

Questioning rationality: the case for risk consumption

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resumo

résumé / abstract

As hipóteses padrão de comportamento racional e de perfeita antecipação do futuro têm sido fortemente postas em causa dada a sua incapacidade para compreender certos consumos de risco. A teoria do “vício racional” de Becker e Murphy constitui um marco na medida em que desencadeou novos desenvolvimentos a partir desta teoria bem como novas e promissoras abordagens baseadas na ciência cognitiva.

Este artigo propõe uma síntese confrontado as duas principais abordagens baseadas em diferentes hipóteses quanto à natureza das preferências temporais dos consumidores.

De um lado assume-se um comportamento racional mesmo em situações limite de consumos de risco – os comportamentos viciantes. Novos desenvolvimentos na explicação dos consumos habituais e viciantes têm em consideração uma abordagem económica e também psicológica com implicações substancialmente diferentes no domínio das políticas públicas.

Les hypothèses standard de comportement rationnel e de perfectif anticipation de l'avenir on été fortement mise en cause en conséquence de sa incapacité pour faire comprendre certaines consommations à risque. La théorie de l'addition rationnel de Becker e Murphy a déchainé des nouveaux développements aussi que des nouvelles et prometteuses approches axés dans la science cognitive.

Cet article propose une synthèse qui confronte les deux principales approches à partir de différentes hypothèses sur la nature de la préférence temporelle des consommateurs. D'un coté on assume la rationalité des comportements même dans des situations de extrême risque – les comportements additives. D'autres contributions mettent en jeu des contributions économiques autant que psychologiques avec des implications fort différentes dans le domaine des politiques publiques.

The standard assumption of rational, forward looking behavior has been heavily questioned given the impossibility of understanding some risk consumption behaviors within such a framework. The Becker and Murphy theory of rational addiction made a start on this debate fostering new refinements within the original rational theory framework as well as promising approaches based on the latest developments of cognitive science.

This paper makes an overview confronting two main approaches highlighting their different time preferences assumptions. On the one hand the debate assumes rationality even in extreme situations of risk consumption – addictive behavior. On the other, new developments in the explanation of habits and addictive behaviours take an economic-psychological approach into consideration and have substantially different policy implications.





1. Introduction

Economists' debates on the effects of habits on demand and the modelling of addictive behaviour always stress the backward-looking intertemporal correlation of these consumption patterns. Moreover, in recent years, there has been a wider use of the rational choice theory approach, the dominant paradigm in economics to understanding human behaviour. One reason for this tendency seems to result from the mathematical nature of the approach, which provides opportunities for the empirical confirmation of theories. The explanation of risk consumption – a behaviour possibly leading to unwanted and harmful dependency situations – only knew substantive development after the groundbreaking¹ article by Becker and Murphy – BM – (1988). Here, the authors explored the dynamic behaviour of the consumption of addictive goods in detail, and pointed out that many phenomena previously thought to be irrational are consistent with rational optimization according to stable preferences.

This paper is a synthesis of the debate on risk consumption together with its policy implications. Section 2 presents the Becker and Murphy rational approach model. Section 3 summarizes the main extensions of the rational framework, while in Section 4 “non-rational” approaches are reviewed. Finally, in Section 5, the policy implications of the different approaches are discussed.

2. Becker and Murphy's rational model

The rational addiction model follows previous works (Becker et al., 1994) that considered the interaction of past and current consumption in a model with utility-maximizing consumers. The main features of these models are that past consumption of some goods influences their current consumption by affecting the marginal utility of current and future consumption. Therefore, past consumption is reinforcing for addictive goods.

The BM (1988) model deals with these characteristics considering a rational consumer who has a forward-looking behaviour and stable preferences.

Addictive behaviour is usually assumed to involve psychological and physiological effects: tolerance, reinforcement and withdrawal. Tolerance is associated with habit creation, implying that to obtain the same level of pleasure; the amounts consumed must be progressively augmented. Reinforcement means that greater past consumption increases the desire for present consumption. The withdrawal syndrome is linked to the intense physical and mental suffering associated with consumption cessation or decrease. These characteristics are hard to match with rational behaviour since a distinguished feature of harmful addictive behaviour is the apparent trade-off of immediate gratification or pleasure against adverse consequences in the future. While non-addicted individuals appear to recognize this trade-off and are aware of harmful consequences, addicts appear to impulsively ignore the adverse consequences of their actions in favour of immediate pleasure. It is this apparent violation of the standard assumption of rational, forward-looking maximization behaviour that is answered by Becker and Murphy's rational addiction model. Hereafter the economic approach will begin to build up a framework to explain apparently pathological aspects of some behaviours.

