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Fabio D'Orlando⁽¹⁾ and Eleonora Sanfilippo⁽²⁾

(1) Dipartimento di Scienze Economiche, Università di Cassino

(2) Dipartimento di Scienze Economiche, Università di Roma, La Sapienza

Behavioral Foundations for the Keynesian Consumption Function

Dipartimento di Scienze Economiche

Università degli Studi di Cassino

Via S. Angelo Località Folcara, Cassino (FR)

Tel. +39 0776 2994734 Email dipse@eco.unicas.it

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Fabio D'Orlando and Eleonora Sanfilippo*

Abstract

This paper has two main goals. The first is to show that behavioral rather than maximizing principles emerge from textual analysis as the microeconomic foundations for Keynes's Consumption Theory; the second goal is to demonstrate that it is possible to ground a Keynesian-type aggregate Consumption function on the basis of (some of) the principles underlying contemporary behavioral models.

Keywords: Keynes, Behavioral Economics, Keynesian Theory, Consumption, Hyperbolic Discounting, Mental Accounting

JEL classifications: B22, D01, D11, D91, E12, E21

Introduction

In his Nobel Lecture Akerlof, emphasizing the increasing role that behavioral principles play within contemporary macroeconomics, argues that “in the spirit of Keynes’ *General Theory*” behavioral macroeconomists are substituting the ‘primitive’ New Classical micro-foundations of macroeconomics with more realistic behavioral assumptions “grounded in psychological and sociological observation” (Akerlof 2002, p. 413).

Starting from the above statement our paper aims to show (i) that behavioral rather than maximizing principles emerge as the micro-foundations for Keynes’s Consumption Theory; and (ii) that it is possible, theoretically legitimate and empirically robust to ground a Keynesian-type aggregate consumption function on (some of) the principles underlying contemporary behavioral models.

To pursue the first goal we adopt a history-of-ideas perspective. We perform textual analysis of the *General Theory* and its preparatory works to ascertain, with particular reference to consumption behavior, to what extent Keynes assumes maximizing agents and to what extent he refers, rather, to alternative psychological motivations for individuals’ decisions, in a spirit closer to contemporary behavioral models. We argue that, although Keynes never explicitly refuses the maximizing principle, this principle plays virtually no role in the *General Theory*; on the contrary, he often attaches a crucial role to alternative behavioral principles. For the particular case of consumption, Keynes grounds consumers’ decisions almost exclusively on these alternative behavioral principles.

To pursue the second goal we adopt a theoretical perspective. We investigate contemporary behavioral economics approaches in search for empirically robust foundations for the Keynesian consumption function (both in Keynes’s original and in later *IS-LM* version). In doing so we conclude that the main psychological principles which, in addition to the standard maximizing principle, influence individuals’ consumption decisions (and which are quite similar to some of the psychological motivations for individuals’ behavior adopted by Keynes) are *preference for procrastination*, *shortsightedness* (or *myopia*) and *miscalculation*, *mental budgeting* and *debt aversion*; whereas the behavioral economics theoretical approaches that have been applied in the study of these principles are mainly *hyperbolic discounting* and *mental accounting*. We also show that adopting neoclassical foundations (maximizing agents and exponential discounting) we get results coherent with the standard life-cycle and permanent-income models, but which are at odds with the empirical evidence. On the other hand, by adopting these alternative behavioral foundations we get results coherent both with the empirical evidence and with Keynesian Consumption theory. In particular, we show that both the psychological principles

* Fabio D’Orlando, Dipartimento di Scienze Economiche, Università di Cassino, e-mail fabio.dorlando@unicas.it; Eleonora Sanfilippo, Dipartimento di Scienze Economiche, Università di Roma, La Sapienza, e-mail eleonora.sanfilippo@uniroma1.it. A preliminary version of this paper was presented at the Iarep-Sabe 2006 Conference and at a seminar held in the University of Cassino. We wish to thank all those who participated in these presentations, and in particular Marina Bianchi, Andreas Chai, Sergio Nisticò and Maurizio Pugno. The usual *caveat* apply.

which characterize consumers' behavior and the method that can be used for building the aggregate consumption function are common to Keynes and contemporary behavioral approach. As a consequence our behaviorally based consumption function is similar – although not identical in its formal specification – to the Keynesian one.

The paper is organized as follows.

Section 1 discusses the role of the maximizing principle in Keynes's approach and investigates the presence of behaviorally-inspired determinants for individuals' decisions in Keynes's consumption theory. Section 2 discusses whether an empirically robust aggregate consumption function can be obtained on the basis of the life-cycle and permanent-income hypotheses, i.e. within the traditional (maximizing) approach. Section 3 explores the possibility of building an empirically robust aggregate consumption function of Keynesian flavor on the basis of behavioral assumptions, hence outside the traditional (maximizing) approach. Section 4 sums up the main results and draws the conclusions.

1. Maximizing and Behavioral Principles in Keynes's Consumption Theory

1.1 The maximizing principle in Keynes's analysis

Textual analysis of the entire *General Theory* comes up with very few references to maximizing procedures and these references are also somewhat ambiguous. One is contained in Chapter 6 of the book, in which Keynes gives his definitions of income, saving and investment: “[T]he entrepreneur's income [...] is taken as being equal to the quantity, depending on his scale of production, which he endeavors to maximize, i.e. to his gross profit in the ordinary sense of this term; - which agrees with common sense. [...] Since it is the entrepreneur's expectation of the excess of this quantity over his outgoings to the other factors of production which he endeavors to maximize when he decides how much employment to give to the other factors of production, it is the quantity which is causally significant for employment.” (Keynes 1973a, pp. 53-4; see also p. 56 and pp. 24-5).

