

Investment Decision and Methodology: Keynes and Neoclassical

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RESUMO

O objetivo do trabalho é mostrar, por meio do estudo da decisão de investimento, como que o uso de diferentes metodologias pode determinar diferentes interpretações teóricas. Duas visões são escolhidas: Keynes e os Neoclássicos. Comparações teóricas e metodológicas são feitas, permitindo ao autor concluir que existe uma relação direta entre a metodologia utilizada por cada linha de pensamento e suas respectivas interpretações acerca do processo de decisão de investimento. O artigo está estruturado em cinco seções. Nas duas primeiras as duas teorias de investimento são brevemente apresentadas. Na seção três é feita uma comparação teórica visando clarificar as diferenças mais importantes. Na quarta seção é demonstrado que diferenças metodológicas bem mais profundas determinam as diferenças encontradas na comparação teórica. Finalmente, algumas conclusões são tiradas, mostrando como tais diferenças metodológicas impõem as diferentes teorias conclusões distintas sobre os determinantes do investimento.

PALAVRAS-CHAVE

investimento, metodologia, Keynes, neoclássicos

ABSTRACT

The aim of this paper is, in analysing the investment decision, to show how methodological differences can determine differences in the theories and statements about economic events. Two views were chosen, Keynes and neoclassical, and theoretical and methodological comparisons were made. These allowed the author to conclude that there is a direct relationship between the methodology used by each school of thought and its understanding of the investment process. The paper is structured in five sections. In the first two, the two investment theories are briefly presented. In section three, a theoretical comparison is made aiming to clarify the most important differences. In section four, it is shown that underlying the theoretical differences between the two schools of thought, there is a deeper methodological difference, in such a way that the latter determines the former. Finally, some conclusions are drawn, showing how the methodological differences dictate the theoretical statements.

KEY WORDS

investment, methodology, Keynes and neoclassical

INTRODUCTION

The differences among interpretations of economic events by different schools of thought has been a matter of extensive debate for many years. Most of the discussion on methodological difference, however, has taken place outside the mainstream economics whether amongst heterodox economists or some philosophers of science. Nevertheless, given the pervasiveness of the consequences of this discussion, it is not surprising that, as time goes by, economists from all schools of thought have become more interested in this matter.

The aim of this paper is, in analysing one specific economic event, the investment decision, to show how differences in the methodological approaches can determine differences in the theories and statements about economic events. Two views were chosen, Keynes and neoclassical, and theoretical and methodological comparisons were made. These allowed the author to conclude that there is a direct relationship between the methodology used by each school of thought and its understanding of the investment process.¹

The paper is structured in five sections. In the first two, the two investment theories are briefly presented. The discussion focuses only on those aspects relevant to the purpose of the paper. In section three, a theoretical comparison is made aiming to clarify the most important differences. In section four, it is shown that underlying the theoretical differences between the two schools of thought, there is a deeper methodological difference, in such a way that the latter determines the former. Finally, in the last section, some conclusions are drawn, showing how the methodological differences dictate the theoretical statements.

1. THE INVESTMENT DECISION: THE KEYNES APPROACH

Keynes' concept of the investment decision is set out in Chapters 11 and 12 of his most famous work, *The General Theory of Employment, Interest and Money* (hereafter *GT*). In the former chapter, he analysed the concept of Marginal Efficiency of Capital (hereafter MEC) and in the latter he explained long term expectations. The Keynes approach insists that the two chapters must be analysed together to maintain the correct understanding of Keynes' theory.

1 It is not the aim of the paper to discuss scientific methodology as a whole. One specific interpretation of scientific methodology is chosen and applied to the analysis of one specific economic event. For a survey of different interpretations of scientific methodology see BACKHOUSE (1994).

In Chapter 11, as a first step in the construction of a theory of investment, the amount of investment at any period of time is related to the marginal efficiency of capital, d , and the interest rate, r . That is:

$$I = f(d, r) \quad (1)$$

To understand the form of this relation, firstly we need to analyse the Keynes concept of MEC. He defines the MEC as the rate of discount that makes the prospective returns obtained from the selling of the outputs from investment (prospective yield) equal to the supply-price (SP) of a capital-good. This supply-price means, in Keynes' words,

not the market price at which an asset of the type in question can actually be purchased in the market, but 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. (KEYNES, C.W. VII, p. 135)

The calculation of the MEC of a capital asset deserves a detailed analysis.

The present value of the stream of expected profits (V_0) is given by the formula:²

$$V_0 = \sum_{t=1}^n \pi_t (1+r)^{-t} \quad (2)$$

where : π_t is the expected profit at time t .

If we substitute in equation (2) the interest rate, r , for a rate of discount, d , "*which will equate P_k [supply price] with the present value of the profit stream*" (CHICK, 1983, p. 120), we find the following;

$$P_k = \sum_{t=1}^n \pi_t (1+d)^{-t} \quad (3)$$

In other words, the marginal efficiency of capital, d , is equal to the solution of (3) for d .

The value of the MEC is then compared with the current interest rate.

2 The notation used here follows CHICK (1983).

If it [the MEC] is greater than the interest rate, the return from investing in the machine is greater than the return from lending out an equivalent sum at the current rate of interest, so the producer decides in favour of the machine. (CHICK, 1983, p. 120-1)

The concept of marginal efficiency of capital has a central role in Keynes's theory of investment. It is the connection between the profits expected to accrue in the future and the cost that has to be handled in the present. Therefore the investment decision has the key function of linking the present to the future.

This special feature makes the use of the MEC (as it relates to prospective yields) quite distinct from the use of the marginal physical productivity of capital (PMPC) in determining the amount of investment. As Keynes points out,

The mistake of regarding the marginal efficiency of capital primarily in terms of the current yield of capital equipment, which would be correct only in the static state where there is no changing future to influence the present, has had the result of breaking the theoretical link between today and tomorrow. (C. W VII, p. 145)³

Indeed, in Chapter 16 of *General Theory*, Keynes makes it clear that the investment decision to acquire assets is made independently of their real productivity. The investor is concerned with the prospective yield of the capital-asset, not with the capital-asset as such. What determines this prospective yield is the expectation about the future demand in relation to future conditions of supply. So, changes in that yield can actually happen even when the productivity of capital in physical terms remains constant.