The BM model² assumes that an individual can consume two goods, an addictive, c , and a non-addictive, y , the utility function at time t can be written as:

$$U(t) = u(c(t), y(t), S(t)) \quad (1)$$

¹ For a different survey of the theoretical explanations of addiction see Herrnstein and Prelec (1992).

² Stigler and Becker (1977) was a first contribution to the BM model.



where $S(t)$ is the stock of addictive capital. At any time t , the individual's utility³ depends on current consumption $c(t)$, current consumption of $y(t)$ and the stock of past consumption $S(t)$.

The basic definition of addiction is that a person is potentially addicted to c if an increase in his current consumption of c increases his future consumption of c .

According to the BM model, tolerance and reinforcement are the main characteristics of an addictive good. Tolerance implies that current utility is negatively related to past consumption ($\partial u / \partial S = u_S < 0$). Reinforcement means that past consumption leads to higher consumption today ($dc / dS > 0$) and requires that an increase in past consumption raises the marginal utility of current consumption ($\partial^2 u / \partial c \partial S = u_{cS} > 0$)⁴.

The model assumes that present and future behaviour is part of a consistent maximizing plan. This intertemporal link is also expressed in the way that past consumption influences current utility through the so-called "stock of addictive capital".

The stock of the addictive capital at time t depends on the stock in time $t-1$ (S_{t-1}) and the consumption of the addictive good in the period $t-1$ (c_{t-1}).

More formally:

$$S(t) = (1 - \delta) S_{t-1} + c_{t-1}$$

δ is the rate of depreciation of the addictive stock capital. By assumption, the influence of past consumption decreases over time what is captured by the rate σ . This stock $S(t)$ decreases through the depreciation rate (δ) and increases through consumption of the addictive good (c_t).

Considering the length of life T and a constant rate of time preference δ , the utility function would be:

$$U(0) = \int_0^T e^{-\delta t} u(t) dt$$

Utility is discounted exponentially which implies a constant rate of discounting⁵.

2.1. Becker and Murphy model characteristics

One of the main features of the BM model is the concept of adjacent complementarity, which shows that the quantities of the addictive good consumed in different time periods are complementary – which is due to reinforcement in consumption. Thus it is possible to define addiction as a strong complementarity between past and current consumption.

Another key factor to the understanding of rational addictive behaviour is the existence of an unstable steady state⁶. An unstable steady state is one in which a small change in some factor affecting consumption (price or other) can cause a drastic change in consumption, including starting or stopping consumption.

3 They assume that U_t is a strongly concave function of c and S , and that the lifetime utility function is separable over time.

4 Although this is a sufficient condition for myopic consumers, who do not consider future consequences of their current behavior, it is not so for rational utility maximizers.

5 Exponentially discounting is *time consistent* because the relative values of consumption in any two periods remains constant. BM's model assume that time preference is exogenously determined.

6 A steady state is defined as a situation in which current consumption is just sufficient to offset the depreciation of the addictive stock ($C(t) = \delta S(t)$).



Unstable steady states are crucial to explaining why few people consume small amounts of a highly addictive good, and the majority are either abstainers or consume large quantities⁷; and to understand “cold turkey” quit and binge behaviours.

Becker and Stigler’s model shows that steady-state consumption is unstable when the degree of addiction is strong (which means strong complementarity between past and current consumption). This kind of “pathological” consumption rises over time even for people who anticipate future consequences. However, the interaction between persons and addictive goods is crucial in this process. According to Becker and Murphy (1988): “a good may be addictive to some persons but not to others and a person may be addicted to some goods but not to other goods. The importance of the individual is clearest in the role of time preference in determining whether there is adjacent complementarity”. It is expected that individuals who discount future more heavily, present-oriented individuals, are potentially more addicted to harmful goods than future-oriented ones.

The unstable steady states also lead to another important feature of addictions – the existence of multiple steady states. However, the utilization of a quadratic utility function⁸ cannot explain multiple steady states. Instead, it implies only two steady states, one stable (addictive consumption) and one unstable (near abstinence). Consumption of the addictive good will rise over time when above unstable steady-state levels, and will fall over time (eventually until abstinence) when below the unstable steady state. In the first case, the individual consumes so much that depreciation of capital is more than compensated; in the last case, the individual starts with a positive capital stock but consumes less than depreciates. Therefore, the capital stock will depreciate until it eventually reaches zero.

