

Rhetoric and Methodology of Behavioral Economics: The Case of Intertemporal Choice

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Abstract

This paper aims to present and discuss some values in theory construction and the resulting methodological and rhetorical strategies adopted by behavioral economics in search of improved explanations and predictions of choice behavior. Its point of departure is the conjecture that changes in theorizing and methodological perspectives are motivated by doubts about whether the resemblance between the standard economic model of choice and reality is close enough given the purposes of explanation and prediction.

To undertake the foregoing task, it focuses attention on the terms of the debate about why (and how) to reform the behavioral foundations of the basic model of intertemporal choice (i.e. constant discounted utility model). More importantly, it will advance the thesis that behavioral economists' way of using experimental data to test and justify the hyperbolic discounting hypothesis is rather persuasive and has contributed to improved explanation of intertemporal choice anomalies, though it involves important methodological challenges.

Keywords: Rhetoric, Methodology, Economics, Psychology, Explanation

JEL Classification: B40, B41, D11, D91

Resumo

Este artigo apresenta e discute alguns valores de teorização e as resultantes estratégias metodológicas e retóricas adotadas pelos adeptos da economia comportamental em busca de melhores explicações e previsões do comportamento decisório. O seu ponto de partida é a conjectura de que mudanças nas perspectivas metodológicas e teóricas surgem a partir das dúvidas sobre se a aproximação entre o modelo econômico convencional de escolha racional e a realidade é suficientemente adequada para satisfazer os propósitos de previsão e explicação. Para efetuar a tarefa, o presente trabalho concentrará atenção sobre os termos do debate sobre como e por que revisar as bases psicológicas do modelo convencional de escolha intertemporal (i.e. o modelo de utilidade descontada contante). Mais fundamentalmente, será defendida a tese de que a maneira dos economistas comportamentais testarem e justificarem a hipótese de desconto hiperbólico é bastante persuasiva e tem contribuído para a compreensão de anomalias da escolha intertemporal, mas ainda envolve vários desafios metodológicos.

Rhetorically self-conscious argument, when all is said, is something like growing up. Perhaps the time has come, after a useful childhood spent in positivism, for economics to grow up, too.

McCloskey, 1994, p. 396

It is plainly and patently bad social science that we don't care about how realistic our assumptions are.

Rabin, 2002, p. 672

1. Introduction

This paper aims to present and discuss some values in theory construction and the resulting methodological and rhetoric strategies adopted by behavioral economics in search of more realistic representations (i.e. models) of decision-making in the real economic world. Its point of departure is the view that changes in theorizing and methodological perspectives are motivated by doubts about whether the resemblance between the standard economic model of choice and reality is close enough given the purposes of explanation and prediction. To undertake this complex task, I focus attention on the terms of the debate over reforms of the behavioral foundations of the basic model of intertemporal choice (i.e. constant discounted utility model) and why and how behavioral economists use experimental data to test and justify their alternative hypothesis of non-constant time discounting.

The paper will be structured as follows. Section 2 presents the basic model of intertemporal choice and discusses some issues that are at stake in the debate over 'realism' of its underlying assumptions. Inspired by Ariel Rubinstein's (2005) remarks about the actual practice of behavioral economics, Section 3 discusses methodological problems that are often neglected (and ignored) by behavioral economists, such as the usage of experimental results to test and justify assumptions, and appeal to animal studies and neuroscientific experiments to persuade their fellow economists about the 'goodness' of their hypotheses and models. Section 4 suggests that further explanatory progress depends on reformist theorizing strategies that shift from incremental relaxation of constant utility models to consistent efforts to open up the 'black box' of decision machinery. Section 5 wraps the overall argument up and concludes.

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2. The Standard Account of Intertemporal Choice and the Debate over its Unrealistic Assumptions¹

Intertemporal choice is a pervasive phenomenon of economic relevance. This might be so because a great deal of human action often involves consequences that are spread over time and conflicting present and future preferences (utilities). Contemporary orthodox economists often appeal to Samuelson's 1937 model of discounted utility (henceforth: DU model) to explain/predict patterns of intertemporal choice. The model is built on some idealizing or simplifying assumptions that do not serve to offer a complete description of the complex phenomenon of choice over time.² Rather, the unrealistic assumptions of the constant DU model might serve to isolate those explanatory factors that are thought to play major roles in intertemporal patterns of behavior.³