Another important point to be stressed here is the role of savings in Keynes's theory of investment. For him there is a distinction between the act of saving and the act of buying capital goods. Investment must result in the creation of capital. The purchase of some kind of financial asset cannot be understood as an investment, since a bank does not have to create physical capital to supply this financial asset. For the mainstream approach both (saving and buying capital goods) are investment.⁴ Keynes assumes that

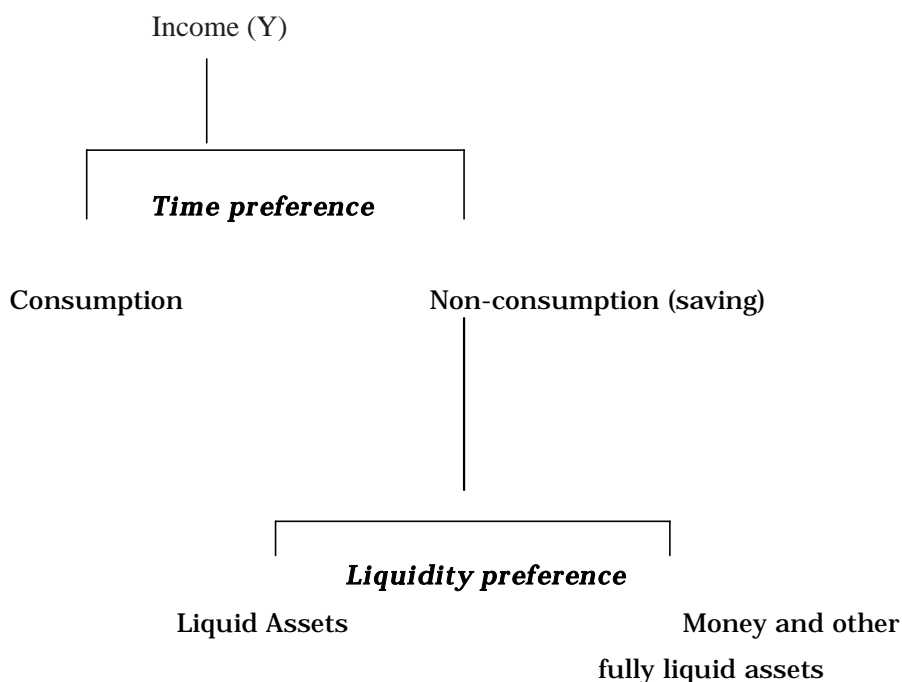
3 We will discuss this point in detail in Section 3 below.

4 Actually, this relationship comes first from the Classics, and is maintained in the mainstream framework.

an act of saving means - so to speak - a decision not to have dinner today. But it does not necessitate a decision to have dinner or to buy a pair of boots a week hence or a year hence to consume any specified thing at any specified date.(KEYNES, C. W. Vol. VII, p. 210)

To understand this disassociation between savings and demand for durable goods we have to keep in mind that the process of income allocation incorporates two types of preference, a “time” preference and a “liquidity” preference (cf. DAVIDSON, 1994, p. 52). This assumption can be better understood with the assistance of the figure below:

FIGURE I



5 “**Liquid assets** are durables traded in well-organised, orderly markets where the market maker assures that the next price will not differ significantly from the last transaction price.”(DAVIDSON 1994, p. 50)

6 “**Fully liquid assets** are any assets that can be immediately converted into (resold for) money in a spot market where a market maker ‘**quarantees**’ a fixed and unchanging net spot money price.”(DAVIDSON, p. 50)

The first kind of decision that consumers face is a time preference decision. This means that after receiving their income, consumers have to choose how much will be allocated to current consumption and how much will *not be spent* on consumption. This latter decision does not mean a desire to consume in the future. What is behind this decision is a desire from the consumer or firms to “*transfer command of unspecified resources to the indefinite and uncertain future.*” (DAVIDSON, 1994, p. 52) Thus, the time preference decision does not mean a choice between consuming today or consuming in the future, but between spending on consumption today or keeping the purchasing power for an unspecified period of time.

The second kind of decision faced by the consumer and firms is related to the way they intend to hold this purchasing power. It is this second decision that the mainstream economics fails to recognise. As shown in Figure I, this decision is related to what kind of asset plays the function of holding purchasing power more efficiently, according to the needs and expectations of firms and consumers. To make this choice they look for two important features that the asset has to have. The first is the capacity of the asset to protect, and possibly to increase, the value of that part of their income that they have decided not to consume. The second, is the liquidity of this asset.

The motivation to invest, on the other hand, is completely different. Investors are more interested in the returns from the service of the capital good, i.e. the returns that the investor will obtain from the sales of the products that he/she will produce with the new capital good.

Thus, whereas the mainstream makes no distinction between saving and investing, in the Keynes approach motivations to save and to invest are completely distinct and investors and savers are looking to different prices.

The discussion of the long-term expectations set out in Chapter 12 completes the understanding of the investment decision, and the introduction of the concept of *animal spirits* into the framework of this kind of decision renders the Keynes approach more comprehensive and realistic. In Chick’s words (1983, p.121), “*it was Keynes’s view that animal spirits substantially dominated the investment decision,*” and the influence of the MEC on investment “*is merely that part of the decision which is amenable to economic analysis.*”

Chapter 12 is certainly one of the most important chapters of the whole *GT*. A thorough reading of it reveals to the reader the most important concepts in Keynes’s work. In that chapter, Keynes discusses how long-term expectations are formed. As we have seen in the discussion of the MEC, when an investor has to decide how

much to invest in a new capital good, he makes assumptions about its prospective yields. However, what is peculiar in Keynes's analysis is the basis on which these expectations are grounded.

To understand this point we have to bear in mind that Keynes treats 'time' as historical. This means that time is irreversible and decisions are irrevocable. Moreover, the past is unrepeatable and the future is unknown and unknowable. Today's decisions cannot be made using the past as a perfect image⁷ of the future and the complete consequences of today's decisions can only be known in the future. Thus, this conception of time is strongly connected with uncertainty. Accordingly, when forming long-term expectations, investors cannot deduce from existing data what the future course of events will be. This means that the social process is not an ergodic process (cf. DAVIDSON, 1982-83), that is, the average calculated from past observation is different from the average of future outcomes (cf. DAVIDSON, 1991). Thus, there is no replicability and the economic process is time-dependent.

However, the existence of uncertainty, and thereby, the impossibility of making use of frequency distributions does not imply some kind of nihilism⁸. What is wrong with this interpretation is that it implies that expectations are only formed based on some kind of demonstrative logic amenable to formal representation (cf. DOW, 1996a). In Keynes's approach, long-term expectations are formed based on convention, qualitative judgement and intuition. These non-formalised elements provide the basis for action.

The fact that agents base their behaviours on habits and conventions means that they have to have some hypotheses to guide their decisions. What are these hypotheses?

- i) Human agents have a passive behaviour concerning the future. "*Single investors did not think they could influence or determine the future.*" (CARABELLI, 1988, p. 224) In addition, it is considered that recent facts are "*a more serviceable guide to the future than a candid examination of past experience would show it to have been hitherto.*" (C.W. Vol. XIV, p.114);

7 The past could be used as a basis for action but this does not mean that the future is a mirror of the past.

8 According to Keynes, the *animal spirits* - a characteristic of human nature - make nihilism an impossibility. In an environment of true uncertainty, what makes the difference in the decision process is exactly this characteristic of human behaviour. As Keynes points out,

Most, probably, of our decisions to do something positive, the full consequences of which will be drawn out over many days to come, can only be taken as a result of animal spirits - of a spontaneous urge to action rather than inaction, and not as the outcome of weighted average of quantitative benefits multiplied by quantitative probabilities. (C.W. Vol. VII, p. 161)

- ii) Conventional judgement. “*We endeavour to fall back on the judgement of the rest of the world which is perhaps better informed.*” (C.W. Vol. XIV, p. 114);
- iii) Economic agents assume that the “*existing state of opinion as expressed in prices and the character of existing output is based on a correct summing up of the future prospects.*” (C.W. Vol. XIV, p. 114). So, economic agents behave as if they are perfect Benthamite calculators.

