scarcity of capital*

Keynes explains the profit from the scarcity of capital; he defines scarcity of capital as the reason why the return of capital is greater than its supply price : "For the only reason why an asset offers a prospect of yielding having an aggregate value greater than its initial supply price because it is scare" (GT, p. 180). He then adds "If capital becomes less scare, the excess yield will diminish, without its having become less productive - at least in the physical sense" (Idem).

The source of the profit is its scarcity. But what is the nature of this scarcity? As noted by Keynes, *scarcity may not be defined in physical terms*. This conception is incompatible with its neoclassical counterpart:

(a) As demonstrated by Pasinetti (1997, p. 207), the marginal efficiency of capital is a concept different from the neoclassical marginal productivity of capital. The former allows us to determine the last profitable investment; it is an *extensive* conception of the investment. On the contrary, the neoclassical conception is defined in an *intensive* way, in terms of capitalistic intensity evaluated from the capital/labor ratio (K/L). In such a conception, the monotonic relation between the interest rate and the ratio K/L explains the convergence toward the steady-state (Solow, 1956).

(b) The neoclassical conception is based upon physical quantities of production factors. Implicitly, *this means that it is possible to measure such factors, and that their value is independent of the distributive variables*;

(c) The neoclassical limits of accumulation are physical in nature when comparing the quantity of capital and the quantity of labor. For Keynes, as in Smith and in Marx, such limits are explained by the *social conditions*, and not by the technical or physical ones. The concept of scarcity of capital is present in the Classical Economy. Adam Smith, for example, defined this scarcity in the following manner: "As the capital of a country increases, the profits that it is possible to obtain with their employment decrease" (1980, p. 615), in part because the wages increase implies in a profit decrease (Idem, p. 616).

Keynes explains the economic cycle as "(…) cyclical changes in the marginal efficiency of capital (…)" (GT, p. 268). These cyclical changes in the marginal efficiency of capital are caused by the abundance, or the scarcity, of capital. In Keynes´ conception, the trade cycle is simply the alternation between expansion and recession. Such theoretical approach may

explain this alternation between expansion and recession, but, despite Keynes´ affirmations (GT, p. 268), it does not provide an explanation relative to the temporal regularity of these fluctuations. Such mechanisms allow for the formulation of an endogenous explanation regarding the cyclical fluctuations: economic fluctuations are produced by endogenous variables: long-run expectations and marginal efficiency of capital.

Finally, within a *dialectical perspective*, Keynes demonstrates that the conditions of the expansion reach economic limits, beyond which they are exhausted. I mean dialectical in the sense of Kalecki (1971) and Marx (1976). These authors show that the cyclical fluctuation is an endogenous movement [6], by the fact that, in each phase of the cycle, countertendencies appear and develop. Such mechanism highlights (a) the endogenous character of the cycle, conceived as a *continuous* movement (b) the existence of a turning point between the different phases of the cycle and (c) the differences with the neoclassical analysis. Those mechanisms correspond to the Kalecki´s analysis of the business upswing (1971) and Marx´s analysis of capitalist competition (1976, Livre III, chapter XV) .

During the expansion, the initial conditions disappear progressively, in reference to the increasing abundance of capital. The recession creates the scarcity necessary to produce a new expansion, and so on (GT, p. 268). Based on such mechanisms, I will formalize, in a simple model, such relations.

The cyclical dynamic presents the following characteristics:

i) During the expansion phase, the abundance of capital produces an over-investment: this can be defined as "(…) a state of affairs where there is no new investment which is expected (…) to earn in the course of its life more than its replacement costs" (GT, p, 274). Such over-investment may also be explained by the path-dependence between short and long-run expectation: since short-run expectations determine partially long-run expectations, during the expansion, the increase in short-run expectations implies in an increase of long-run expectations, an increase in marginal efficiency of the capital, i.e., an increase in investment. This is the cumulative period of the cycle (Herscovici, 2006).

ii) The initial optimistic expectations which explain the boom "(…) are destined to disappointment" (GT, p. 275), and are substituted by pessimist ones. *We observe an endogenous change in the long-run expectations which determine the investment*. This corresponds to the turning point of the expansion phase.