The constant DU model assumes that, for any two intertemporal consumption profiles $c_t = (c_1, c_2, \dots, c_n)$ and $c'_t = (c'_1, c'_2, \dots, c'_n)$, c_t is preferable to c'_t if and only if,

$$\sum U(c_t)\delta^t \geq \sum U(c'_t)\delta^t$$

Where $U(\cdot)$ is a utility function, and δ^t a discount function that $0 < \delta^t < 1$. The DU model is built on two critical assumptions. One states that individual's utility at a particular time only depends on consumption at that time. In this case, if an intertemporal consumption profile (d_1, d_2, \dots, d_n) and another (e_1, e_2, \dots, e_n) have the same outcome at a certain time, the preference is determined by $(n - 1)$ outcomes. The independence assumption is important because it allows for $U(X) = \sum u_t(x_t)$. Due to independence assumption, the model implies that outcomes are discounted at the same rate. The model also assumes that preferences are stationary. It implies that any individual has a neutral response to time delay, i.e., any time delay has the same impact on her preferences and therefore discounting occurs at an exponential (constant) rate.

Behavioral economists complain that the standard model of choice over time – the discounted utility model – offers a very poor description of actual behavior because it is based on too unrealistic assumptions. The assumptions of stationary preferences and independence yield a positive consequence to the task of modeling. It suggests that individual preferences are time invariant, i.e., the weight an individual gives to her current and future utilities do not change. Yet two

¹ This section is very much based on Muramatsu (2006).

² According to Mäki (1993), idealizing assumptions state that some forces or causes are powerless, i.e., they have no impact or a null effect on a selected phenomenon to be explained. Their role is to theoretically isolate the causal influence of a factor from any other existing (less important) elements. One famous example of idealizing assumption underlying Galileu's law of falling bodies is that the effect of air pressure is zero.

³ According to Samuelson,

It is completely arbitrary to assume that an individual behaves so as to maximize an integral of the form envisaged in [DU]. This involves the assumption that every instance in time the individual's satisfaction depends only upon consumption at that time, and that furthermore, the individual tries to maximize the sum of instantaneous satisfactions to some comparable base by time discount (Samuelson 1937, p. 159).

problematic consequences arise – these assumptions imply that all the complex psychology of intertemporal choice is reduced to a well behaved discount factor and individual preferences are time-independent. Despite the analytical tractability that the foregoing assumptions yield, there is much empirical evidence suggesting that in the actual world individual's preference are not stable over time and are independent from past, current and future consumption.

2.1. The behavioral economist's terms of the debate over unrealistic psychological assumptions

It is at the core of behavioral economics a concern with improving the quality of predictions as well as explanations of actual choice behavior (Camerer and Loewenstein 2003, p. 3). Behavioral economists claim that they aim to make economic analysis as psychologically realistic as possible. Some even suggest: “the more realistic our assumptions about economic actors, the better our economics” (Rabin 2002, p. 658). In so doing they seem to capitalize on Herbert Simon's critique of the methodology of positive economics following Friedman's aphorism – the better the economic theory or model, the more unrealistic its assumptions (Simon 1997). Behavioral economists regard unrealistic assumptions as ‘necessary evil’ rather than virtue. This paper puts forth the idea that the terms of the debate over unrealistic psychological assumptions serve rhetorical purposes.⁴ Behavioral economists aim to challenge the positivist trend in economics that recommended accounts of choice behavior free from non-tractable psychological entities (e.g. emotion, attention, memory and learning). In so doing they neglect that some unrealistic behavioral assumptions serve to separate those major (even essential) features of a slice of reality under study from the rest of the world (Mäki 1993). With this in mind, it might be worth presenting the main assumptions of the standard explanation of intertemporal choice and the roles they play in a systematic fashion.

2.2. Unrealistic behavioral assumptions of the DU model and their functions

The main assumptions underlying the DU approach can be presented in the following way (Muramatsu 2006):⁵

- A1.** Integration of new course of action with previously existing consumption plans
The agent does not evaluate prospects in isolation, but based on how a particular new alternative can change his or her pattern of consumption in all periods.
- A2.** Utility Independence – The agent's overall utility is identical to the discounted sum of the utilities in each period of time. In this case, the agent is thought to exhibit no special preference for patterns of utility across time.

⁴ Following McCloskey (1994), I do not regard rhetoric as mere fancy talk with empty content. Alternative, the term is used in the Aristotelian sense – an art of a good argument capable of changing the prior value and belief structure of a particular audience concerned with certain phenomena.

⁵ My list of DU assumptions is based on Frederick et al. (2003).