The third hypothesis deserves some consideration. In Chapter 11, Keynes stresses the importance of a sort of calculus in the investment decision, even if it is based on an expected variable (marginal efficiency of capital). However, in the next chapter he makes very clear that it is naive to have confidence in this calculus, as the grounds for belief in it are very weak (see Dow, 1989). As Keynes says,

It would be foolish, in forming our expectations, to attach great weight to matters which are very uncertain. It is reasonable, therefore, to be guided to a considerable degree by the facts about which we feel somewhat confident, even though they may be less decisively relevant to the issue than the other facts about which our knowledge is vague and scanty. (C.W. Vol. VII, p. 148)

If it is “foolish”, then the investor must base his/her decision on other criteria, which for Keynes means “convention”. Thus, Chapter 11 has to be understood as “*describing the technique by which investors apply as if habit*” (CARABELLI, 1988, p. 225), whereas in Chapter 12 Keynes makes it clear that the long-term expectations and the confidence in them are the most important factors in the investment decision.

2. THE NEOCLASSICAL THEORY OF INVESTMENT

In economic literature the expression “neoclassical theory of investment” has more than one definition. In this article, the term “neoclassical” means the method of analysis which is based on,

- a) what Simon (1976) has defined as substantive rationality: “*Behavior is substantively rational when it is appropriate to the achievement of goals within the limits imposed by given conditions and constraints.*” (p. 130) Moreover, these goals are commonly “*some form of utility or profit maximisation*” (LAVOIE, 1992, p. 51); and

- b) equilibrium, which should be understood as “*a logical structure built on a priori assumptions about behaviour; with ancillary mathematical assumptions employed which render the system potentially capable of yielding the solution of a unique, stable equilibrium position.*” (DOW, 1996b, p. 116)

It is obvious that this methodological definition of the “neoclassical theory of investment” (hereafter NTI) covers a very large range of theories. However, the differences among these theories are irrelevant in respect to the comparison with the Keynes approach.

The firm’s maximisation problem, in the NTI approach, is to choose the paths of employment and investment that maximise its net real cash flow, subject to the evolution of the capital stock. Letting V_t be the value of the firm at time t , the firm’s problem is

$$V_t = \max \int_t^{\infty} X_t R(t, s) ds \quad (1)$$

$$\text{subject to } \Delta K_t = I_t - \theta K_t \quad (2)$$

where:

$X_t = Y(K_t, L_t) - w_t L_t - p_t I_t$ is the net real cash flow;

$R(t, s) = \exp\left[-\int_t^s r_v\right]$ is the discount factor that discounts real cash flows at date s back to date t ;

r_t is the instantaneous real rate of interest at time t ;

θ is the depreciation rate.

Considering a standard neoclassical production function, the solution of the problem above (using the standard optimal control theory) can be expressed in the following equations:

$$Y_L(K_t, L_t) = w_t \quad (3)$$

$$Y_K(K_t, L_t) = (r + s)\mu = c_u \quad (4)$$

$$p_t = \mu_t \quad (5)$$

where, μ is the Lagrange multiplier or the costate variable of the Hamiltonian.

Equation (3) shows that the firm hires labour until the point at which the marginal revenue product of labour is equal to the wage rate (w), the marginal cost of labour. Similarly, the marginal revenue of a unit of capital is set equal to its marginal cost, $(r + \delta)\mu_t$, where μ_t is the shadow price of an additional unit of capital (4), which is the famous Jorgenson definition of user cost (c_u) without taxes. Finally, equation (5) shows that a firm chooses a rate of investment such that its marginal cost p_t is equal to the value of an additional unit of installed capital, μ_t (or equal to the shadow price).

Assuming constant returns of scale in K_t and L_t and a constant elasticity of substitution between K_t and L_t (Cobb-Douglas function), Jorgenson (1963) concludes that in steady-state the desired amount of capital stock, K^* , is proportional to revenue Y , and inversely proportional to the user cost, c_u :

$$K^* = \gamma Y / c_u \quad (6)$$

Jorgenson concludes his model by defining the investment equation, which relates the account of investment to changes in the desired capital between two periods of time, as shown below:

$$I_t = \left\{ \sum_{i=0}^n \beta_i [K_{t-i}^* - K_{t-1-i}^*] \right\} + \theta K_t \quad (7)$$

where β is the power series of the lag operator.

As pointed out by Abel (1990), “Jorgenson assumed that there is some exogenous mechanism that determines the rate at which the gap between the desired capital stock and the actual capital stock is closed.” In addition, as Jorgenson assumes elasticity of substitution between capital and labour is equal to one, the desired capital stock, and thereby the investment, depends only on the ratio of revenue to the user cost of capital.⁹

9 JORGENSON defines user cost as “implicit rental of one unit of capital service per period of time.”(1963, p. 249)

Moreover, if we suppose that there is no substitutability between labour and capital, it is possible to transform equation (7) into the famous accelerator model (ABEL, 1990, p. 761),

$$I_t = \left\{ \sum_{i=0}^n \beta_i [Y_{t-i} - Y_{t-1-i}] \right\} + \theta K_t \quad (8)$$

The introduction of adjustment cost into the model does not imply significant modifications to the results. The idea of adjustment cost was introduced by Eisner and Strotz (1963), and it is a non-negative function and is convex in the rate of investment I_t .¹⁰

Let $z_t(I_t, K_t)$ be the adjustment cost function. This is related to the cost of an increase in capital stock and the speed of this increment. It is more costly to achieve this increase rapidly than slowly.

The introduction of the adjustment cost function into the model changes the equation of the real cash flow as follows:

$$X_t = Y(K_t, L_t) - w_t L_t - p_t I_t - Z_t(I_t, K_t) \quad (9)$$

In the solution of the maximisation problem, the marginal cost of the investment is now expressed by $p_t + z_t(I_t, K_t)$, which means that in choosing its rate of investment, a firm has to equate this marginal cost to the value of an additional unit of installed capital, μ .

$$p_t + Z_t(I_t, K_t) = \mu_t \quad (10)$$

Equation (10) shows that the investment rate is positively related to the value of μ ¹¹, the value of an additional unit of installed capital, which is also known as the *marginal* μ , or the shadow price.

10 There are different formulations for the minimum value of the adjustment function. In its original formulation, the adjustment cost has a value of zero at zero investment. (EISNER & STROTZ, 1963) Many authors have been following this conception (HAYASHI, 1982; BLANCHARD & FISCHER, 1989, among others). Recently, Abel and Eberly have developed a model of an augmented adjustment cost which includes the possibility of fixed costs, and thereby is greater than zero even at zero investment. (ABEL & EBERLY, 1994)

11 Blanchard and Fischer show, after some algebraic transformations, that positive rates of investment require $\mu > 1$, and at $\mu = 1$ the rate of investment is equal to zero. (BLANCHARD & FISCHER, 1989, p. 62)

A further development of the model incorporates a new definition of the user cost (c), which can be expressed in the following way,

$$Y_k(K_p, L_t) = (r_t + \delta)\mu_t + \mu^* + z_k(I_p, K_t) = c_u \quad (11)$$

where:

μ_t is the shadow price, and

μ^* is the capital gain.

Equation (11) states that the marginal product of capital is equal to the user cost plus the adjustment cost. As we can see, the only distinction between this equation and the original Jorgenson conditions is that the adjustment cost in Jorgenson's approach does not exist, so the marginal adjustment cost related to an increase in the capital stock is equal to zero.