Whether a consumer becomes addicted or not depends on a series of factors: the initial stock of the addictive good (S_0), the time preference rate (σ), the price of the addictive good and the depreciation rate δ . For example a drop in addictive price⁹ or a lower time preference would increase steady state consumption in an addicted individual or, eventually, turn a non-addicted consumer into an addicted one.

The rational framework is also valid to justify particular behaviours of addictive consumption: “cold turkey” and binges. Cold turkey quit means that strong addictions can be stopped only with an abrupt cessation of consumption. The theory suggests that if a rational individual decides to end this consumption this is only possible by lowering the addictive stock through a significant cut in consumption decrease. Because this change in current consumption has a greater effect on future consumption when the degree of complementarity (or the degree of addiction) is stronger, then rational people are supposed to end severe addictions more rapidly than weaker ones¹⁰.

Binge behaviour is common in certain addictions, like alcoholism, overeating etc. The BM model defines it as a cycle over time in the consumption of a good. Although seeming an “archetype of irrational behaviour”, it could be consistent with rationality.

In brief, the BM model explains consumption of addictive goods in a rational-choice framework, considering a forward-looking user one who maximizes her/his utility and whose preferences are consistent over time (stable over the life cycle). To draw the consumption history of the addictive consumption, into the intertemporal optimization process, Becker and Murphy consider a stock

7 What Which is described by a bimodal distribution of consumption (as in smoking). This is not the case for the distribution of alcohol consumption that is, apparently, more continuous with the majority being moderate consumers.

8 Viewed only as a local approximation to of the true function near a steady state (Becker and Murphy, 1988).

9 Note that price in this context is associated with a full price concept, formed also by all those aspects that result from the money value of any adverse effects like restrictions, limits on availability and new information that raises perception relative to long-term health hazards.

10 The authors claim this behavior rational because the consumer exchanges a large short-term loss in utility (withdrawal) for an even larger long-term gain.

variable ("addictive consumption capital") serving as direct link between past and present consumption.

Rationality in this context implies a consumer who considers the future consequences of his/her current consumption decisions and discounts the future exponentially, at a constant rate.

3. Extensions of the rational addiction model

3.1. Learning by consuming – risking addiction

One of the most criticized features of the rational addictive model is the common implicit assumption of "perfect foresight". Those theories, however, fail when it comes to explaining the possibility that consumers of addictive goods regrets their past decisions and become naturally unhappy *ex post*¹¹.

Orphanides and Zervos' (OZ) theory of "learning and regret" (1995) intended to resolve these criticisms by proposing a new extension of BM rational addiction model. The authors recognise uncertainty and the initial inexperience of consumers as the essential features lacking in those models.

The decision to take the inevitable risk of becoming addicted is considered a rational one. Consuming an addictive good is in this context a voluntary choice, yet not an intentional one; the individual recognizes that addiction is harmful and does not wish to become addict *ex ante*. Despite his rationality he is uncertain about his predisposition to addiction, but at same time he knows it cannot be detected without the experience gained from repeated consumption.

While experimentation is optimal for the ordinary goods it is problematic for potential addictive goods¹². The "regret model" considers that consumption of those goods has a different addictive potential for different people, but that nobody knows its potential in advance. Nevertheless, everybody has a subjective assessment of his addictive potential and updates it up given the experiences made.

This dependence on beliefs emphasizes the key role of information and the crucial importance of individual initial beliefs in determining the risk of addiction through experimentation. Naturally those who think strongly that they are non-addict individuals are more likely to risk the consumption experience; whereas if they are less confident about their judgements, they are more likely to abstain, and thus may never learn their potential.

3.1.1. The Model

The population is divided in two groups: the non-addicts and the potential addicts. Two goods are available, at any point of time t : an ordinary good y and a potentially addictive good a ¹³. In this framework a is not necessarily addictive, particularly if the individual manifests no addictive tendencies.

As in the BM model, becoming addicted calls for the accumulation of a stock of past consumption (S_a) beyond some level – a designed "critical level" (S_c)¹⁴. Thus, consuming the potentially addictive good augments addictive capital, but contrary to the BM model, addictive capital only has an influence on utility for some people. Similarly the OZ model considers a constant

¹¹ The prediction of the effects of post-behavioural regret or as it has been referred to in the literature, 'anticipated regret' has been based upon the regret theory (Bell, 1982). This theory assumes that the value of choosing one alternative is dependent on the alternatives simultaneously rejected and that people attempt to avoid decisions that could result in regret.