- A3.** Consumption Independence – An individual’s utility associated with consumption of a good at a period $t+k$ is independent of her or his consumption in any other period. Therefore, one’s comparison between her consumption at period τ and τ' (i.e. her marginal rate of substitution) is completely independent of consumption in τ'' .
- A4.** Discounted utility function is stationary, constant across time – The agent’s well-being associated with any consumption or activity is identical in different periods of time.
- A5.** The agent’s time preference discounting is independent from her or his consumption – The discounted utility function is not responsive to different types of consumption. This means that the agent is assumed not to discount utility from different sources and at different rates.
- A6.** The agent’s discounting is constant and her or his intertemporal preferences are consistent – The individual evaluates time in an even-handed fashion, i.e., if in a period t she or he prefers A at period τ to B at period $\tau+d$ (for a certain τ and a constant amount d), then in any period t she or he also opts for A at τ to B at $\tau+d$ for all possible τ . This implies that individual preferences between outcomes are not changed if outcomes are delayed or anticipated by a common factor.
- A7.** The individual’s marginal utility is decreasing – The utility function is concave, i.e., individuals are thought to spread their patterns of consumption over time.
- A8.** Individuals have positive time preferences – The agent’s discount rate is positive, i.e., it assumes that agent’s preferences are biased towards immediate consumption (rather than future and higher gratification).

It is important to stress that the assumptions A1 to A8 play quite specific roles in theorizing and explanation of intertemporal decision-making. Together these assumptions remove some factors from the set of explanatory items (i.e. explanantia) that are thought to play minor (if any) role in intertemporal choice. In the next section, I will show that many of the above assumptions will be relaxed once economists and psychologists have doubts about their capacity to isolate explaining factors that are sufficient or even necessary for an adequate representation of actual choice over time. Before that it might be useful to elaborate a bit on what explaining items the DU model seems to include and to exclude. To undertake this task, I pay some attention to the functions of the DU model’s assumptions.

Pointing out that an assumption helps exclude a factor is not to yet to justify such exclusion. Other tools are needed for the latter task. To meet this purpose, I am employing the classification of assumptions based on what claims they help make: negligibility assumption, applicability assumption, and early-step assumption (Musgrave 1981; Mäki 2000). More recently, Hindriks (2005) proposes to supplement Musgrave-Mäki’s classification of assumptions by including another important type of assumption that is justified by claims about tractability, viz. tractability assumption.

A negligibility assumption justifies the exclusion of a certain explanatory factor (F) based on the belief that its effect on the phenomenon under study is negligibly small given the model's purposes. In this case, claims about negligibility can be true or false and it is an empirical matter to inquire into their truth status. Some behavioral economists often seem to imply that a factor excluded by the conventional model of choice like non-constant discounting has non-negligible impact on behavior, therefore should be included in an improved theoretical representation of choice over time. An applicability assumption justifies the exclusion of a certain explanatory factor based on the idea that a model or theory applies only if the factor is absent. This type of assumption differs from claims about negligibility since the excluded item is thought to play significant (non-negligible) roles in production of the phenomenon under study. Yet the application of the model/theory is possible only in cases where the factor is not present, or is present but negligibly weak. Applicability assumptions can be either true or false but behavioral researchers, for the sake of empirical testability, work hard to come up with assumptions that are true as often as possible (Mäki 2000, p. 325). An early step assumption justifies the exclusion of a factor based on the vision that, perhaps for analytical convenience, one first removes a certain explanatory item F and will incorporate it into the previously selected set of explainers once a model or theory is further developed. Finally, a tractability assumption is imposed for reasons of tractability, i.e. it is imposed to circumvent some tractability problems associated with formal derivation of a well-behaved objective function, determination of boundary conditions, and so forth. In the next lines I show that, most of the time, economists (behavioral economists included) impose some psychological assumptions due to reasons of negligibility, tractability and applicability. I go on to suggest that behavioral economists and economic psychologists are very aware that relaxation of some DU assumptions, often justified in terms of tractability and negligibility claims might be conducive to the attainment of progress (Frederick et al. 2003).

I take the integration assumption (A1) as an example of applicability assumption. This means that the DU model is only applicable to situations in which individuals can integrate new options with his or her existing consumption plans (i.e. when integration holds). It may be with this in mind Frederick, Loewenstein and O'Donoghue emphasize that integration is a central assumption in most models of intertemporal assumption; it guarantees the possibility of theoretical representations of judgments and decisions over time (2003, p. 20).

Utility independence (A2) can be regarded as a negligibility assumption. It seems to suggest that the explanatory factor 'the agent's well-being in period t is dependent on her or his past, current and expectations of future well-being' play negligibly small effects on intertemporal choice given the DU model's cognitive purposes and for that reason it can be excluded. This assumption seems to be justified by the belief that only discounting shapes distribution of utility across time in a significant fashion. With this in mind, economists can entertain the idea that the overall utility of a sequence of outcomes is identical to the discounted sum

of utility. This assumption is not very discussed by economists but this may be because it reflects economists' concern with removing any type of preference for patterns of utility over time because this might bring some tractability problems. If this is so, the imposition of A2 might also be interpreted in terms of tractability reasons.