Another passage is contained in the preparatory work of the *General Theory*, in one of the drafts of Chapter 3¹ and represents the most explicit reference to the marginal cost=marginal revenue rule: “[E]ach firm calculates the prospective selling price of its output and its variable costs in respect of output on various possible scales of production. [...] Output is then pushed to the point at which the prospective selling price no longer exceeds the marginal variable cost” (Keynes 1979, p. 98; see also p. 89). However, even though there is no textual evidence anywhere in the *General Theory* of an explicit rejection of profit maximization by Keynes, this passage, perhaps significantly, was not included in the final version.²

A clearer reference to marginal analysis is contained in Keynes's treatment of the labour market (Chapter 2 of the *General Theory*), and in particular in his acceptance of the first postulate of the neoclassical theory of employment (the equality between wage and marginal productivity of labour) and of the inverse relation between real wages and the level of employment (Keynes 1973a, pp. 17-18). This result – as Keynes himself admits - is a consequence of the assumption of decreasing marginal productivity of labour for increasing level of employment and production, which is fully in accordance with the traditional theory and implies maximizing procedures by entrepreneurs. However, Keynes himself introduces many other elements of realism in the analysis to explain the level of the aggregate employment in the system and workers' behavior. First of all, the consideration of the institutional character of the labour market: the workers, organised in trade unions, negotiate the monetary and not real wages, whose level they are not able to control directly;³ secondly, they are much more sensitive to changes in monetary than in real wages; thirdly, they tend to resist decreasing wage levels and in so doing, they contribute to the stability of the economic system. In Keynes's words: “[T]hus it is fortunate that the workers, though unconsciously, are instinctively more reasonable economists than the classical school, inasmuch as they resist reductions of money wages [...]” (Keynes 1973a, p. 14)

The non-stabilizing role of wage-flexibility for the whole economy is fully examined by Keynes in Chapter 19, where the conclusion is reached that a decrease in monetary/real wages is not able to guarantee the result of full

¹ The Chapter was entitled “The Characteristics of An Entrepreneur Economy” (according to the December 1933 Table of Contents of the *General Theory*, Keynes 1973b, p. 421).

² For an analysis of the role of profit maximization in Keynes's *General Theory* see Marcuzzo and Sanfilippo (2007, pp. 76-78).

³ “There may exist no expedient by which labour as a whole can reduce its real wage to a given figure by making revised money bargains with entrepreneurs” (Keynes 1973a, p.13).

employment and, on the contrary, can negatively affect the level of aggregate demand and employment *via* its influence on the propensity to consume, the rate of interest and the preference for liquidity (Keynes 1973a, pp. 260-68). One of the main arguments suggested by Keynes is of an institutionalist type, based on the deterioration of the industrial relations and widespread sense of uncertainty brought about by a reduction in wages. Therefore, the partial acceptance of marginal analysis in the labour market does not imply optimal results in terms of employment for the system as a whole.

In the end, it appears evident that when Keynes “adopts” the marginal language, he employs it quite sparingly, as if it were extraneous to the core of his model. Reliance on marginal analysis and maximizing behaviour is, in fact, very limited in the *General Theory*, whose main message lies in its being *other* than the “classical” theory. Keynes’s criticism of the latter consists “in pointing out that its tacit assumptions are seldom or never satisfied, with the result that it cannot solve the economic problems of the actual world” (Keynes 1973a, p. 378).

1.2 Behavioral principles in Keynes’s consumption theory

Turning, now, to Keynes’s consumption theory, we not only find that analysis of the consumption choices by individuals in terms of the standard optimizing consumer theory is totally absent from the *General Theory*, but also that Keynes proposes an alternative treatment for the determinants of individuals’ consumption decisions. Keynes addresses consumption directly from an aggregate point of view (Keynes 1973a, pp. 61-65; pp. 91 and ff.), maintaining that the level of aggregate consumption increases at a decreasing rate as the current income increases (Keynes 1973a, p. 96). Notwithstanding this ‘macro’ approach to the question, he also discusses in some detail the fundamental determinants of individual consumption but, interestingly enough for a Marshallian pupil, he does so without any reference to the maximizing utility *apparatus*. On the contrary, he provides a list of psychological *motivations* which are behind consumption behavior, emphasizing “subjective factors” which lead individuals “to refrain from spending out of their incomes” or, conversely, to consume. According to Keynes, the psychological motives behind abstinence are: “Precaution, Foresight, Calculation, Improvement, Independence, Enterprise, Pride and Avarice”; whereas the motives behind consumption are: “Enjoyment, Shortsighted-ness, Generosity, Miscalculation, Ostentation and Extravagance” (Keynes 1973a, pp. 107-8). In the same Chapter of the *General Theory* devoted to analysis of the propensity to consume (Chap. 9), there is also extensive discussion of the fundamental role played by social and institutional factors in determining the “strength” of these psychological motives (Keynes 1973a, p. 109).

Evident here is the distance between Keynes’s approach to consumption and the traditional one. The influence attributed to psychological explanations of individuals’ behavior, the consideration given to social and institutional aspects, and the mix between ‘rational’ (e.g. Foresight, Calculation) and ‘irrational’ (e.g. Pride, Avarice, Ostentation) elements as determinants of the consumption/saving levels open a gap between Keynes and neoclassical analysis, on the one hand, while at the same time constituting a bridge with the contemporary behavioral approach, which appears, in this light, as a further development of Keynes’s initial intuitions.

Two other elements characterizing Keynes’s analysis are relevant to our discussion.

First, there is the idea of a stable consumption profile of individuals, at least in the short period, because sociological and institutional factors exercise their influence only smoothly and slowly. In this context we should also include Keynes’s critique of the negative dependence of expenditure on consumption from the rate of interest assumed by the neoclassical school⁴ (Keynes 1973a, p. 93). According to Keynes, decisions of consumption and saving are not taken simultaneously in function of the rate of interest but, rather, people first decide how much to consume, and then how to allocate their savings in different activities.