¹² With some highly addictive substances, as like cocaine or heroin, the strong risk of addiction seems sufficient for the majority optimally choosing not to experiment with the good.

¹³ Defined as c in the BM model.

¹⁴ Which corresponds to the BM unstable steady state.





depreciation rate (δ) of the consumption stock S . For isolating the differences across individuals, mentioned above, the authors introduce θ , to indicate the presence of individual addictive tendencies. Departing from an uncertain context, a person does not know, *a priori*, her value of θ . It is assumed that $\theta = 0$, if she has no addictive tendencies, and that $\theta = 1$ for potential addicts.

Formally, the momentary utility function, for any individual, appears in two separate parts:

$$U(t) = u(c_t, \alpha_t) + \theta \eta_t v(\alpha_t S_t) \quad (1)$$

$u(c_t, \alpha_t)$ represents the immediate positive rewards for current consumption of both goods, and $v(\alpha_t S_t)$ represents the detrimental addictive side effects of past consumption (for example, craving, depression and illness). The more the individual has consumed in the past, the higher is the probability of such harmful effects occurring. The term η_t is a random variable with distribution:

$$\begin{aligned} \eta_t &= 1 \text{ with probability } \pi(S_t) \\ &0 \text{ with probability } 1 - \pi(S_t), \text{ with } \pi(0) = 0, \pi(S) \in \{0, 1\} \end{aligned}$$

If somebody starts consuming the potentially addictive good and no shock occurs on utility, she knows that she either has no addictive potential or she has luck. If no harmful side effects are observed the individual is sure of being a non-addictive type. On the contrary, if the shock of utility happens, she instantly concludes she has addictive potential. OZ call this kind of behaviour "the learning experimentation".

Learning by consumption experimentation allows the self observation of one's addictive potential and the updating of the subjective beliefs about an individual's addictive tendencies. Contrary to the BM rational consumer, experimenters take the initial risk because they get an immediate reward, utility gain, but addiction is not certain to follow.

The chances of an individual becoming addicted are driven by the momentum of his addictive potential discovery. In general, some potential addicts discover their tendencies early through experimentation (if they are below the critical level S_c), and they manage to control their addictive tendencies by changing their consumption patterns. They eventually rapidly change their consumption ("cold turkey" effect), returning quickly to the low stable steady state (S^s_1).

Others realize their true θ too late (above the critical level S_c) and increase their consumption of the addictive good (go on a "binge") until reaching the high consumption steady state S^s_2 ¹⁵. The process of experimentation acts as a *signal* that permits individuals to continuously update their subjective beliefs (an endogenous resolution of the initial uncertainty).

Thus, the OZ "learning and regret" theory coexists with the rational framework, while makes it possible to explain the existence of addicted consumers and casual users. As they say, "without the appeal of controlled casual consumption, potential addicts would never risk addiction".

Finally, the authors also shed light on the "apparent paradox" of voluntarily being drawn into a harmful addiction and later regretting it. The model identifies "multiple motives" for the individual's regret. He may regret his *bad luck*, or that he learned his true θ too late, or even regret a wrong assessment of his probability of becoming addicted, possibly being overoptimistic.

In fact it is precisely this misinformation problem that explains how rational agents are fooled or "hooked" into an addiction.

¹⁵ In difference to BM (1988) where any positive consumption in the steady state is defined as addiction.

3.2. Consumption cycles – the dual effect of consumption capital

One of the most criticized features of the BM model is its insufficient justification of changing consumption patterns over time. The extension developed by Dockner and Feichtinger (1993) (and later by Orphanides and Zervos, 1998) presents an explanation for cyclical consumption patterns.

As mentioned, the BM model assumes that past consumption affects current consumption through a stock consumption variable. A consumer can be called addicted to a good if its consumption increases with that stock. This concept implicitly assumes that the addictive good, c , accumulates a single stock of consumption capital (S_1). Dockner and Feichtinger (DF) call this stock “commodity specific consumption capital”.

Furthermore, they suggest that the consumption of addictive goods not only has an addictive element, but may also have reverse effects, such as the risk of severe health problems. To capture those effects a separate analysis of addiction is required. In order to achieve it they presented a model of addiction in which a single consumption good accumulates two capital stocks (S_1 and S_2). S_1 corresponds to the capital stock of the addictive good in BM model and S_2 represents the negative effects of addictive consumption.