Consumption independence (A3) is a quite famous DU assumption. It is also justified by the idea that the explanatory factor 'individual's comparison between consumption of two goods is dependent on her or his past consumption and estimated future consumption' can be ignored since it exerts negligible effects on the occurrence of patterns of intertemporal behavior with economic relevance. It implies that individuals' preferences over certain intertemporal consumption profiles are not affected by the nature of consumption. This is one of the most debated DU assumptions, since it is consistent with the idea that an agent's preference between a Japanese restaurant and a French one tonight is independent on whether she or he ate French yesterday (or expect it to have it at tomorrow's dinner). Many challenged the empirical accuracy of consumption independence. The very father of the DU model recognized the inexistence of a compelling reason for 'consumption independence'. A3 can be interpreted as a false assumption and this is implied by Samuelson's claim that 'the amount of wine I drank yesterday and will drink tomorrow can be expected to have effects on my today's indifference slope between milk and wine (Samuelson 1952, p. 674). Yet consumption independence was not relaxed until the 1980s. In my own interpretation, this is largely so because this assumption circumvents the problem of deriving a tractable and well-behaved discounted utility model. If this is so, there are also grounds for regarding A3 as a tractability assumption. Nowadays behavioral economists realize that the claims about negligibility and tractability associated with A3 can be challenged. This assumption removes an explanatory item that are significant (rather than causally unimportant) for the occurrence of actual behavior.

The stationary instantaneous (discounted) utility (A4) also seems to be an assumption that involves claims about negligibility and tractability. Its exclusion of the explanatory factor 'individual preferences change over time in predictable and non-predictable manners' seems to be justified by the idea that its impact on patterns of behavior at the economy level is negligibly small. A4 is also imposed for tractability reasons. By excluding the explanatory factor 'preferences change over time', it allows for a tractable discounted utility function (Frederick et al. 2003).

Independent discounting from consumption (A5) is a clear example of tractability assumption. It seems to justify the exclusion of a non-negligible (significant) explanatory item, viz. 'utility discounting is made at different rates and depends on the agent's perception of the nature and type of consumption' by the idea that a tractable model of intertemporal choice is only possible when the agent's discount function has a particular property – it is invariant across all types of consumption. (Frederick et al. 2003, p. 22) suggest that if this assumption does not hold, the very notion of unitary time preferences loses its bite. This might bring tractability problems to economic models of intertemporal choice, since

characterization of a time preference becomes dependent on the thing being delayed, such as ‘chocolate time preference’, ‘summer vacation time preference’, and so forth. If this is so, tractability seems to be a crucial (pragmatic) consideration for imposing an unrealistic (false) assumption like A5.

Constant discounting (A6) seems to be a negligibility assumption. It excludes the factor ‘individuals have conflicting preferences’ from the explanatory set based on the belief that its effect on behavior patterns within the economy is negligibly small. It is also likely that tractability considerations also serve as reasons for imposing A6. Frederick et al. emphasize that if the assumption constant discounting is not imposed, formal characterization of an individual’s time preferences will become less tractable since it may require specification of an entire discount function and individual time preferences cannot be taken as a single discount rate *ibid*, p. 23). Based on experimental research, behavioral economists challenges the claims about negligibility associated with constant discounting. Some of them even seem to take A6 as an early step that might be relaxed on behalf of a generalized hyperbolic discount function (Laibson 1994; Angeletos et al. 1998).

Diminishing marginal utility (A7) is an assumption that involves claims about negligibility, justified by the idea that the factor ‘the individual prefers to concentrate rather than to spread patterns of intertemporal consumption’ can be excluded from the analysis since its effect on the phenomenon under study is negligibly small. Economists offer some evidence that support the claim that most people within the economy opt for spreading their consumption over time.

Finally, the assumption of positive time preferences (A8) is an idealization that refers to claims about negligibility. It is justified by the idea that the factor ‘the individual prefers future to immediate consumption’ plays negligible roles in the production of economically relevant patterns of behavior (and therefore can be removed). More recently, behavioral economists challenge this assumption and take them sometimes as early step assumption that might be relaxed to allow for a model of intertemporal choice that pursues the goal of scope expansion.