Second, there is the adhesion to a sort of *status quo* bias according to which people, especially in a context of ‘fundamental’ uncertainty, follow in their actions and decisions (both of consumption and production) some conventional rules as for example, “to take the existing situation and to project it into the future, modified only to the extent that we have more or less definitive reasons for expecting a change” (Keynes 1973a, p. 148).

In conclusion, the main elements in Keynes’s analysis which are in sharp contrast with the application, by agents, of the standard neoclassical maximizing behavior are: (i) the adoption of the notion of ‘fundamental’ uncertainty and related concept of ‘logical’ probability (see, e.g., Carabelli 1988); (ii) the role attributed to the social context and the influence of habits and conventions on individuals’ actions; (iii) the employment of a notion of rationality which is different from the neoclassical one not only because of the lack of full information - as is also admitted in the New Keynesian literature - but because it explicitly considers the complexity of the

⁴ As far as the long period is concerned the influence of changes in the rate of interest “modify social habits considerably [...] in which direction it would be hard to say [...]”. As far as the short period is concerned “fluctuation in the rate of interest is not likely [...] to have much direct *influence* on spending either way” (Keynes 1973a, p. 93, emphasis in the text).

mental processes and the impact of non-economic factors like psychological, emotional and socially driven considerations on individuals' decisions.

2. Maximizing Foundations for an Aggregate Consumption Function

2.1 Nobel-prize winning hypotheses

The psychological richness of the microeconomic foundations of Keynes's aggregate consumption function had little impact on Post-Keynesian economic thought and was rapidly obscured by the neoclassical attempt to base aggregate consumption, too, on the traditional maximizing approach. In particular Modigliani and Brumberg (1954) and Friedman (1957) provided the initial inspiration for models within which consumption and saving functions, both for the short and for the long run, were obtained on the basis of the life-cycle and permanent-income hypotheses. Their procedure, which provides micro-foundations for consumption/saving functions assuming intertemporal utility maximization by rational consumers, soon became the standard one, while Keynes's psychological principles were discarded as useless for the purpose of rigorously founding aggregate functions.

Although the neoclassical attempt to create micro-foundations for consumption and saving functions now seems a success story, the consumption function that the neoclassicals succeed in microfounding was very different from the Keynesian one. This would have been a minor problem if the neoclassical function were empirically more robust than the Keynesian one, but this was not the case. Thus, after a phase of uncritical enthusiasm, it became clear that the neoclassical aggregate consumption function, at least in its original version, entailed a number of empirical drawbacks. So it was that the neoclassicals were forced to introduce "ad hoc" hypotheses within their approach to obtain results compatible with the empirical evidence. Nonetheless, the main drawbacks of the approach are still there today.

2.2 Current consumption as the result of intertemporal utility maximization: the life-cycle and permanent-income hypotheses

The standard neoclassical approach obtains an aggregate consumption function on the basis of intertemporal maximizing behavior of a representative consumer. In this context the consumer will maximize intertemporal utility by solving the problem:

$$1) \quad \begin{cases} \max & \sum_{t=0}^T \frac{1}{(1+\gamma)^t} u(C_t) \\ \text{sub} & \sum_{t=0}^T \frac{C_t}{(1+i)^t} - \sum_{t=0}^T \frac{Y_t}{(1+i)^t} = 0 \end{cases}$$

Where C_t is consumption at time t , Y_t is income at time t , i is the interest rate, $\sum_{t=0}^T \frac{1}{(1+\gamma)^t} \cdot u(C_t)$ is an

intertemporal (separable) utility function, $\frac{1}{(1+\gamma)^t}$ is the discount factor (γ is the subjective time preference:

the larger γ is, the more the consumer prefers present to future consumption) and

$\sum_{t=0}^T \frac{C_t}{(1+i)^t} - \sum_{t=0}^T \frac{Y_t}{(1+i)^t} = 0$ is the intertemporal budgeting constraint.

It is worth noting that in this approach subjects maximize *and* discount exponentially.

If we simplify the analysis by assuming that only two times exist, $t = 1$ (present) and $t = 2$ (future), and that

the intertemporal utility function is a logarithmic function such as $U = \log C_1 + \frac{1}{1+\gamma} \log C_2$, the consumer's problem becomes:

$$2) \quad \begin{cases} \max & \log C_1 + \frac{1}{(1+\gamma)} \log C_2 \\ \text{sub} & C_1 + \frac{C_2}{(1+i)} - Y_1 - \frac{Y_2}{(1+i)} = 0 \end{cases}$$

Solving this problem and posing $C = C_1$ gives:

$$3) \quad C = \frac{1+\gamma}{2+\gamma} \cdot \left[Y_1 + \frac{Y_2}{(1+i)} \right].$$

For the general case ($T > 2$ and generic utility functions) the relation is slightly more complex, but its main implications remain the same. In particular, since in this context wealth, W , can be considered as the current

income plus the present value of the future income (i.e. $W = Y_1 + \frac{Y_2}{1+i}$)⁵, the consumption function 3 can be written as follows:

$$4) \quad C = \frac{1+\gamma}{2+\gamma} \cdot W.$$

Relation 4 is coherent with the results obtained within the life-cycle approach proposed by Modigliani and Brumberg. In their approach current consumption is a function of wealth, and not of current income alone (or mainly), as it was in the Keynesian approach.

We can also refer to relation 4 to derive the consumption function which results on the basis of Friedman's permanent-income hypothesis.⁶ Within our context permanent-income can be defined as that constant level of

income Y_P which solves $Y_P + \frac{Y_P}{1+i} = Y_1 + \frac{Y_2}{1+i}$, so that wealth W can be defined as:

$$5) \quad W = Y_P \frac{2+i}{1+i}.$$

Substituting the right side of relation 5 for W in relation 4, the consumption function can be written as follows:

$$6) \quad C = \frac{1+\gamma}{2+\gamma} \cdot \frac{2+i}{1+i} Y_P = k \cdot Y_P.$$

This latter formulation is coherent with Friedman's approach.