It is the consideration of two stocks that causes the “irregular” behaviour. These counterbalancing effects (caused by S_1 and S_2) mean that optimal consumption might exhibit cycles – an addictive one and a satiating one. The addictive forces cause the increase of current consumption as past consumption accumulates (ascending part of the cycle); the satiating force causes the decrease of current consumption as habits accumulate (the descending part of the cycle).

The utility function for a representative consumer who at each instant of time t derives utility from consumption of good c and accumulates two different consumption capitals – S_1 and S_2 – will be:

$$U(t) = U(C_t, S_{1t}, S_{2t})$$

Stocks, S_1 and S_2 , are measures of past consumption of c_t that affect current utility through an accumulation process:

$$S_1(t) = f_1 c(t) - \delta_1 S_1(t) \text{ and } S_2(t) = f_2 c(t) - \delta_2 S_2(t)$$

δ_1 and δ_2 are constant depreciation rates, assuming that $\delta_1 > \delta_2$

Yet the consumption cycles are the result of forward-looking behaviour. Only a smoker who desires to smoke but cares about his health, and anticipates the future consequences of his current consumption, can end up in cycles of smoking and giving up smoking.

DF model demonstrates that consumption behaviour may end up in “persistent oscillations”. Contrary to the smooth evolution predicted by BM model, the authors described an addictive consumption most often characterized by periods of lower consumption followed by high consumption, and so explaining why “binges” continue to cycle much through a person’s lifetime.

3.3. “Myopic-rationality”

Some of the models that overcome the incompatibility of rational theory with one of the defining aspects of addictive behaviour, the apparent difficulty with delaying gratification and disregard for the future, emphasize non-rational aspects of addictive behaviour, namely myopia. Orphanides and Zervos, (1998) consider the possibility that individuals may be initially uncertain with regard





to the degree the addictive good renders them myopic. Initially, individuals must weigh the momentary benefits of consumption against the negative future effects and the potential risk of severe myopia. This uncertainty provides a simple mechanism which leads the individual – with some probability – into a harmful addiction, and highlights the cause of the *ex post* regret associated with addiction.

They propose a rational model that provides a resolution for this rational approach weakness. Addicts' myopia and non-addicts' farsightedness can be easily reconciled within an optimizing expected utility framework which maintains the desirable properties of current rational models yet yields some predictions often associated with the non-rational approach. The key assumption is that as past consumption of addictive good increases, the rate of time preferences increases as well. Two sorts of individuals would then exist: one with accumulated consumption capital (in BM terms) with induced myopia, and others who choose not to experiment the addictive good maintaining a normal fixed rate of time preference.

The increased impatience from consumption of the addictive good enhances the desirability of present utility and diminishes the perceived future costs associated with current consumption. This has the effect of making consumption even more desirable and generates a reinforcement mechanism, which is precisely what may lead to addiction. The resulting myopia is a side effect of addiction and not its cause, as posited in the non-rational framework.

This model stays explicitly within the confines of dynamically consistent rational preferences, exploring the bounds of standard rational assumptions. This development of their work illustrates the importance of the existence of heterogeneous outcomes stemming from risk consumption enabling a better understanding of addiction and *ex post* regret.

Following the same trail, Vanini and Braun (2002) suggest that only by considering the degree of impatience as a determinant of the intensity of substance use will we be able to distinguish habits from addictions. Time preferences will thus depend on consumption history and it will be the accumulation of a large stock of consumption capital that generates addictive behaviour. Adopting this point of view, the assumption of exogenously fixed time preferences will only be suitable for analysing habitual consumption but would not allow addiction to be tackled.

The consideration of time inconsistent decision-makers from the outset would then be fundamental to explain consumers' non-rational behaviour namely the lack of self-control.

4. Models with time inconsistent preferences

Many researchers that have studied time-preferences have proposed formal and general models of time-inconsistent preferences¹⁶. Based on the seminal papers of Strotz (1956) and Pollak (1968), O'Donoghue and Rabin (1999a, 1999b) presented a time – inconsistency and self-control model of addiction.

Particularly they have coined the term "present-biased preferences" to mean that people's preference have a bias for the "present" over the "future" (where present is constantly changing)¹⁷.

The steady state model of addiction developed by BM (1988) shows how it can be optimal for an individual to maintain a severely harmful consumption, assuming that people have naturally forward-looking behaviour and they are fully rational; they fail, however, to explain why the person chooses and maintain this harmful consumption.