An important variation on the Neoclassical Theory of Investment is the so called Tobin q -theory (Brainard and Tobin, 1968 and Tobin, 1969). Its importance comes from the claim of the authors that their interpretation is based on the Keynes approach. According to them, investment is a positive function of the ratio, q , of the market value of equity to its replacement cost. Alternatively, Tobin (1969) also defines q as the ratio between R (the marginal *productivity* of capital relative to replacement cost) to r_k , the rate of return on equity. According to this theory,

Investment is stimulated when capital is valued more highly in the market than it cost to produce it, and discouraged when its valuation is less than its replacement cost. Another way to state the same point is to say that investment is encouraged when the market yield on equity r_k is low relative to the real returns to physical investment. (BRAINARD & TOBIN, 1968, p, 357)

What is important in the q -theory is its claim that it allows the understanding of the links between the real and the financial sector. In the authors' words,

An increase in q , the market valuation, can occur as a result of an increase in the marginal efficiency of capital r ; i.e., as a result of events exogenous to the financial sector. But an increase in q may also occur as a consequence of financial events that reduce r_k , the yield that investors require in order to hold equity capital. Indeed, this is the sole linkage in the model through which financial events, including monetary policies, affect the real economy. In other words,

the valuation of investment goods relative to their cost is the prime indicator and proper target of monetary policy. (BRAINARD & TOBIN, 1968, p, 357)

In the same way as adjustment cost, the introduction of ‘uncertainty’ into the NTI model does not represent significant modification. The explanation for this is related to the concept of ‘uncertainty’ used by the NTI approach. According to Hirshleifer & Riley (1992, p. 7) there are five elements that characterise the decision an investor makes under ‘uncertainty’:

- (i) a *set of acts* available for the agents;
- (ii) a *set of states* available to Nature;
- (iii) a *consequence function* showing outcomes under all combinations of acts and states;
- (iv) a *probability function* expressing his beliefs (as to the likelihood of Nature choosing each and every state);
- (v) an *elementary utility function* (or *preference-scaling function*) measuring the desirability of the different possible consequences to him.

It is important to note that to use the NTI approach to make a decision under conditions of ‘uncertainty’, it is not necessary for the *probability function* described in (iv) to be an objective probability distribution. For the results that the NTI approach intends to reach, it is sufficient to use subjective probability distributions, which basically are indices of the subjective belief in outcomes.

Using the expected-utility rule, individuals can rank their preferences from the utility derived from their actions. “Given certain ‘postulates of rational choice’, there is a way of assigning a cardinal preference-scaling function over consequences such that the Expected-utility Rule determines the individual’s preference ranking $U(x)$ over actions” (HIRSHEIFER & RILEY, 1992, p. 14), where $U(x)$ is the utility function. This utility function is calculated as the mathematical expectation (the probability-weighted average) of the consequences.

As individuals know all possible results with their probability distribution, and are able to rank these results in a preferential scaling, it is possible to define three patterns of individual behaviour related to these results. First, when persons prefer a certain consequence to any risk prospect whose mathematical expectation equals that certainty, it is said that these persons display *risk aversion*. Second, if these persons behave in the opposite way they are *risk-preferrers*. Finally, if they are indifferent to these two alternatives (certainty and risk) it is said that they are *risk-neutral*.

It is worth considering two aspects of this concept of ‘uncertainty’. First, in the NTI approach of ‘uncertainty’, the individuals are not allowed any kind of vagueness or confusion. They always know what is the best possible action to do, even if they recognise that they have imperfect information. As pointed out by Hirshleifer & Riley (1992, p. 8),

our excuse for not picturing vagueness or confusion is that we are trying to model economics, not psychology. Even the very simplest models in economic textbooks, for example indifference-curve diagrams, implicitly postulate a degree of precise self-knowledge that is descriptively unrealistic. The ultimate justification, for indifference-curve diagrams or for theories of decision under uncertainty, is the ability of such models to help us understand and predict behaviour.

This rejection of any kind of vagueness or confusion is a direct consequence of the assumptions. As the probability distribution is always supposed known, there is no source for any kind of haze.

Second, the NTI approach claims to recognise that there is a distinction between risk and ‘uncertainty’ as postulated by Keynes (*C.W.*, Vol. VII) and Knight (1921). However, they consider this distinction a sterile one, as they can find their results using a subjective probability distribution. (HIRSHLEIFER & RILEY, 1992, p. 9) We will return to this point later.

The introduction of ‘uncertainty’ in the NTI model (in the way explained above) does not alter the results. As shown by Blanchard & Fischer (1989), Abel (1990), Dixit & Pindyck (1993), Abel & Eberly (1994), among others, the main conclusions of the model with certainty remain the same when ‘uncertainty’ is introduced. In this case, if the expected present value of marginal revenue products of capital increases, the optimal rate of investment increases accordingly. Some slight modifications are shown by Dixit & Pindyck (1993). Using the concept of user cost of capital, they show that in the presence of ‘uncertainty’ and irreversibility of investment, the critical profit level for investment now becomes greater than the user cost. In the same way, using Tobin’s q theory, the critical value of q now becomes greater than one.

3. THEORETICAL COMPARISON

It is evident from the previous discussion that there is a major difference between the Keynes and the Neoclassical Theory of Investment, that is, the understanding of the marginal efficiency of capital and its relation with the interest rate.

Since the publication of *GT*, one of the most important and widespread interpretations of the MEC concept has been that it is equal to the concept of Physical Marginal Productivity of Capital (PMPC). As we saw in Section II, this view was incorporated in both the NTI approach and its variation (*q*-theory). However, this interpretation has been systematically denied by Post-Keynesian authors, and even Keynes made explicit his disagreement with this opinion (e.g. KEYNES, C.W. Vol. VII, p. 137 - 41).

The MEC relates the expected sales of the goods produced by a new capital good with the cost of investment (supply price). The PMPC, on the other hand, is a physical relation between the total output and the variation in the quantity of one factor of production. In Eichner's words, "*the essential point ... is that while Keynes's concept of the marginal efficiency of capital does not require that the ratio of capital to other types of inputs vary, the marginal productivity concept does.*" (EICHNER, 1991, p. 430)

What made these different concepts appear similar in mainstream economics, is that it assumes that all future output will *necessarily* be sold. Using this assumption, the mainstream transmutes a physical relationship (PMPC) into a monetary relationship. This transformation is only possible because mainstream economics incorporates the Say Law in its framework, which is rejected by Keynes.

Keynes, on many occasions, makes it clear that he completely disagrees with the use of marginal productivity of capital as the determinant of the earnings of capital. This is particularly so when he discusses the effect on the marginal efficiency of capital of an expectation of changes in the prospective cost of production related to an expected innovation. As he says:

The output from the equipment produced today will have to compete, in the course of its life, with the output from equipment produced subsequently, [...] perhaps by an improved technique, which is content with a lower price for its output and will be increased in quantity until the price of its output has fallen to the lower figure with which it is content. Moreover, the entrepreneur's profit (in terms of money) from equipment, old or new, will be reduced, if all output comes to be produced cheaply. In so far as such as developments are

foreseen as probable, or even as possible, the marginal efficiency of capital produced today is appropriately diminished.(KEYNES, C.W. Vol. VII, p. 141)

As one can see from the quotation above, Keynes's stress on the expectations of the investors, and consequently on their beliefs, makes it clear that for him the investment decision is a speculative process. In another passage, he says:

The reader should note that the marginal efficiency of capital is here defined in terms of the expectations of yield and of the current supply price of the capital asset. It depends on the rate of return expected to be obtainable on money if it were invested in a newly produced asset; not on the historical result of what an investment has yielded on its original cost if we look back on its record after its life is over.(C.W. Vol. VII, p. 136)

Thus, as a speculative process, it is evident that the MEC cannot be based on physical products or on features of physical products as productivity.