Based on the aforementioned assumptions, the DU model gives an account of choice overtime in terms of maximization of a well-behaved discounted utility function that represents an individual’s preferences over a certain intertemporal consumption profile.⁶ The DU model offers a framework to deal with various instances of consumption (and savings behavior). For instance, the model explains why people live off their own (family) endowments in their early study and working years, why they save more during mid life (their most productive working phase) and why they live off saved income when they get retired (Modigliani and Brumberg 1954).

⁶ In a more generalized form, the discounted utility function is presented as $U_t(c_1, c_2 \dots c_T) = \sum_{k=0}^{T-t} D(k) \cdot u(c_{t+k})$, where $D(k) = (1/1 + \rho)^k$. The function $U(\cdot)$ denotes an additive instantaneous function, the discount function $D(k)$ represents the importance an individual assigns, in period t , to her well-being (consumption) at the period $t+k$, and $u(\cdot)$ corresponds to an individual’s unit of preference satisfaction at a particular period of time.

Based on the above attempt to classify the roles of the main DU assumptions, I am inclined to argue that tractability considerations play an important influence on certain DU assumptions and even seem to justify the removal of explanatory factors that do not play negligible effects on the phenomenon under study (for an account of tractability considerations, see Hindriks (2005)). It is worth stressing that behavioral economists also proceed similarly to neoclassical economists during theory (model) construction. Even though they might complain about some economists' strong commitment to parsimony and tractability, their very reformist theorizing strategy is motivated by these values (Rabin 1998). For instance, Kahneman et al. (1986) suggest that reforming the psychological foundations of economic models does not go against the goal of developing parsimonious and tractable accounts if this helps them to resolve choice anomalies and eventually predict novel facts.

2.3. *Anomalies as empirical sources of objections to the DU model*

In order to persuade their fellow economists about the positive implications of putting economics and psychology back together, behavioral researchers studying intertemporal choice claim that some unrealistic assumptions like constant discounting and independence constrain the predictive (explanatory) capabilities of economic analysis. Intertemporal choice anomalies (i.e. empirical violations of predictions by the DU model) are often cited as reasons for incorporating new behavioral assumptions into the basic model. The underlying idea is that modifying assumptions in the direction of more psychological realism (realisticness) will contribute to prediction of economically important anomalies like savings after retirement, overborrowing in credit cards, addiction and planning behaviors (Camerer and Loewenstein 2003).⁷

The most famous anomaly of choice over time is hyperbolic discounting. In contrast to predictions made by the DU model, psychologists and economists found evidence that agents often exhibit dynamic inconsistency. The latter refers to actual patterns of choice behavior in which individual time preferences are traded-off differently. More specifically, experimental findings suggest that individuals reveal present-biased (myopic) preferences when time delay is too short but often become patient (i.e. willing to receive a delayed higher reward) as time goes by. In other words, the term hyperbolic discounting sheds light on individuals with a declining rate of time preference.

Thaler (1981) found evidence that individual time preferences might be accurately represented by a hyperbole-shaped discount function. In order to be indifferent to gaining \$15 immediately or receiving a higher delayed sum in 1 month,

⁷ This paper follows Uskali Mäki's proposal of replacing the term realism by "realisticness". The latter is regarded as an attribute of models and theories that represent and refer to entities, activities, relationships existing in the objective world; whereas realism amounts to a class of philosophical doctrines sharing the idea that scientific models and theories make statements with true value (because they are about real occurrences in the world). For details, see Mäki (1992, 1993, 1996, 1998).

1 year and 10 years, average agents requested \$20 for the month delay; \$50 for a year delay, and \$200 for a 10 year-horizon. These findings reveal average discount rates of 345% (month-interval), 120% (delay of a year) and 19% (within a 10 year time-horizon). Frederick et al. (2003) offer evidence that when mathematical functional forms are used to fit the data for consumption over time, the hyperbolic function (implying declining rate of discounting) fits better than the DU model's exponential discount function (which involves a constant rate). There is also evidence that people often prefer \$110 in 31 days to \$100 in 30 days but reveal a preference reversal by opting for receiving \$100 now to \$110 tomorrow.

Laibson (1996) engages in a theorizing strategy that became popular even among neoclassical economics. This might be so because he addresses his fellows by using the same economic language of utility maximization and equilibrium explanation. The novelty is to come up with another discounting functional form. More precisely, Laibson modifies the standard discount utility model by incorporating a generalized hyperbolic discount function that enable him to account for puzzling consumption-saving behaviors such as co-movement of income and consumption, high rates of credit card debts in revolving credit markets, the phenomenon of asset-specific propensity to consume, low levels of precautionary savings, the strong correlation of patience levels with income, wealth and even age (Laibson 1994; Angeletos et al. 1998). The hyperbolic discounting model accommodates phenomena such as procrastination and over consumption of addictive goods O'Donoghue and Rabin (1999). In addition it predicts new phenomena like strategic ignorance (i.e. why people sometimes do not acquire information even when it is free).⁸ This puzzling phenomenon can be explained in terms of the idea that agents, who discount future consumption "hyperbolically", may be concerned with withdrawing from a satisfactory course of action when its costs become imminent and therefore opts no as this serves the role of a "commitment strategy".