Similar elements are present in the Treatise on Money. In this book, Keynes shows that an excess of saving over investment corresponds to a situation where the entrepreneur´s profit is less than the normal profit (GT, p. 67). Keynes builds the following function:

$P = I - S$ (P as the excess of profit, in reference to the normal profit, I and S as the total investment and saving)

If, for example, $S > I$, $P < 0$, i.e., the profit is less than the normal profit. This situation is characteristic of a recession. On the contrary, if $S < I$, the profit is greater than the normal one, and this characterizes a phase of expansion. It is true that in the Treatise, Keynes ´s argument is made in terms of effective profit, while, in the GT, the argument is built in terms of expected profit. During the recession, the entrepreneurs reduce the scale of production, while, during the expansion, they increase the scale of production. Consequently, the normal profit may be defined as a situation in which the entrepreneur has no incentive to modify his scale of production [7].

Finally, we must note the similarity with Marx´s analysis: like Keynes, for Marx, the abundance and the scarcity of capital are not linked with changes in physical labor productivity, but instead with *social conditions of valorization*, i.e., the ratio between the surplus value and the wages. In this regard, for Marx, the expansion leads to over accumulation and over production of capital (1976, p. 269). Marx shows that the capitalist competition implies the destruction of part of the social capital, so that the other part is able to continue valorizing (at this regards he speaks of *fallowing* of part of social capital). The periodical depreciation of the capital corresponds to Chapter 22 of the GT. Marx, much like Keynes, provides an endogenous analysis of the fluctuations, and of the alternation between expansion and recession [8].

2) *Structural Instability: the convergences with the neo-Ricardian school*

2.1 *The neo-Ricardian school: some methodological observations*

The main results of the neo-Ricardian school may be synthesized by the following elements: a formal resolution of the "transformation problem" from Ricardo´s theory of labor value and a specific conception of the nature of capital. From a dynamical perspective, the first result is

not useful, while the second is fundamental. From the latter, I will study the convergences between Keynes and the neo-Ricardian school, as well as the role of distributive variables in the structural instability of the whole system [9].

On one hand, from a post-Keynesian perspective, a predetermined long-period equilibrium is incompatible with the hypothesis of non-ergodicity (Cardim, 1983-1984). On the other hand, the Cambridge Controversy results are incompatible with the existence of a stable long-period equilibrium position, in which the quantity of capital is constant: "*Long- period equilibrium cannot be determined, because the datum relative to the endowment of 'capital' is logically indeterminable*" (Petri, 1998, p. 17). As the value of an aggregate quantity of capital changes with a modification of the distributive variables, the long-period equilibrium is undetermined (Setterfield, 1999). Moreover, the path dependence between short and long-run variables is incompatible with the existence of a stable long-period equilibrium. Harrod's model, for example, allows for the formulation of such results (Herscovici, 2006).

As previously noted, Chapter XIV of the GT is a crucial component of the Keynesian criticism with regard to the neoclassical framework. The interest rate is determined in an exogenous way, whilst the equilibrium realized is not, systematically speaking, a full employment equilibrium. The neo-Ricardian analysis leads to similar results. In the neoclassical macroeconomic, the perfect flexibility of the interest rate explains the convergence toward equilibrium: the excess of loanable funds demand (supply) will be eliminated from an increase (decrease) of the interest rate. The neo-Ricardian analysis refutes such automatic adjustments:

(a) The Cambridge controversy demonstrates that there is no monotonic relation between the interest rate and the aggregate quantity of capital; thus, the variation of the interest rate does no guarantee the automatic adjustment to the equilibrium position.

(b) On the other hand, the existence of a stable equilibrium is incompatible with such an approach: such equilibrium implies that the quantity of capital must be constant, i.e. does not depend on the modification of the distributive variables. Such a condition is not verified (Petri, 1998, p. 14).

2.2 *The structural instability*

We can observe the same type of causal relations in the GT: *the absence of a monotonic relation between the interest rate and the ratio K/L, as well as the absence of a negative correlation between the interest rate and the aggregate quantity of capital.* Let us write:

$I = \varphi_1 (e - r)$, with $\varphi'_1 > 0$ (7)

$\Delta Y = \Delta L = 1/s \, . \, \Delta I$ (8).