It is important to note that if one is able to agree that MEC and marginal productivity of capital are distinct things one must conclude that there is no ground for the supposed link between the monetary and real sectors in Tobin's analysis.

Despite Keynes's arguments, mainstream economics continues to use both the MEC and the PMPC as synonymous. This interpretation has implications for the understanding of the role of the interest rate.

For NTI - which, in its origin, claims that its interpretation of this point is to be found in Keynes (HICKS, 1937) - there is an inverse relation between the amount of investment and the interest rate. For NTI theorists, the investment will be carried until the marginal productivity of capital - which is decreasing - becomes equal to the interest rate. As the latter decreases, the investment is increased until the decreasing marginal productivity of capital equates to the new interest rate.

Indeed, Keynes, as we have seen above, relates his MEC with the current interest rate, but in a different way. Keynes points out that, at any period of time, the prospective returns of many different kinds of investment can be calculated and thus also their marginal efficiency of capital. If these investments are arrayed in the descending order of their MEC, it should be possible to derive an investment demand schedule. This MEC schedule will be compared with the rate of interest, and obviously, an investment at which the MEC is lower than the interest rate will not be made.

This contrast with the interest rate has led to interpretations that erroneously generalise this comparison into a direct relationship. That is,

$$I = f(r)$$

So, according to this view, *coeteris paribus* (including here technology and the expectations) as the interest rate changes, the amount of investment changes inversely. This interpretation is a complete misunderstanding of Keynes's view of the investment decision. First of all, it is impossible to admit changes in interest rate and simultaneously suppose that the expectations will be the same.¹² This is a wrong interpretation of Keynes's work. Secondly, it is based on a confusion about relevant variables in the investment process. In Keynes's words,

The equality between the stock of capital goods offered and stock demanded will be brought about by the prices of capital goods, not by the rate of interest. It is equality between the demand and supply of loans of money, i.e. of debts, which is brought about by the rate of interest. (C.W. Vol. VII, p. 186)

Moreover, as discussed above, the NTI approach misinterprets one of the most important aspects of the Keynes investment theory, namely, the concept of marginal efficiency of capital. To calculate the marginal efficiency of capital, one has to relate the *expected value of future* returns with the *present* supply price of equipment. In Keynes' words,

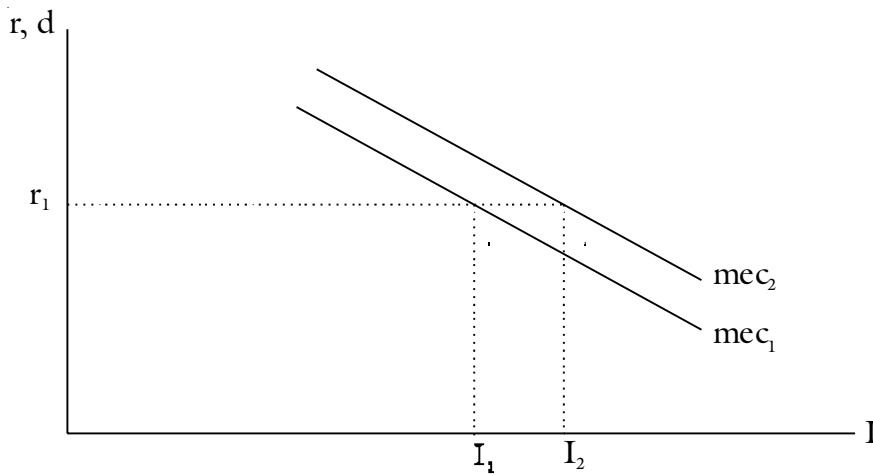
The schedule of the marginal efficiency of capital is of fundamental importance because it is mainly through this factor (much more than through the rate of interest) that the expectation of the future influences the present. (C.W. Vol. VII, p.145)

The figure below will help us to clarify the relation between interest rate and the amount of investment. The figure shows that, given the initial expectations about the future, the intersection between the mec_1 and the market interest rate (r_1) gives the total amount of investment (I_1). If for some reason the state of expectations about the future changes positively, the marginal efficiency schedule curve will shift (from mec_1 to mec_2), as shown in Figure 2. Thus, with the same interest rate we have two different amounts of investment, each one related to *different states*

12 As in Keynes's monetary economy the interest rate is a monetary phenomenon, changes in its value should reflect the liquidity preference of the society and this could affect the expectation about future behaviour of the demand.

of expectation. What is important here, is to note that the state of expectation alters the position of the MEC curve. The direct relation supposed by the NTI approach is possible only under the assumption of perfect knowledge of the future. Under complete certainty there will be only one possible position for the MEC curve, and only one possible rational outcome.

FIGURE 2



where :

r is the interest rate

d is the marginal efficiency of capital

mec_1 is the schedule of the marginal efficiency of capital given the *initial* state of expectations about the future;

mec_2 is the schedule of the marginal efficiency of capital given the *new* state of expectation about the future.

A variation in the interest rate may affect the investment level through indirect chains. If this variation alters the state of expectations, the MEC curve will move and the new amount of investment will be defined by the intersection of this new MEC schedule and the new given interest rate. However, this new amount of investment will be different from the old amount depending on the conditions on which industry operates. Since the concept of supply price reflects capacity, there is a presumption of idle capacity, otherwise the MEC would be truncated at the point of full capacity, so the increase in demand resulting from a decrease in the interest rate will have the consequence of an expansion of the amount of

investment.¹³ But, if one supposes that the capital goods industries work with full capacity or the increase in demand is higher than the idle planned capacity, then there will be no alteration in the amount of investment. Keynes illustrates this argument as follows:

Suppose, for example, that the extensive increase in the demand for capital in general is due to a fall in the rate of interest. I would suggest that the sentence be rewritten: In so far, therefore, as the extensive increase in the demand for capital goods cannot be immediately met by an increase in the total stock, it will have to be held in check for the time being by a rise in the supply price of capital goods sufficient to keep the marginal efficiency of capital in equilibrium with the rate of interest without there being any material change in the scale of investment. (C.W. Vol. VII, p. 187, n. 2)

What is important here is the fact that, in any case, the reflection on the MEC provided by changes in the expected demand flow is the primary cause of possible changes in the volume of investment, not in the interest rate.

4. METHODOLOGICAL COMPARISON

A fully understanding of the differences shown above can only be achieved if one goes deeper into the methodological comparison between the two interpretations. Behind the disagreement about MEC, uncertainty, concept of time and the role of interest rate, there is, an underlying difference between the methodological approaches used, which, in the same way, determines a divergent comprehension of the investment decision. In this section, we intend to show how different methodological approaches can dictate the final conclusions of each theory.