Note that hyperbolic discounting became persuasive because it is often presented as general principle to explain and predict many unrelated phenomena. This seems to be an effective rhetoric strategy because the economics profession pursues the ideal of "explaining much by little". In addition, replacing the assumption of constant discounting with hyperbolic discounting seem to be a movement towards making economic models of choice over time as realistic as possible. In Rabin's own words,

If present-biased preferences are more behaviourally accurate than exponential (constant) discounting, is the realism of importance to economics? Yes ... incorporating present-biased preferences into economics likely to help us better understand savings behavior... and other risky activities (Rabin 2002, p. 677).

Note that the above passage also reveals the rhetoric of empirical finding that is valued highly by contemporary economists.⁹ Behavioral economics persuades

⁸ For details, see Carrillo and Mariotti (2000).

⁹ I thank an anonymous referee for drawing my attention to the fact that behavioral economists push

because it offers a chance to transform economics into an empirically progressive science. This ideal is often invoked to justify their interdisciplinary research methodology (Camerer and Loewenstein 2003).

3. A Persuasive Methodology also Faces Severe Limitations and Objections

Based on Ariel Rubinstein's (2005) constructive criticisms about how behavioral economists test and justify their assumptions, this section addresses methodological problems that seem to be underestimated (and even ignored) by economists fascinated by the developments of behavioral economics. I argue that behavioral economists ought to be very careful about how to use their experimental findings to legitimize their reformed models. My idea is to challenge a behavioral economist's vision that "as a rule, it is bad to spend time on methodological and broad stroke issues rather than the nitty gritty of the phenomena being studied" (Rabin 2002, p. 659).

The complexity of decision-making in the real economic world might motivate behavioral economists to employ various research methods, such as hypothetical choice experiments, animal studies, field experiments and brain scans. Behavioral economists often hesitate to define their research agenda by their methodological strategy. They take themselves as methodological eclectics interested in making economic analysis as psychologically realistic as possible (Camerer and Loewenstein 2003). Despite the important contributions to explanatory progress that behavioral economic models have brought, it is worth considering some troubling issues associated with the development of empirical (experimental) studies needed for justification of assumptions and hypothesis testing. As Guala and Mittone (2005) properly put it,

Some economists have welcomed the experimental anomalies as the ultimate proof that the fundamental principles of mainstream economics are flawed and need drastic revision. Others remain unconvinced and rebut by means of a simple but powerful argument: economic models are supposed to be applicable to real economies not to the artificial conditions implemented in the economic lab.

In this section, we will see that many of the difficulties refer (more or less directly) to the Duhem Quine problem. The latter sheds light on the fact that any experiment involves testing of at least two things – the hypothesis (on which a model or theory is built) and a whole bunch of initial conditions and auxiliary assumptions.¹⁰ This gives an extra boost to Lakatos' vision that no theory or model is ever killed by empirical observation. There is always the possibility of rescue by auxiliary hypotheses (Smith 1992).

the idea that their results and theoretical claims are grounded on empirical findings a bit far.

¹⁰ Auxiliary assumptions and initial conditions might involve measurement techniques, incentives, payments and so forth.

3.1. *Evidence from hypothetical choice experiments*

As said, behavioral economic attempts to justify assumptions of their reformed models by referring to findings obtained from experiments. For instance, the hypothesis of hyperbolic discounting is justified through different research methods. Let us start with finding from hypothetical choice tasks. Thaler (1981) designed an experiment in which participants are asked whether they would prefer one apple today to two apples and another apple in 50 days to 2 apples in 51 days. He found that most people opt for receiving an apple now to two apples tomorrow but prefer two apples in 51 days to one apple in 50 days.

The foregoing evidence of time preference reversal ought to be interpreted more carefully than behavioral economists often do. They rely on hypothetical situations which might influence agent's responses. Participants have no clear incentive to exhibit their true time preferences. These results cannot deal well with the problem called external validity (Loewenstein 1999, Guala 2005a). The latter refers to the difficulty with generalizing such findings to the (outside) world. Some behavioral economists do not take this problem very seriously because they encountered similar findings in replicated designs and the results seem to be intuitive.