$e = \varphi_2 (I)$, with $\varphi'_2 < 0$ (9)

$I = \varphi_1 [\varphi_2 (I) - r]$ (10)

(*s* as the marginal propensity to save and L as the total quantity of labor)

On the one hand, investment depends on the difference between the marginal efficiency of capital (*e*) and the interest rate (*r*). On the other hand, *e* depends on the stock of capital. i.e. the scarcity or the abundance of capital. Under certain specific conditions, such a system may produce endogenous fluctuations.

i) If individuals anticipate a reduction of uncertainty, in regard to the liquidity preference, this will cause a subsequent decrease in the interest rate. From (7) we can deduce that the investment will increase; the Keynesian multiplier (Equation (8)) will cause an increase in the product and, consequently, in the employment; the hypothesis of Chapter 4 of the GT implies that there is a proportional relation between the variations of the product and the variations of the quantity of labor. By the multiplier, the increase in Y and L will be greater than the increase in K; the variation of labor (L) will be more than proportional to the variation of the investment, and consequently K/L will decrease. Contrary to the neoclassical theory, while *r* decreases, K/L also decreases. Such a mechanism is incompatible with the automatic adjustment toward the steady state, in neoclassical growth models, particularly with Solow´s model (1956).

ii) From (9), we can deduce that *e* decreases when *I* increases. The impact of investment depends on the difference between *e* and *r*: if the *e* decrease is smaller than the *r* decrease, investment will increase.

(i) and (ii) explicitly demonstrate that the monotonic relation between *r* and *I* is not verified in the Keynesian economy; this is an important convergence between the Keynesian and the

neo-Ricardian framework. From such convergences, I will demonstrate how, and why, it is possible to deduce that the system produces, in an endogenous way, a structural instability.

iii) An increase of *r* will cause, initially, a decrease of *I* and, as well as a consequent increase of *e* (Equation (9)); if the increase of *r* is greater than that of *e*, *I* will decrease: by the multiplier mechanism, this will cause a recession. During such a recession, an *I* decrease corresponds to an *e* increase; such a mechanism produces the conditions of a new expansion phase. On the contrary, an exogenous decrease of *r* has the following implications: an increase of I, and a decrease of *e*. If the decrease of *r* is smaller than the decrease of *e*, this causes, via multiplier mechanism, a recession. In other words, such endogenous fluctuations are due to investment and product fluctuations; in the last instance, fluctuations are caused by a change in the individual evaluations regarding uncertainty. If we introduce temporal lags in Equation (10), it is possible, with regard to the value of the parameters, to obtain chaotic movements:.

$$I_t = \varphi_1 [\varphi_2 (I_{t-1}) - r] \qquad (11)$$

iv) Finally, it is possible to highlight the limits of such fluctuations, i.e. the existence of *turning points* in each phase of the cycle. In an expansion phase, the increase of the investment causes a decrease in the marginal efficiency of capital. In certain periods, the decrease of *e* will be greater than the decrease of *r* [10]*;* this results in a recession process, and in the progressive restoration of *e*.

Such mechanisms correspond to the elements of the chapter 22 of the GT (Notes on the trade cycle): (a) the cycle is produced by endogenous variables (b) each phase of the cycles corresponds to variations in the marginal efficiency of the capital and in the long-run expectations (c) contrary to a "mechanical" approach which combines multiplier and accelerator, the fluctuations are not explosive; the countertrend explains the turning point, i.e, the switching between expansion and recession (d) finally, the initial variation of the interest rate is not a shock, by nature exogenous, but the consequence of a change in individuals´ expectations concerning the uncertainty, i.e. *in the liquidity preference.*

Conclusion

This analysis allows us to affirm that (a) there is not a monotonic relation between *r* and K/L. This is also a neo-Ricardian result; (b) the mechanisms pointed out in the GT allows us to provide an endogenous explanation of economic fluctuations and (c) it also possible to determine the limits of such fluctuations, from the existence of turning points (GT, p. 274).

Such conception of capital is incompatible with the neoclassical macroeconomics causalities: (a) the distributive variables, the interest rate and the wages rate are not determined by the market logic, but in an exogenous way; it is incompatible with the functional theory of distribution; such variables are determined by institutions [11]; (b) it is logically impossible to conceive an aggregate quantity of capital as constant when the distributive variables change; (c) consequently, it is impossible to conceive a predetermined position of long-run equilibrium constant that the system will automatically reach.