Economic analysis can be understood in terms of hierarchy. We have the following levels: statements, theory, methodology and mode of thought. The statements are made in relation to the real world. Sometimes some prescription of policy could be included in the same level as statement. These statements are made according to some theoretical view about economic events. Theory itself is based on some methodological approach, which has some correspondence with modes of thought (cf. DOW, 1994).

¹³ Supposing that the increase in demand is less than the idle planned capacity.

In economic analysis, a theory that serves as a basis for statements and/or policy prescription is always made explicit. However, in many situations, the methodology applied is not. The fourth level of hierarchy - mode of thought - is, on almost every occasion, left implicit. As it serves as a basis for the choice of methodology and, as the latter serves as a basis for theory and statements, the discussion of mode of thought is crucial.

Here, we adopt Dow's (1985, 1994, 1996) definition of mode of thought: "*Mode of thought refers to the level at which a particular world-view and technique of analysis are appraised. ... [It] enables an economist to order observations and ideas in such a way as to form a basis for theorising.*" (DOW, 1994, p.146)

Historically the most important mode of thought was the Cartesian/Euclidean approach. It consists in a procedure where some basic axioms are established and, through some deductive logic, theorems are derived. These basic axioms have to be true or at least self-evident, whereas the theorems need not necessarily be self-evident. As one can see, mathematics has the best features in which to use this mode of thought, since mathematics is a definitional system, which is defined independently of the observation of reality in such a way that it is possible to establish incontestable axioms. However, it has been applied in many other disciplines, and as pointed out by Dow (1985, p.12), all western scientific thought has been influenced by the ideal of closed systems of axiomatic logic, which is the logical sequel of the utilisation of the Cartesian/Euclidean mode of thought.

The Cartesian/Euclidean approach has two important features that are derived from the aim of building a closed system. The first is called reductionism (or atomism). The necessity for the axioms to be as close as possible to the truth or at least the best approximation of what is self-evident means that the propositions must be broken into their smallest part ('atom').

Second, there is a tendency in this approach to classify "*concepts, statements and events according to duals, as belonging to only one of two all encompassing categories: true or false, logical or illogical, positive or normative, fact or opinion and so on.*" (DOW, 1985, p. 14) As one can see, dualism excludes any kind of middle ground: "*given a category x, any entity must fall either into the category x, or into the category not-x.*" (DOW, 1990, p. 143) It is a method that claims the advantage of imposing order on ideas, or on perceptions of reality, and allows the possibility of drawing distinctions.

The acceptance of this mode of thought imposes a methodological approach that preserves its main features. In economics this methodology can be defined as deductivism/positivism and is used by the mainstream economics.¹⁴ (DOW, 1985, 1990, 1994, 1996B; LAWSON, 1994a, 1994b, 1995; GERRARD, 1990, 1995) For the mainstream, the central aim of science is to seek out constant conjunctions, so as to make possible some kind of ‘rational prediction’;

it [positivism] is a claim that human knowledge takes the form of sense-experience or impression. [...] if particular knowledge is of events sensed in experience then any possibility of general (including scientific) knowledge must be of the constant patterns, if any, that such events reveal in space and over time. (LAWSON, 1994b, p. 111)

The objective of this approach is to find universal laws, in such a way that whenever event x occurs then event y follows. For statements of this kind to be valid, or in other words, to have a wide applicability, it is necessary for them to be applied in a sealed system. Thus, for mainstream economics, reality is seen as a closed system, with atomistic events. Moreover, this conception of reality allows the use of experience (empirical test) to prove the validity of some theorem.¹⁵

Mainstream economists have made use of this mode of thought and this methodology, even though they do not make explicit these options. We can find the most important features of the Cartesian/Euclidean mode of thought (atomism and dualism) and the positivist methodology (science based on event regularity and social theory based upon the atomistic individual) in the discussion about the neoclassical approach to the investment decision.

14 This methodological choice is not evident. On many occasions, mainstream authors have argued that methodological questions do not matter, and in some cases are inadmissible. Hahn (1992) makes explicit his opinion about this question and says that discussing methodology “*makes little difference for economic practice, and any effect it does have is unhelpful.*” (DOW, 1994, p. 14) BACKHOUSE (1992) and LAWSON (1992) point out that this opinion is in itself a methodological approach. LAWSON (1994b) explains that this position is connected to the positivist approach. For positivism, empirical success is sufficient to establish connection to the truth of facts. So, every time that empirical success is alleged to be achieved, discussion about methodology becomes irrelevant.

15 This aspect does not carry consensus in the mainstream economics. There is a group, including Hahn in particular, which argues that if the theorems are deduced and proved using a logical deductive process, it is not necessary to go to experience to prove the validity of the theorem. For more details see DOW (1994) and in the special number of the *Economic Journal*, v. 101, 1991.

The atomism is shown by the utilisation of the individual and of the firm as the smallest units of enquiry. The maximising behaviour of the firm and the individual is taken as a true or self-evident characteristic of the system and so, it is used as an axiom.¹⁶ As this axiom is always observed there is only one procedure for the economic agent when he/she has to decide how much to invest. The economic agent is completely passive. He/she only responds to changes in the value of an external variable, the interest rate.

Dualism is also observed. Given the relevant variables, there are only two dual patterns of behaviour: 'rational', which means maximisation, and 'irrational', which means any other behaviour. Finally, the relationship between interest rate and investment is defined such that always when the interest rate increases (decreases) the amount of investment decreases (increases), thus assuming the character of a universal law. However, as shown before, universal laws can only operate in closed systems. The fixed causality between interest rate and investment can only be valid if expectations are given (closed system).

The use of this methodology explains why, for the mainstream, the treatment of *animal spirits* constitutes a problem. As Dow and Dow (1985, p. 54) comment,

If the long-term expectations are generated by the conventional optimising procedure, using 'rational criteria', then it is simply a question of finding the appropriate technique with which to model them. The only other possibility considered is that the process as irrational. But irrational in this context can only mean not susceptible to modelling; rationality in general requires the application of reason, which may nevertheless elude modelling.

Despite the fact that one can find regularities in special circumstances in the physical sciences,¹⁷ the use of this mode of thought and this methodology in social science is seldom helpful and may generate (and frequently does generate) statements

16 One could argue that the utilisation of methods of maximisation of utility functions is not only a privilege of mainstream economics, as it is also a procedure used by Keynes in Chapter 2, specially when he accepts the first postulate of classical theory. However it is widely accepted that Keynes by 1939,

had begun to realized that he accepted too readily the first classical postulate [...] together with marginal productivity theory. (BROTHWELL, 1997, p. 3)

17 It is important to stress that these circumstances are very special and do not correspond to the wide view of the physical sciences. CHICK (1995) makes this very clear. Discussing PRIGOGINE & STENGERS's (1984) view of physical science she says:

They argue that there are two apparently contradictory tendencies operating in the physical world: ordered systems are continually breaking down, producing chaos where before there was order, and, under special but not particularly rare conditions, chaos is being transformed into order. (p. 26-7)

about the real world which are unrealistic. The basic reason for this inapplicability in social science is that human beings make intentional choices. If this is true, we must agree that human beings, when asked to make a choice, can choose an action different from that they had chosen in the past. Moreover, sometimes when asked to make a choice, human beings have to deal with future expectations and current facts which add a component of uncertainty in this process. So, in order to deal with these different choices, which produce different results, the world must be considered an open system. (LAWSON, 1994a, 1995)