Neoclassical micro-foundation of the consumption function thus breaks the link between current income and current consumption that characterizes Keynes's original function $C = \mathcal{X}(Y)$ and its later *IS-LM* version

$C = \bar{C} + c(Y_d)$: current consumption depends on wealth or, as in relation 6, on permanent-income.

According to this approach, an *unpredictable* change in current income (and hence in wealth) generates the so called consumption smoothing effect, i.e. a change in both current and (by means of saving) future consumption, since "individuals would wish to smooth consumption and not let it fluctuate with short-run fluctuations in income" (Meghir 2004, p. 293); whereas a *predictable* change in current income generates no change in current and future consumption, since individuals have already taken that change into account when planning their (current and future) utility maximizing flow of consumption. Consumption smoothing has important implications for the representative agent's consumption profile through time. According to Thaler (1990, p. 195) "[t]he heart of the life-cycle theory of saving is a hump-shaped age-saving profile. The young, whose incomes are below their permanent-income, borrow to finance consumption; the middle-aged save for retirement; the old dissave".

⁵ In general, wealth is the sum of a number of elements: real capital, financial capital, current labour income, future (discounted) labour income, etc. Here we have considered wealth as depending on income alone; we could extend the analysis and consider a broader concept of wealth, leaving our conclusions unchanged.

⁶ In our highly simplified analysis we have deliberately ignored the main difference existing between the life-cycle and the permanent-income model, i.e. the circumstance that the time horizon is finite for Modigliani and Brumberg, whereas it is infinite for Friedman.

2.3 The empirical weaknesses of the life-cycle/permanent-income hypothesis

The consumption theory based on the life-cycle/permanent-income hypothesis comes up against a number of problems in coping with many empirical findings, and two major problems in particular: current consumption seems more sensitive to current income than is predicted by the theory; and, curiously enough, different forms of wealth (and also gains of different amounts) appear to have different effects on consumption, i.e. are not close substitutes.

The first problem follows from the empirical finding that quite often unpredictable changes in aggregate income generate variations mainly in current (and not in future) aggregate consumption, whereas predictable changes in aggregate income generate variations in aggregate consumption only when they actually occur (and not when individuals know that they will occur) – two results which are at odds with the life-cycle/permanent-income hypothesis. Current consumption seems therefore to be closely tracking current income and its fluctuations (predictable and unpredictable), whereas it does not seem sensitive enough to (expected) future income and asset price, i.e. to consumers' wealth or permanent-income. A number of empirical studies supported these results in the 80s (see e.g. Flavin 1981 and 1983, Hall and Mishkin 1982, Wilcox 1989, Zeldes 1989b) and later (see e.g. Singleton 1990, Carroll 1994, Shea 1995, Souleles 2002, Stephens 2003). As a result individuals do not seem prone to save when the standard theory predicts they should (i.e. when they are middle-aged and should be saving for retirement), and also do not seem prone to borrow when they should (i.e. when they are young with temporarily low but expected high future income).

The second problem is particularly intriguing from a theoretical viewpoint. In empirical studies and experiments subjects seem to violate the fungibility of money: "The essence of the [traditional] theory is that an individual spends the annuity value of his or her wealth in each period, so an extra dollar of housing wealth, pension wealth, or current lottery winnings all generate the same increase in consumption. [...] this prediction of the theory is not consistent with behavior. People behave in ways that suggest that the source or location of wealth can influence the marginal propensity to spend it" (Thaler 1994, p. 188). Furthermore, also the dimension of the increase in income/wealth can influence the marginal propensity to consume: in particular, people seem to have larger marginal propensity to consume out of small rather than out of large extra amount of income/wealth (Souleles 2002). Summing up, the propensity to consume out of *identical increases* in *different kinds* of income/wealth is different, and the propensity to consume out of *different increases* in *the same kind* of income/wealth is different too (see also Thaler 1990 and Heath and Soll 1996).

The neoclassical approach has mainly tried to address the first of the above problems. Developments of the theory have been based on the hypothesis that subjects have liquidity constraints, i.e. they cannot borrow (see e.g. Flavin 1981 and Blinder and Deaton 1985). In this way neoclassicals claim that they can explain the co-movement of consumption and income. But even this amended version of the theory seems ill-equipped to cope with the empirical data, since it can explain why people do not borrow, but cannot explain why they do not save enough. And the empirical evidence is robust in showing that in most cases people reduce their consumption when they retire since they have not saved enough during their life (see Bernheim, Skinner and Weinberg 1997; Banks, Blundell and Tanner 1998).⁷ Hence, also the consideration of liquidity constraints can explain only half of the whole story.

We believe that behavioral economics might do a better job in providing theoretical explanations of the empirical findings which were at the basis of our discussion of the weaknesses of the traditional approach.

3. Behavioral Foundations for an Aggregate Consumption Function

3.1 Micro-foundations within a behavioral context

On the behavioral side, interest in the consumer's choice was generated with the birth of behavioral economics. Nonetheless, in spite of the circumstance that "[a]lmost every where Keynes blamed market failures on psychological propensities (as in consumption)" (Akerlof 2002, p. 428), to the best of our knowledge no one has till now explicitly made the attempt to link the "new" psychological principles referred to by (contemporary) behavioral economists when studying consumption behavior, with the "old" psychological principles referred to by Keynes when building his aggregate consumption function. Our argument is that, since the two sets of principles are actually quite similar, the enormous number of empirically based theoretical studies proposed by behavioral economics can contribute to provide sound and up-to-date micro-foundations for both the original

⁷ The standard approach faces other problems in deriving the explicit solution for consumption when uncertainty about future income exists. Solutions to these problems were provided (see e.g. Carroll 1992 and Zeldes 1989a) within models with impatient consumers and precautionary saving.

and later *IS-LM* version of Keynesian consumption function, reconciling the Keynesian approach with micro-foundations, and consumers' theoretically predicted behavior with the empirical evidence.