From a History of Economic Thought perspective, we can affirm that there is *a methodological and epistemological continuity between Keynes and the neo-Ricardian school*. As demonstrated in this paper, these two approaches show that there is no monotonic relation between the rate interest and the ratio capital/labor; this is one of the fundamental elements of the refutation of the neoclassical results. *The Cambridge Controversy is the continuity and the generalization of such conception of the capital*. Such a perspective allows us to go beyond the traditional opposition between post Keynesian and neo-Ricardian, and to provide a coherent alternative to the neoclassical paradigm.

One of the most innovative (and perhaps least commented) elements of the GT is the conception relative to the nature of capital: here is the key point of Keynes´ rupture with the "classical" economists. At the same time, such a conception allows us to refute the neoclassical macroeconomics and to design a dynamical alternative. It is no longer necessary to invoke a shock to explain the economic movement; this last point is, in my view, an important step when it comes to building a specifically dynamic analysis.

References

Asimakopulos, Athanasios, *Keynes´s general theory and accumulation*, Modern Cambridge economics, 1991.

Barrère, Alain, *Macroéconomie keynésienne. Le projet économique de John Maynard Keynes*, Bordas, Paris, 1990.

----------, « Les fondements de l'économie monétaire de production », *Keynes aujourd'hui: théories et politiques,* Economica, Paris, 1985.

Carvalho, Fernando Cardim de, Moeda, produção e acumulação: uma perspectiva pós-keynesiana, *Moeda e produção: Teorias comparadas*, Editora UnB, Brasília, 1992.

----------, On the concept of time in Shacklean and Sraffian economics", *Journal of Post Keynesian Economics*, Winter 1983-84, vol. VI, n°2, Cambridge, 1983-1984..

Chick Victoria, *Macroeconomics after Keynes. A reconsideration of the General Theory*, First MIT Press edition, 1983.

Cohen Avi J., Harcourt G.C., "Whatever Happened to the Cambridge Capital Theory Controversies?" *Journal of Economic Perspectives – Volume 17, Winter 2003*.

Davidson, Paul, *Money and the real world*, The MacMillan Press LTD, London and Basingstoke, 1978.

----------, Reality and economic theory", *Journal of Post Keynesian Economics*/Summer 1996.

Dow Sheila C, *Macroeconomic Thought. A Methodological Approach*, Basil Blackwell, Oxford. 1985.

Harris, Donald, *Capital, Accumulation and Income Distribution*, Standford University Press, Stanford, California, 1978.

Harrod, Roy F., "An Essay in Dynamic Theory", *The Economic Journal*, 1939.

Herscovici, Alain, *Dinâmica macroeconômica: uma interpretação a partir de Marx e de Keynes*, EDUFES/EDUC, São Paulo, 2002.

----------, "O modelo de Harrod: natureza das expectativas de longo prazo, instabilidade e não linearidade", *Economia e Sociedade* (UNICAMP), Campinas, v. 15, n.26, 2006.

Hodgson, Geoffrey M., "The Approach of Institutional Economics", *Journal of Economic Literature*, Volume 36, Issue 1, March 1998.

Keynes, John Maynard**,** *The General Theory of Employment, Interest and Money*, Classic Books America, New York, 2009.

----------, *The Collected Writtings of J. M. Keynes*, London, Mac Millan, 1973.

Kalecki Michael, "Outline of a Theory of the Business Cycle", in *Selected Essays on the Dynamics of the Capitalist Economy*, Cambridge University Press, 1971.

Kregel, J. A, Economic methodology in the face of uncertainty: the modelling methods of

Keynes and the post-keynesians. *The Economic Journal*, 86, junho 1976, pp. 209-225.

----------, "Markets and institutions as features of a capitalistic production system", *Journal of Post-keynesian Economics*/Fall 1980, Vol.III N° 1.

Lebowitz, Michael 1. Marx's Falling Rate of Profit: a Dialectical View, *The Canadian Journal of Economics*, May 1976, IX n. 2, pp. 232-454

Marshall, Alfred, *Principles of Economics* Macmillan and Co. 8th ed., London, Book II, Chapter IV, 1920.