3.2. *Animal Studies*

Hyperbolic discounting is also justified by evidence from animal studies. Some experiments indicate that pigeons' current and future utilities are not traded-off in constant fashion and discounting resembles a hyperbola-shaped function (Ainslie 1992). One source of objection concerns doubts about whether data from experiments with animals is useful for inferences about human behavior. The problem of external validity is very serious. Therefore the design of the experiment and its implications for human decision-making ought to be carefully scrutinized (Rubinstein 2005).¹¹

3.3. *Pros and Cons associated with field experiments*

Field experiments have become quite popular among behavioral economists. They arise in response to many objections made to the validity of their experiments. In the past, most participants were college students. Behavioral as well as experimental economists have worked hard to run experiments in naturally occurring environments (Camerer and Loewenstein 2003).

Economists interested in intertemporal choice 'venture in the wild' so as to develop improved experiments to test the phenomenon of dynamic inconsistency

¹¹ I am grateful to the referee's remark that animal studies might not be the most important research method employed by behavioral economists interested in more realistic accounts of human decision-making. Yet I opted for briefly citing it because it is part of the practicing psychological economists' empirical research toolbox.

(which cannot be accommodated by the basic DU model). Nowadays many try to test the hypothesis that some anomalies arise from human capacity to adjust their future preferences to positive or negative outcomes. Gilbert et al. (1998) asked assistant professors of University of Texas to predict their future well-being at various points in time subsequent to a positive or negative decision over tenure. Subjects expected that their preferences would take 5 to 10 years to adjust to any decision, but when interviewed years later, participants admitted that they adjusted much faster and exaggerated the positive consequences associated with a promotion. Sieff et al. (1999) asked patients, who were about to take a HIV test, to estimate their feelings about receiving a negative or positive result. They found that subjects, when later interviewed, declared that they exaggerated how happy they would feel on learning that they were HIV negative or how sad they would be if turned out to be HIV positive.

The great advantage of field studies is that they circumvent the problem of external validity. Yet, it is important to stress that some problems emerge as soon as we broaden our subjects and type of tasks. The demands for controlling various factors like culture, gender are now much larger. This puts some constraints on our capacity to draw conclusions about causal relations and make generalizations.

3.4. *Using neuroeconomics to test and reform behavioral hypotheses*

Brain scans are new research methods that behavioral economics use to test their model's hypotheses. In the context of choice over time, McClure et al. (2004) hypothesize that individuals ascribe strong importance to immediate consumption at the present but prefer to delay gratification as time goes by. They assume that this phenomenon is represented by a quasi-hyperbolic discounting function. The latter suggests that the discounted value of a consumption, u , at delay $t = 0$ is u and $\beta\delta^t u$ for $t > 0$, $0 \leq \beta \leq 1$ and $\delta \leq 1$ (p. 504). The authors interpret the inverse of β parameter as the value people give to immediate reward, whereas δ treats a given delay just equivalent independently of time period. Their main testable hypothesis is that β and δ parameters represent patterns of behavior – emotional and higher order cognitive actions – activated by brain regions responsible for impulsiveness (structures of the limbic system like ventral striatum) and areas responsible for careful thinking (cortical system). They run a general linear regression in which β and δ refer to activated areas of the limbic system and cortical system, respectively. The underlying idea is to find evidence from magnetic resonance imaging to justify the hypothesis that dynamic inconsistency is a result from activation of two neural systems. Participants of this experiment made a series of binary choices between smaller-immediate and higher-delayed reward while their brains were scanned through magnetic resonance imaging. The specific amounts of rewards varied from \$5 to \$40 and times of delay from the moment of the experiment to 6 weeks. Their findings confirm the behavioral economist's prediction that choice patterns that involve immediate reward (no delay) is associated with higher activation of limbic

structures, whereas courses of action that prefer delayed gratification involve more activation of the prefrontal cortical areas associated with higher order thinking and deliberation. The enthusiastic behavioral economist might not see the problems associated with this kind of empirical study. The findings offer no indisputable reasons to conclude that human preferences are realistically represented by a quasi hyperbolic function. Nor do they allow for conclusions that the limbic system (striatum) is the physical substrate for parameter, whereas the higher cortical regions (lateral prefrontal cortex and parietal cortex) are the counterpart of δ parameter.