Unlike neoclassical theory, behavioral economics does not possess one single, simple principle (maximizing subjects) and one simple procedure (maximization under constraint) on the basis of which to ground, from a theoretical viewpoint, subjects' behavior. Behavioral economics is, rather, made of a variety of models and based on a multiplicity of determinants for subjects' behavior. Therefore, the problem of microfounding aggregate functions changes abruptly. Within the neoclassical approach, once given some more or less 'ad hoc' assumptions on the characteristics of the utility function, the maximizing procedure determines the form and the values of the parameters for the resulting aggregate function. Within a behavioral context, the lack of a single principle and a single procedure able to dominate the others implies that we can only speculate on the links between a great number of often vague principles and some general property of the aggregate function. It is hence not legitimate to derive aggregate functions on the basis of any simple mathematical procedure.

On these aspects behavioral economics and Keynes's method are identical. Keynes did not build his aggregate functions on a single principle and a single procedure. Rather, he indicated a plurality of psychological principles and discussed the connections among them and the properties of the aggregate functions (although his study of the psychological principles was not as deep as that made by the many models of behavioral economics). This procedure came in for criticism, with the argument that Keynes did not microfound his aggregate functions. But the opposite is true. In the presence of a multiplicity of possible determinants for subjects' behavior the correct microfounding method seems more a listing than a derivative procedure, as for the aggregate functions in behavioral economics.

The same arguments apply when we try to propose behavioral micro-foundations for the consumption function. In this case, a great number of psychological principles are in general able to explain, at least partially, some specific characteristics of the actual behavior of aggregate consumption. These psychological principles will enter our "list" of micro-determinants for the building of an aggregate behaviorally and empirically based consumption function. In the following pages we have tried to limit our list to the smallest possible number of principles compatible with the necessity to take account of empirical findings. The main among these principles are *preference for procrastination*, *shortsightedness* (or *myopia*) and *miscalculation*, *mental budgeting* and *debt aversion*. Many of these principles are quite similar to those used by Keynes in the construction of his consumption function, i.e. "Enjoyment, Shortsightedness, Generosity, Miscalculation, Ostentation and Extravagance" (Keynes 1973a, p. 108). And, moreover, all of them have been explained applying different theoretical approaches of behavioral economics.

It is important here to stress that it is far from our intentions to suggest that subjects never maximize intertemporally, never smooth consumption, and never consider wealth and future income in their consumption choices. Simply, we suggest that maximizing behavior (foresight and calculation, in Keynes's words) is neither the only nor the principal among the determinants of consumption choices (i.e. among the many items of our list of principles). It can contribute to the building of an empirically based consumption function on a level of equal importance with other behavioral principles (and their explicative models).

3.2 Preference for procrastination

The first principle, *preference for procrastination*, has recently been thoroughly studied within the *hyperbolic discounting* approach. This approach accepts maximizing behavior but criticizes the traditional procedure for obtaining an aggregate consumption function, which is based on *exponential* discount and implies time consistency (consumers make choices at time t for $t+n$ that they will confirm when $t+n$ arrives), since "[c]asual observation, introspection, and psychological research all suggest that the assumption of time consistency is importantly wrong. Our short term tendency to pursue immediate gratification is inconsistent with our long term preferences" (Rabin 1998, p. 38). If time consistency is not satisfied, agents make choices at time t for $t+n$ that they won't confirm when $t+n$ arrives. Another empirical finding that the exponential discounting procedure cannot grasp is that real "agents are relatively farsighted when making tradeoffs between rewards at different times in the future, but pursue immediate gratification when it is available" (Ho, Lim and Camerer 2006, p. 21). The implications of all these empirical findings are self-control problems or preference for procrastination (people decide to do tomorrow the unpleasant task they were supposed to do today, e.g. begin a diet or save, but when tomorrow arrives they decide to procrastinate to the day after tomorrow, and so on) and declining instead of constant discounting rates. Hyperbolic discounting models can cope with all these empirical findings without going too far from the neoclassical realm.

The first contribution on the theme of hyperbolic discounting was by Strotz (1956). He criticized the realism of the exponential discounting procedure and suggested that better specifications for the discounting function should imply declining discounting rates. However, he did not propose any specific alternative functional form. A number of specific functional forms have since been proposed (for a list see Angeletos, Laibson, Repetto, Tobacman and Weinberg 2001, p. 50, fn. 13; and Frederick, Loewenstein, O'Donoghue 2002, p. 360). In

general, “[h]yperbolic discount functions are characterized by a relatively high discount rate over short horizons and a relatively low discount rate over long horizons. This discount structure sets up a conflict between today’s preferences, and the preferences that will be held in the future” (Laibson 1997, p. 445).

The easiest way to model hyperbolic discounting is to write down the intertemporal utility function as

$$u = u(C_0) + \beta \sum_{t=1}^T \frac{1}{(1+t \cdot \gamma)} u(C_t), \text{ or even as } u = u(C_0) + \beta \sum_{t=1}^T \frac{1}{t} \cdot u(C_t).$$

However, often enough theoretical analysis refers to quasi-hyperbolic or present-biased models, within which the intertemporal utility

function becomes $u = u(C_0) + \beta \sum_{t=1}^T \frac{1}{(1+\gamma)^t} u(C_t)$, where $\beta < 1$ (see e.g. Phelps and Pollak 1968 and

Laibson 1997).