To deal with the elements raised above it is necessary to use an alternative mode of thought and methodology. These could be the Babylonian mode of thought (DOW, 1985, 1990, 1996), together with the critical realism methodology. (LAWSON, 1988, 1994a, 1995) The Babylonian approach can be defined as holistic. It starts from the recognition of the impossibility in general of establishing watertight axioms, since reality is taken as complex, that is, it is regarded

as being beyond complete understanding, and thus endemically uncertain. [...] The Babylonian approach, then, is to construct theory in a non-dualist manner in order to promote correspondence with reality. (DOW, 1990, p. 146)

This method of thought assumes open systems and derives methodology from that assumption. A different logic allows one to deal with open theoretical systems (cf. DOW, 1994, p. 26).¹⁸

The Babylonian approach can appear inconsistent, since every part of the analysis cannot be gathered into a unique formal and cohesive system. But, as pointed out by Dow (1994, p. 148), this conception of inconsistency cannot be applied to a Babylonian system, since it involves the acceptance of the dualist approach. A system can be logically consistent even when it departs from a different starting point. *“More weight is attached to the conclusions of any one chain of reasoning if it is confirmed by the conclusions of the other chains of reasoning.”* (DOW, 1990)¹⁹

18 This perspective of reality implies that any approach about any issue can be made using a variety of starting points, many of them reinforcing each other. The complete picture is built using partial analyses. It is worth noting that these partial analyses may be derived from some axioms, but what is important is that these axioms cannot be true or self-evident as in the Cartesian/Euclidean approach, but rather a conclusion of another partial analysis.

19 By no means should the definition of Babylonian mode of thought given here be compared with the methodological anarchy proposed by FEYERABEND (1970). By assuming that reality is complex and beyond *complete* understanding, the Babylonian assertion is that it is impossible to capture the whole complexity and organicity of reality using a rigid, closed and exclusive mode of thought, such as the Cartesian/Euclidean.

Keynes's works are an important example of the use of the Babylonian approach. Indeed, its use by Keynes is very well shown by Kregel (1976). He showed that Keynes used different hypotheses about the effects of uncertainty and disappointment to explain different problems chosen for analysis.²⁰ Moreover, the question of which variables are to be classified as independent, given and dependent will also be dependent on the choice of the problem to be analysed. In Kregel's words,

The post-Keynesian approach is simply to use the general model of the General Theory to expand the analysis to cover different questions by taking the determinants of the Theory in different combinations. It is thus in no sense 'ill-equipped', and has simply chosen to analyse additional problems because all the problems of interest cannot be analysed under Keynesian methodology at the same time nor with the same division of the economic determinants. (1976, p. 219)

The discussion about the relationship between investment and interest rate is, again, a good illustration. Chapter 12 of *G.T.* clearly shows that expectations and interest rate are related to each other. Variations in one leads to changes into another. There is no a fixed causality. Variations on the liquidity preference of the economic agents alter the interest rate which in turn affects the expectations of investors. On the other hand, changes on expectations due to political problems can affect the liquidity preference, and so alter the interest rate. To capture this relationship a method of thought distinct from the Euclidean/Cartesian should be used, as it cannot deal with the complexity of this relationship.

Another important feature of the Babylonian system is its relation to uncertainty, which gives it an epistemological justification for its use. Presuming that full knowledge of reality is impossible to attain, the use of partial system analysis allows one to deal with the incompleteness of knowledge. In the Babylonian thought, information is not treated as known or not known, a dual approach. An intermediate category can exist. Indeed, information can be treated as known, but subject to uncertainty of various degrees which are in general non-quantifiable.

Keynes's view of uncertainty makes it clear that he can be labelled as Babylonian. For the Keynes approach, as the future is not a mirror of the past, there is an inherent uncertainty related to actions, of which the sequels still exist for a long

20 This approach can be seen when Keynes discusses the three 'psychological' relations: the propensity to consume, the marginal efficiency of capital and liquidity preference.

time. In this situation, some actions must be made with incomplete knowledge²¹ about their premises and their sequels. In other words, knowledge is partial and “*then the decision maker has to fill the voids, has to ‘create’ the additional premises which may be needed in order to apply logical methods to them.*” (CARVALHO, 1988, p. 74)

In addition, the relevance of the set of knowledge is connected to the duration of the process in question. Thus, the longer the process, the greater the relevance of knowledge derived by induction. This is very clear in the following quotation from Keynes:

The considerations upon which expectations of prospective yields are based are partly existing facts which we can assume to be known more or less for certain, and partly future events which can only be forecast with more or less confidence. (1973, p. 147)

However it is important to observe that for Keynes, it is impossible, due to uncertainty, to make use of any kind of frequency distribution that would transform uncertainty into risk. In Keynes’s words,

The whole object of the accumulation of wealth is to produce results, at a comparatively distant, and sometimes at an indefinitely distant date. Thus the fact that our knowledge of the future is fluctuating, vague and uncertain, renders wealth a peculiarly unsuitable subject for the methods of the classical economic theory By ‘uncertain’ knowledge, let me explain, I do not mean merely to distinguish what is known for certain from what is only probable. The game of roulette is not subject, in this sense, to uncertainty; nor is the prospect of a Victory bond being drawn. Or, again, the expectation of life is only

21 It is important to note that this incomplete knowledge is very different from that supposed by the New Keynesians. It is not a problem of market failure or information cost. Keynes’s concept of knowledge is connected to his view of probabilities. It differs radically from the classical and subjective views of probability. In Keynes’s concept, “*probability was embodied in arguments and judgements which had no direct relationship with empirical and physical entities and which referred to the process of reasoning, rather than to the happening of events.*” (CARABELLI, 1988, p. 15) Probability is a relation between two arguments: one set as a premise and the other set as a conclusion. This conclusion is achieved by using logical deductions. To this conclusion we designed some degree of confidence. This relation, between the premise and the conclusion is said to be probable (CARABELLI, 1988, 1992, 1995; CARVALHO, 1988, 1995; LAWSON, 1985, 1988, 1994, 1995; O’DONNELL 1989, 1990, 1991; among others):

It is clear from the quotations above that probability is a branch of logic, in Keynes’s formulation. As pointed out by CARABELLI (1988, p. 18) “*Keynes’s logic of probability appealed to those categories traditionally associated with the theory of belief, opinion, limited knowledge, logical doubt and ignorance, i.e. uncertainty and probability.*”

slightly uncertain. Even the weather is only moderately uncertain. The sense in which I am using the term is that in which the prospect of a European war is uncertain, or the price of copper and the rate of the interest twenty years hence, or the obsolescence of a new invention, or the position of private wealth owners in the social system in 1970. About these matters there is no scientific basis on which to form any calculable probability whatever. We simply do not know. (CW XIV, p. 113-4)

It is clear from the quotation above that in the presence of uncertainty, decision makers have to deal with insufficient information and thereby, insufficient conditions for predicting future events by frequency distributions.