Marx, Karl, *Le Capital, Critique de l'économie politique*, Editions Sociales, Paris, Livre III, 1976.

Modenesi A., Modenesi R., Oreiro J., Martins N, "Convention, interest rates and monetary policy: a post-Keynesian–French-conventions-school approach", *European Journal of Economics and Economic Policies: Intervention, Vol. 10 No. 1*, 2013.

Pasinetti, Luigi L., "The marginal efficiency of Investment", *A "Second Edition" of the General Theory-Vol. 1*, Edited by G.C. Harcourt and P.A. Riach, Routledge, 198-218, 1997.

Petri Fabio, "The "Sraffian" critique of neoclassical economics: some recent developments", *Revista da Sociedade Brasileira de Economia Política n. 3*, dezembro de 1998, Rio de Janeiro.

Ricardo, David, *Princípios de Economia Política e Tributação*, Abril Cultural, São Paulo, 1982. [Original: *On The Principles of Political Economy and taxation*, edited by Pierro Sraffa, in the Works and Correspondence of David Ricardo, University Press for the Royal Economic Society, 1970, v.1)].

Robinson, Joan, *Ensaios sobre a teoria do Crescimento Econômico*, Os Economistas, São Paulo, 1983 [Original: *Further Contribution to Modern Economics*, Oxford, Basil Blackwell Publisher, 1980).

Rotheim Roy J, " Keynes and the marginalist theory of distribution", *Journal of Post Keynesian Economics*, Spring 1988, Vol. 20 n.3 355-387.

Setterfield Mark,Expectations, path dependence and effective demand: a macroeconomic model along Keynesian lines, *Journal of Post Keynesian Economics*, Spring 1999, Vol. 21, n. 3., 1999.

Smith, Adam, *Inquérito sobre a natureza e as causas da riqueza das nações*, Fundação Calouste Gulbenkian, Lisboa, Vol I, 1980 [Original: *An Inquiry into the Nature and causes of the wealth of Nations*, Methuen and Co Ltd, London, 1950).

Solow, Robert , " A contribution to the theory of economic growth", *Quartely Journl of Economics*, vol. 70, p 65-94, 1954.

Vercelli, Alessandro, " Keynes, Schumpeter, Marx and the srtuctural instability of capitalism", *L'hétérodoxie dans la pensée économique*, G. Deleplace, P. Maurisson org., Paris. 1985.

----------, *Methodological foundations of macroeconomics: Keynes after Lucas*, Cambridge University Press, 1991.

Wicksell, Knut, " Lições de Economia Política", *Os clássicos da Economia*, Ricardo Carneiro org., Ática, São Paulo, 1987 [Original: *The influence of interest rate on the prices* in K. Alec Chrystal, *Monetarism*, E. Elgar, London, 1990].

Footnotes

1: With regard to the first point, see Barrère (1985, p. 43), and for the second see Petri (1998).

2: We may observe that the yields of the productive asset are uncertain, while the yields of a financial asset, as a bond, are certain, by the determination of the interest rate (Dow, 1985, p. 159).

3: Such mechanism is analyzed by Davidson, from the concept of short-period flow-supply price of capital (1978, p. 70 and 71).

4: "Keynes´ notion of the marginal efficiency of investment might appear to have some analogy with Ricardo´s notion of extensive rent" (Pasinetti, 1997, p. 207).

5: For a synthesis, see Cohen & Harcourt (2003).

6: In regard to such interpretation, see the concepts of law of motion (Lebowitz, 1976, p. 249) and of depreciation of part of social capital (Herscovici, 2002, p. 190).

7: This definition was used by Harrod to define the warranted growth rate (1939).

8: For a simples formalization, see Herscovici (2002, p. 299 and following).

9: See Harris (1978, p. 162 and following).

10: As Keynes did, we suppose that there is an inferior limit of the interest rate (TG,p. 175). .

11:Hodgson (1985, p. 175), for example, shows that wages are not determinate by market forces, but from conventions and social institutions. Post-Keynesian authors highlight the role of convention in the determination of the interest rate. (Modenesi et ali, 2013).