The existence of different possible hyperbolically discounted functions, coupled with different possible assumptions on the ‘smartness’ of subjects, have generated a number of different models. Some among these models are built on the hypothesis that consumers are “sophisticated”, i.e. that they have rational expectations (Laibson, Repetto and Tobacman 1998) and realize that tomorrow they will be unwilling to do what they are procrastinating today. Other models are built on the hypothesis that subjects are naïf (Strotz 1956, O’ Donoghue and Rabin 1999 and 2001) and do not realize that tomorrow they will be unwilling to do what they are procrastinating today.

All these approaches bear implications different from those of the standard framework but allow economists to treat hyperbolic discounting using otherwise traditional tools (see on this point Rabin 1998, p. 40). In particular, nothing changes in the idea that subjects maximize their utility function. The only difference is in the discounting method they apply. But the hyperbolic discounting approach models subjects that, albeit following a maximizing procedure, make time inconsistent choices (see e.g. Strotz 1956; Angeletos et al. 2001, pp. 51-52). This explains why hyperbolic discounting also represents a departure from the traditional concept of rationality (*contra* see Browning and Crossley 2001).

The hyperbolic discounting models hold two major implications for our analysis. First, due to problems of self-control that prevent people from saving, effective saving will always be less (and consumption more) than predicted with the traditional approach.⁸ Second, subjects make time inconsistent choices, so that the excess of consumption will spread through time. Hence hyperbolic discounting can theoretically account for the preference for procrastination and, at least partially, myopia. By accounting for the preference for procrastination hyperbolic discounting can explain why saving proves less than predicted by the traditional theory, but can alone explain neither insufficient borrowing, and hence the co-movement of income and consumption, nor the non-fungibility of money.⁹

From what precedes follows that the co-movement of income and consumption can only be the result of introducing ad hoc hypotheses. So that the role of hyperbolic discounting approach in the building of a behaviorally based aggregate consumption function is not essentially different from that played by liquidity constraints in the exponential discounting approach: one can explain insufficient saving, the other insufficient borrowing, both can be used as one among many theoretical building blocks for an empirically based consumption function, but neither of them can alone justify consumption tracking income. Moreover, neither hyperbolic discounting nor exponential discounting can address the other problems that we discussed in section 2.4 above. To deal with these problems and study models able to fully explain the co-movement of consumption and income without introducing special cases and “ad hoc” hypotheses we have to search for something else, and, to do so, we have to refer to psychological principles which are totally at odds with the intertemporal maximizing approach.

3.3 Myopia and miscalculation

Myopia and miscalculation are two among these principles, and they are at least partially explained by hyperbolic discounting (as we saw in section 3.2) and mental accounting (as we will see in section 3.4). Myopia implies that individuals fail to behave as the traditional life-cycle/permanent-income approach predicts because their capacity to correctly predict future events diminishes as these events go away in time. Miscalculation,

⁸ With reference to the analysis in section 2.3, the assumption that subjects discount hyperbolically covers the circumstance that saving for retirement is often less than what predicted by the traditional theory (and less than what subjects need for maintaining their level of consumption when retired).

⁹ Laibson’s model (1997), combining hyperbolic discounting with strong assumptions on the constraints that t selves are able to impose on the consumption behavior of $t+n$ selves, depicts subjects who cannot adequately smooth consumption, so that consumption tracks current income.

whether induced by myopia or not, implies that individuals fail to behave as the traditional life-cycle/permanent-income approach predicts because they are not able to solve the complex intertemporal maximization problems involved in consumption/saving choices (see e.g. Thaler 1994, p. 187). As a result, these approaches generate non-maximizing behavior.

It is certainly true that the mere recognition that people do not intertemporally maximize can suffice to criticize the validity of the standard approach, but it cannot suffice to build an aggregate consumption function on alternative theoretical bases. However if people do not intertemporally maximize, their current consumption will track current income and consumption smoothing disappears. Ultimately, therefore, rejection of intertemporal maximization is not only an element for criticism of the traditional approach, but also holds constructive implications.

3.4 Mental budgeting and debt aversion

The other non-maximizing principles that can be used in order to microfound an aggregate consumption function are *mental budgeting* and *debt aversion*. Mental Accounting seems the best theoretical scheme equipped to deal with both these principles.

Mental budgets are self-control devices: “consumers budget portions of their total resources to separate mental accounts (e.g. entertainment or household expenses) and then track expenses against the budgets. As expenses are incurred, they deplete the funds available in their account, which makes future purchases less likely” (Heath and Soll 1996, p. 40). In other words, certain amounts of money are ex-ante (before occasions of consumption arise) earmarked for specific types of consumption, and there is considerable reluctance to transfer money from one account (i.e. from one type of planned consumption) to another (i.e. to another type of planned consumption). It is worth noting that building inflexible budgets implies the impossibility of re-allocating money among different accounts, so that utility cannot be maximized.¹⁰ The behavioral economics theoretical schemes devoted to the study of mental budgeting is mental accounting, even if the concepts of mental budgeting and mental accounting are often used as synonymous. Mental accounting offers further fuel to critiques of consumers’ intertemporal maximizing behavior, and hence could also account for the Keynesian concepts of shortsightedness (or myopia) and miscalculation. But fundamentally mental accounting can explain the two crucial problems of non-fungibility of money (due to mental budgeting) and insufficient borrowing (due to debt aversion). Insufficient borrowing, coupled with insufficient saving, can explain the circumstance that consumption tracks income.