Again, the distinction between the two theories and their methods becomes clear. For the Neoclassical approach, dealing with uncertainty is possible as far as individuals are able to construct probabilities distributions and rank these results in a preferential scaling. This requires that all possible futures outcomes must be known in advance. It is possible, then, to predict human behaviour, and the aim of elaborating universal laws is achieved. What becomes clear at this point is the fact that to fulfil the axioms of the Cartesian/Euclidean mode of thought the Neoclassical approach must incorporate ‘uncertainty’ in a such way that a probabilistic knowledge is always possible. ‘Uncertainty’ must be represented by numerical probabilities allowing the utilisation of the axioms of rationality previously defined. In this process, the Neoclassical approach has transformed uncertainty into risk.

As a consequence, there is no place in this approach for the discussion of Chapter 12 of the *General Theory*, and therefore, there is no space for the concept of conventions. If all theory must be logically derived from axioms, which, by assumption, are true, the axiomatic definition of individual rationality should be able to explain the economic process as a whole. There is no necessity of making use of procedures that take into account the opinion of other agents, like conventions.

Keynes, on the other hand, has a method that allows him to deal with true uncertainty. As Dow points out:

Keynes’s experience of the economic system indicated that it was predominantly organic [not atomistic]. Economists’ theoretical knowledge or belief must therefore be inferred from experience using methods of which statistical inference would form only a small part.

*... The most obvious consequence of a generally organic view of the economy as a whole was to regard macroeconomics as something other than an aggregation of atomistic parts.*²² (1989, p. 151)

From what we have so far been discussing, it is evident that for Keynes the use of a mode of thought based on universal laws and watertight axioms is not helpful for the study of the economy. Moreover, the adoption of the Babylonian mode of thought makes the use of the deductivism/positivism methodological approach insufficient and imposes the necessity of searching for an alternative methodology.

The methodological approach used by Keynes is very close to the critical realism methodology. (LAWSON, 1988, 1994a, 1995) The conception of the world for critical realism can be understood from the following quotation:

the world is composed not only of events and our experience or impression of them, but also of (irreducible) structures and mechanisms, powers and tendencies, etc., that, although perhaps not directly observable, nevertheless underlie actual events that we experience and govern or produce them. (LAWSON, 1994, p. 262)

The critical realistic view, argues that the world is composed of objects that are structured and intransitive. The former means that the world cannot be reduced to events of experience and the latter means that these objects exist and act independently of their identification.

To identify the underlying causal process which generates the surface outcomes it is necessary to use an “*open system methodology, where assumptions are simplifications rather than abstractions, and where a range of (often incommensurate) methods are employed in order to build up knowledge of complexity of the economic system.*” (DOW, 1996a, p. 16)

This methodology is very clear in Keynes’s investment decision. The discussion about the formation of long-term expectations, conventions and *animal spirits* shows how Keynes is concerned about the organic structure of the economy and how difficult it is to discuss these matters through an atomistic approach and universal laws. The investor is not alone in the world and, does not make his/her

22 One important example of this is known by the name of fallacy of composition:

For a single individual a means of accumulating was to abstain from consuming and allot his abstinence to saving. However, this attitude would have been foolish for the collectively as whole [as the income will decrease]. A way to increase the collective wealth was to spend more and to give up saving. (CARABELLI, 1988, p. 213)

decisions without taking into account the environment in which he/she is inserted, which must be considered as being a result of previous economic agents' decisions. So, when Keynes brings into account conventions as an important element on the decision process, he is, in fact, taking into consideration the structures and mechanisms that govern or facilitate the phenomena of experience.

5. CONCLUSION: WHAT IS THE REAL DIFFERENCE?

In the discussion above we have seen that there is a difference between the mainstream economics and Keynes' thought in their understanding of the investment decision process. This difference is determined by the fact that they look at distinct variables during the investment process. For the NTI approach, the marginal productivity of capital and the interest rate play a fundamental role in this process. For Keynes, on the other hand, the most important aspects are the long-term expectations, conventions and the *animal spirits*.

However, these differences are, in part, a consequence of the use of distinct methodologies and modes of thought. For the mainstream economics, the correct mode of thought is the Cartesian/Euclidean, which claims that the best procedure for scientific investigation is the establishment of basic axioms and, through some deductive logic, the derivation of some theorems. As we have seen, this mode of thought sustains the deductivism/positivism methodological approach which asserts that the central aim of any science is to seek out constant conjunctions, so as to make predictions possible.

The use of this mode of thought, and methodology by the mainstream economics restricted its analysis of economic events. The sacred necessity of looking for universal laws means that, to be considered scientific, an event must show regularities. Moreover, these regularities must exclude the possibility of results that are not foreseen. This framework imposes a conception of time (mechanical) and a process of formation of expectations which guarantee the observation of these regularities. This methodological structure allows the concepts of MEC and PMPC to appear similar, and determines both (a) a directed relationship between interest rate and the amount of investment and (b) the use of one concept of uncertainty (risk) that fits in with the use of probability distributions.

Moreover, the acceptance of this methodological structure renders Chapter 12 of the *GT* completely redundant and the concepts of long-term expectations, conventional behaviour and *animal spirits* non-scientific.

The Keynes approach, on the other hand, uses another mode of thought (Babylonian) and, thereby, another methodology. Starting from the understanding that reality is organic, complex and uncertain, the Babylonian method claims that any approach to any issue could be made using a variety of starting points. This means that this mode of thought rejects two important characteristics of the Cartesian/Euclidean method - reductionism and dualism - which means the rejection also of the use of universal laws and watertight axioms. Indeed, to understand the process of the investment decision, Keynes utilises a variety of chains of reasoning to deal with economic agents that behave *as if* they are Benthamite calculators - as we see in the discussion of Chapter 11 - *but*, at the same time, use conventional behaviour as a guide for their actual actions.

Therefore, this mode of thought demands the use of an alternative methodology from that used by the mainstream economics, and this is called critical realism.²³ Here, the primary concern of science is the study of the deepest governing structures. It is only this methodological approach that can attain a full understanding of the formation of long-term expectations. For Keynes, these expectations are not grounded in regularities or events that exist on the surface, but are formed through conventions. This can only be understood if one analyses habits, institutions, their relations, and the whole social structure, which are phenomena that work beneath the surface of the economic system.

What must be understood is that the two schools of thought discussed here use different scientific paradigms,²⁴ which implies that the appraisal of one school of thought has to be carried out using the same paradigm as this specific school. The sequel is that methodology comparisons and, more importantly, methodology appraisals constitute a very difficult process. However, when we make the analysis together with the discussion of the mode of thought, it seems that it is possible, at least, to discuss the suitability of a specific methodology to the specific object of analysis of a particular discipline.

23 Despite the fact that Keynes does not assume this methodology explicitly, a deeper analysis could show that he uses many of the characteristics of the critical realism methodology.

24 The definition of scientific paradigms used here is strictly related to Kuhn's (1962) definition. For him the concept of paradigm is comprehensive. It ranges from practical analysis to the world view and mode of thought of the scientist. Among other things, a paradigm defines the technical procedures; the relevant problems to be responded to; and, the correct approach to these problems. "*In 'holding' a certain paradigm, what the scientists 'see', or do not 'see', is determined by the paradigm. Observations are not independent and 'theory free', but rather are a product of the paradigm and are 'theory laden'.*" (HANDS, 1994, p. 77) It is clear that the recognition of the existence of many paradigms implies a Babylonian mode of thought, meaning the recognition of the possibility of more than one way of interpreting the reality.

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