Even though neuroeconomics might bring very revolutionary implications for the development of causal explanations of human thinking and decision-making, there are doubts about whether these neuroeconomic findings can be easily extrapolated to the world outside the lab. There are no indisputable reasons for taking the foregoing empirical results as positive evidence for the hypothesis that decision-making is driven by limbic and cortical brain systems. Another serious problem is internal validity, which amounts to the difficulty in knowing whether a particular phenomenon or mechanism detected in a laboratory is correct (Guala and Mittone 2005). These studies identify some statistical associations (correlations) between variables (parameters) but there is no room for a 'causation talk'. Furthermore, philosophers as well as some neuroscientists emphasize that there is not yet a conception of what would be for a brain to make a decision and the plausibility of regarding the information processing brain as a machine composed of two competing systems, the emotional and the cognitive (Muramatsu 2006).¹²

4. In Search of a Genuinely Progressive 'Psychological Economics'

Despite the above discussion of methodological problems involved with the practice of behavioral economics, it is important to stress that its reformist theorizing strategies have contributed to opening up the black box of human decision machinery. There seem to be two different types of strategy – an incremental and a process-description.

4.1. *Types of reformist theorizing strategies and their purposes*

The incremental approach might be characterized by attempts to develop behavioral models that add explaining items (e.g. behavioral assumptions about individual time preferences) to the utility approach without questioning previously included items of explanatory set. The process description approach involves replacement of previously isolated explaining items with new explanantia ones.

¹² For very recent methodological criticisms of neuroeconomics, see Harrison (2008) and Gul and Pesendorfer (2008).

Behavioral economists following the above strategy challenge more clearly the standard body of analysis than those following an incremental approach. They substitute some explanatory factors playing a causal role in production of actual choice behavior for assumptions about agent's rational preferences and expectations. One distinctive trait of this theorizing approach concerns the emphasis put on description of (causally relevant) processes or mechanisms underlying patterns of actual choice behavior (anomalies included).

As to the domain of intertemporal choice, we can suggest that a great deal of behavioral research still rely on an incremental reformist strategy. This movement might be embedded in a rhetorical strategy. Perhaps behavioral economists acknowledge that the profession prefers changes in small steps and do not want to be regarded as rivals. Some like Rabin (2002) suggest that behavioral economics is a natural continuation of neoclassical economics.

On behalf of the rhetoric of 'assumptive realism', economists replace exponential discounting with hyperbolic discounting. This paper acknowledges that there is no indisputable evidence to suggest that hyperbolic discounting is the correct (true?) representation of actual choice over time (despite evidence that hyperbolic discounting sheds light on interesting and intuitive psychological phenomena with economic implications). The behavioral economist's choice over hyperbolic discounting is also dependent on pragmatic values – this functional form offers an analytically convenient and parsimonious account of conflicting time preferences.

Given the various challenges associated with changing and justifying new functional forms of time discounting based on experimental findings, I suggest economists to pay attention to experimental methods of economics and other sciences and follow professor Vernon Smith's and Ariel Rubinstein's advices so as to avoid carelessly designed experiments to test and justify their models and hypotheses (Smith 1987, 1994; Guala 2005; Rubinstein 2003, 2005). Once they engage in this task, they may profit by developing models that uncover domain specific emotional and higher order cognitive processes causally significant for actual choices. This probably requires a radical (revisionist) theorizing strategy *vis-à-vis* the prevailing incremental analysis. This might converge on construction of heuristic-based models that go beyond rhetorical appeals to the notion of bounded rationality. The expected benefit of this theorizing strategy is to come up with a genuinely explanatory (causal) treatment of the complex machinery of decision-making (Hausman 2001).

5. Concluding Remarks

This paper suggests that behavioral economics seems to be a reaction against the theorizing and testing procedures of orthodox economics that have constrained its explanatory and predictive capabilities. Although it shares the view that the reformist strategies employed by psychological economists contributes to improved accounts of intertemporal choice anomalies, it raises some objections to the ways

in which some practicing behavioral researchers use experimental findings so as to legitimate the rather incremental modifications that they make in their behavioral models. The main lesson drawn from this article is that the ‘aim to improve the explanatory power of economic analysis’ might be more effectively achieved by a fresh and eventually revolutionary theorizing strategy that uncovers (mental and neural) processes with major roles in the production of actual choice behavior. This is because it offers the possibility of distinguishing significant causal processes from spurious correlations and of grasping how affective and cognitive factors operate together in the causal chain of events that bring about important behavior patterns (anomalies included). A revisionist movement towards an economic explanation in this richer, causal sense is worth developing since it provides that required knowledge for effective predictions of behavior and informs us about how to behave to bring about certain choice patterns or to prevent them. Fundamentally, an improved account of the complex and pervasive phenomenon of decision-making over time might help us to design more effective policies and institutions than the existing ones. This is because one of the most interesting implications of behavioral economics is its disposition to explicitly address the question of whether economics can be treated as social therapy.

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