The violation of the fungibility of money follows from the circumstance that “people distinguish between wealth in categories like ‘current spendable income’ and ‘current assets’, and are more willing to consume an increase in current income [...] than an increase in current assets” (Heath and Soll 1996, p. 41). Mental accounting helps explain why the propensity to consume out of the same increases in different types of wealth/income (or out of different increases in the same type of wealth/income) is different (see e.g. Heath and Soll 1996 and Thaler 1990): different types/amounts of wealth/income go to different mental accounts and each mental account is linked with a different propensity to consume. Mental accounting can therefore explain what the life-cycle, the permanent-income and also the hyperbolic discounting approach cannot: why people consume different fractions out of different types/amounts of income.

The insufficient level of borrowing due to debt aversion follows from Prelec and Loewenstein’s “Double Entry Mental Accounting Theory” (see Prelec and Loewenstein 1998). According to them, subjects “establish mental accounts that create symbolic linkages between specific acts of consumption and specific payments. Acts of consumption and financial transactions call mental accounts to mind, which generates pleasure or pain depending on whether the accounts are in the red or in the black” (Prelec and Loewenstein 1998, p. 5). In particular, when acts of payment are delayed with respect to the consumption experience (as in credit purchased goods) “thoughts of payment can undermine the pleasures of consumption” (Prelec and Loewenstein 1998, p. 8), i.e. the utility deriving from actual consumption is reduced by the disutility deriving from expected payment so that subjects suffer utility losses. As a consequence, mental accounting can generate strong debt aversion (and even preference for pre-payment).¹¹

¹⁰ “[w]hen people budget too little money, they may underconsume goods that they desire. When they budget too much, they may overconsume goods that they desire less. These predictions clearly differ from those of economic consumer theory, which assumes that people always consume an optimal quantity of each good” (Heath and Soll 1996, p. 40).

¹¹ “Contrary to the standard prediction that people will finance purchase to minimize the present value of payments, our model predicts strong *debt aversion* – that they should prefer to prepay for consumption or to get paid for work after it is performed. Such pay-before sequences confer hedonic benefits because consumption can be enjoyed without thinking about the need to pay for it in the future” (Prelec and Loewenstein 1998, p. 4).

Debt aversion deriving from mental accounting can explain the paradoxical circumstance, for the standard life-cycle theory, that young people with temporarily low income but high future expected income “fail to borrow sufficiently against future earnings” (Prelec and Loewenstein 1998, p. 15). People are not unable to borrow: rather, they are unwilling to borrow due to debt aversion.

3.5 The microeconomic foundations for an aggregate consumption function

We have seen that a number of principles can be used as microeconomic determinants for a behaviourally based aggregate consumption function. Each of these principles is responsible for an empirical result and can be explained theoretically by referring to a behavioural model: preference for procrastination generates insufficient saving and can be accounted for with the hyperbolic discounting approach; myopia and miscalculation generate involuntary non-maximizing behaviour and can be accounted for with hyperbolic discounting and mental accounting; mental budgeting generates non-fungibility of money and can also be accounted for with mental accounting; debt aversion generates insufficient borrowing and can, again, be accounted for with mental accounting; preference for procrastination and debt aversion together make consumption track income and can be accounted for with hyperbolic discounting and mental accounting together (or by Laibson 1997 model alone); finally, maximizing behaviour (i.e. foresight and calculation) generates consumption smoothing and can be accounted for with the traditional maximization under constraint approach. Other psychological principles and explicatory models could be added. However, the short list we propose suffices to obtain a simple but sound, empirically-based aggregate consumption function.

The function described above increases the heuristic power of both the traditional neoclassical and the Keynesian approach, getting closer to the empirical evidence and taking account of the circumstance that, in the real world, decisions are taken responding to more than one (simple) principle. What this function cannot furnish is an a-priori evaluation of the weight of each principle in determining consumption behaviour when actual cases have to be studied. This shortcoming is an inevitable consequence of the circumstance that reality responds to a multiplicity of different rules whose actual relevance changes from case to case.

What remains to discuss is the method to be used to build construct this aggregate consumption function. If a multiplicity of behavioral principles exists, and maximizing behavior is only one principle among many others, then not only do we have to consider all of them when micro-founding the aggregate consumption function, but we must necessarily also change the micro-founding method. In other words, if the only behavioral principle of individuals were maximization under constraint, we could obtain the aggregate function as the result of a maximizing procedure alone. On the other hand, if maximizing behavior is no more than one single principle among many others, we cannot obtain the aggregate function on the basis of a maximizing procedure alone and must consider together all the different principles and all the different possible procedures which matter when building the consumption function. Hence, not only do we have to change the microeconomic behavioral principles (from always maximizing to often non-maximizing behaviors) and the number of them (from one single principle to many), but we must also change the method for building the aggregate consumption function (from maximizing procedures to other procedures).

The same problem had also been faced by Keynes, since his principles were more than one, and maximizing behavior was (at least) one among others. In an initial phase of his analysis he dealt with this problem by listing and discussing the microeconomic characteristics of the psychological principles affecting consumption. But, since his analysis was exploitable for the purpose of obtaining a fairly stable propensity to consume, he had no need to (and actually did not) go deeper into the macroeconomic implications of his list of principles, precisely formalizing the impact of these psychological principles on the consumption function. Incidentally, theoretical analysis capable of dealing with many of these principles simply did not exist at the time. Hence, he assumed as given these “subjective factors” and truncated his analysis by writing his very simple $C = \chi(Y)$ consumption function. All the post-*General Theory* (neoclassical and behavioral) theoretical developments discussed in this paper have shown that such a strategy is no longer sufficient, the very existence and relevance of a relation between consumption and income being questionable. Since theoretical models capable of dealing with these principles now exist, discussion of the impact of all the relevant psychological principles on aggregate consumption must and can be fully carried out, including explicitly all these principles (and all the models that explain these principles) in formal specification of the consumption function.

We believe that the first phase of Keynes’s method can be used in this case too: not a maximizing procedure, but listing of psychological principles with discussion of their relevance and their impact on the aggregate consumption function. Simply, Keynes’s procedure has to be fully implemented and driven to its natural conclusions.

3.6 Construction of the aggregate consumption function

Having discussed the microeconomic principles and the method to be used to build an aggregate consumption function, let us now go on to propose a possible formalization of it. However, some preliminary assumptions have to be made.

In the present paper we have shown that, in general, each type of income/wealth has an impact on consumption which depends on its characteristics and dimension, i.e. each type of income/wealth possesses its own propensity to consume. And nothing could in principle prevent the value of each of these propensities to consume from being the result of interaction among different principles. However, in our formalization we rule out this possibility by assuming that the propensity to consume out of a certain kind of income/wealth cannot depend on more than one single theoretical principle. With this assumption we can encompass all the different principles within the analysis without having to weight them. For the sake of simplicity we will also disregard the dependence of each propensity to consume on the size of income/wealth.

If preference for procrastination, myopia or shortsightedness, miscalculation, mental budgeting, debt aversion and maximizing behavior are the psychological principles, and hyperbolic discounting, mental accounting and maximization under constraint are the possible theoretical foundations for the consumption function, within a two-period time span (t and $t+1$) i consumer's consumption function could be written as follows:

$$7) \quad C^{i,t} = \bar{C}^{i,t} + \sum_{h=1}^H c_{Y,h}^{i,t} \cdot Y_h^{i,t} + \sum_{k=1}^K c_{Y,k}^{i,t+1} \cdot Y_k^{i,t+1} + \sum_{j=1}^J c_{W,j}^{i,t} \cdot W_j^{i,t}$$

In this formalization, for consumer i there exists a different propensity to consume $c_{Y,h}^{i,t}$ for each of the possible H types of current income $Y_h^{i,t}$, a different propensity to consume $c_{Y,k}^{i,t+1}$ for each of the possible K types of future discounted income $Y_k^{i,t+1}$ and a different propensity to consume $c_{W,j}^{i,t}$ for each of the possible J types of wealth $W_j^{i,t}$. Since this function holds for the single consumer, the aggregate consumption function for a universe of N consumers is:

$$8) \quad C^t = \sum_{i=1}^N \bar{C}^{i,t} + \sum_{i=1}^N \sum_{h=1}^H c_{Y,h}^{i,t} \cdot Y_h^{i,t} + \sum_{i=1}^N \sum_{k=1}^K c_{Y,k}^{i,t+1} \cdot Y_k^{i,t+1} + \sum_{i=1}^N \sum_{j=1}^J c_{W,j}^{i,t} \cdot W_j^{i,t}$$

In this functional relationship the propensity to consume varies across different kinds of income/wealth for the same consumer and varies across consumers for the same type of income/wealth. And, consistently with the overall philosophy of our approach, there is no single-principle rule, chosen a-priori – not even for the discounting procedure. Different principles and different procedures have the same legitimacy and each of them will be more or less suited for the treatment of the different real cases. As a result, future incomes can be either hyperbolically or exponentially discounted, depending on the kind of income and its dimension.¹² Finally $\bar{C}^{i,t}$ represents the measure of our ignorance regarding other determinants of the consumption function, i.e. the exogenously given quantity of consumption that is explained by causes other than those included in our list. It is worth noting that $\bar{C}^{i,t}$ is not a stochastic error term: it is not our intention, at least in this phase of study, to present a non-deterministic function.

We understand that our consumption function and the procedure for building it is less elegant, less formally sophisticated, much more complex and also much more difficult to apply for forecasting purposes than the traditional neoclassical and Keynesian ones. This may explain why economists prefer to use simple, elegant one-principle procedures. But nowadays, now that empirical analysis has shown that a multiplicity of principles influence consumption and theoretical analysis has developed models to formalize these influences, using single principle procedures almost exclusively is no longer justified. We therefore suggest that economists stop developing single-principle procedures devoted to the study of single special cases, often of little empirical relevance, and take full account of the complexity of the real world by studying the way in which a number of different principles (and of different theoretical approaches) combine to influence consumption behavior on a basis of a-priori theoretical equal importance.

As a result of the above considerations our function, although quite different from the Keynesian one, is however Keynesian in its inspiration: it is obtained on the basis of many of the Keynesian psychological principles and of a Keynesian method, and is built by driving the Keynesian approach to full implementation.

¹² These different discounting procedures have no impact on the formal specification of relation 8 due to the circumstance that our consumption function considers only time t and $t+1$.

4. Conclusions and possible developments

The main goal of our paper was to discuss the possibility of cross-fertilization between the Keynesian approach and contemporary behavioral economics, with particular reference to the consumption theory. We believe that this possibility exists, since behavioral economics and the Keynesian approach have a number of relevant theoretical foundations in common. In particular, our analysis has shown that:

- (i) the maximizing procedure is not at the heart of Keynes's consumption theory;
- (ii) a number of behavioral principles can be detected in Keynes's discussion of individual choices relating to consumption and many of these principles are quite similar to those used by behavioral economists;
- (iii) the traditional analysis of aggregate consumption based on maximizing agents shows serious empirical drawbacks and is not consistent with Keynes's consumption theory;
- (iv) analysis of aggregate consumption grounded on behavioral principles is possible, allows for better representation of reality itself, and is more consistent with Keynes's consumption theory;
- (v) such an approach has the great advantage of taking full theoretical account of the circumstance that actual consumption behaviors are the result of the contemporary operate of a plurality of behavioral principles.

Our paper simply indicates a direction for future research. Further studies are necessary in order to develop the consumption function here proposed and its formal properties better; more behavioral principles need to be scrutinized and possibly added to our list; the empirical robustness of our aggregate function needs to be fully tested. But we believe that one-principle theoretical approaches must be abandoned and that Keynes's work can be extremely useful in bringing contemporary behavioral economics into macroeconomics.

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