16 In the context of dynamic inconsistency of consumption plans, Mistri (2002) recognises the fundamental importance of dynamic processes of cognitive and physiological mechanisms to explain addiction. Although they are foreign to economic analysis, economists "can and must focus on the economic effects of these factors".

17 In accordance with O'Donoghue and Rabin this is merely their term for an array of older models that went under different names. The (β, δ) preferences that they used in their papers are identical to the preferences studied by Laibson (1994) who uses the term "hyperbolic discount". Prelec (1990) uses the term "decrease impatience" for an alternative formulation of the same phenomena (O'Donoghue and Rabin, 1999a).

O'Donoghue and Rabin (1999b, 2001) introduce self-control problems – e.g., a person's awareness of future self-control addictive consumption – to determine whether it could be a credible cause of addictive over-consumption.

They present a model of addiction in which an individual has to decide in each period of time whether to consume or not (a binary choice model). This simplified version considers two of the more relevant characteristics of harmful addictive goods, negative externalities and habit formation, to explain the “trap of addiction”. Negative externalities¹⁸ say the more the product has been consumed in the past the smaller the person's current well-being (it includes health, job or personal consequences of past consumption). To generate those externalities these goods are necessarily habit-forming: the more the individual has consumed in past the more he will desire to consume now.

According to the theory, the combination of the two characteristics creates the core of the choice of becoming an addicted. The increasing consumption of the addictive good provokes less and less pleasure in the consumer, yet he may continue to consume it because refraining is increasingly painful.

To resolve this trade-off, the individual must choose between the current desire of consumption (“temptation to hit”) and its future costs. The power of each, whether the current desire to consume out-weights the future costs of this consumption, depends on the individual intertemporal preferences.

Time consistency, a person's relative preference for well-being at an earlier date is the same no matter when she is asked, is assumed as a matter of course in the standard economic models. Observation and psychological research show, on the contrary, that the consistency assumption is incorrect because it ignores the human tendency to pursue immediate gratification: a person's relative preference for well-being at an earlier date over a later date gets stronger as the earlier date gets closer (O'Donoghue and Rabin, 2001).

O'Donoghue and Rabin's model assumes that people have time-inconsistent present-biased preferences, and so individuals have self-control problems because they pursue immediate gratification in a way that does not correspond to their long-run well-being.

To study the problem of self-control, the theory considers two extreme possibilities about the awareness of future self-control: *sophisticates* – those people who are fully aware of their future self-control problems, and *naifs* – those who are wholly unaware of their future self-control problems.

In addition they consider a third possibility: people with standard, time-consistent preferences (TCs) used as a reference point for methodical comparisons with *sophisticated* and *naïf* individuals. Those comparisons enable some interesting conclusions about naïf behaviour, but are relatively non-conclusive about sophistication. Thus, the sophisticates can be more or less prone to consume than naïfs; this uncertainty about their behaviour tendency arises because there are two ways in which their full awareness about future self-control can influence their current behaviour. First, they are pessimistic about their future, believing that they will consume more in the future than they would want (*pessimist effect*). The combination of the *pessimistic effect* with habit-forming characteristics of addictive goods may exacerbate the over-consumption due to present-biased preferences. However, a second effect (*incentive effect*) may contribute to refrain from their current consumption in order to induce themselves to resist temptation in the future. The two effects are then acting as counterbalance forces, which leads to some ambiguity about their future behaviour. Therefore, the sophisticates can be more or less prone to consume (hit) than naïfs, due to their awareness and the ambiguity element by they can moderate or exacerbate over-consumption in the future.

18 The term “internalities” was earlier used earlier by Herrnstein, Lowenstein and Prelec (1993) who define an internality to be a “within-person externality” (O'Donoghue and Rabin, 2001).





With respect to the naïf behaviour it is plausible that they show always more tendency to consume than TCs do. This reflects over-consumption as a direct consequence of their present-oriented preferences.

Formally, O'Donoghue and Rabin (1999b) present a simplified version of their model, by considering consumption as a binary choice and a discrete-time model with periods $1 \dots T$. In each period, a person can either consume (or "hit", $\alpha_t = 1$) or not consume (or "refrain", $\alpha_t = 0$).

The effect of past consumption is captured by k_t , the *person's addiction level* in period t . It is assumed that k evolves according to the equation:

$$k_t = Yk_{t-1} + \alpha_{t-1}$$

where $Y \in (0, 1)$ is a parameter¹⁹ indicating the rate at which an addiction decays. If $Y = 0$, this means that refraining for a single period gets the individual completely un-addicted. If the parameter Y is close to one, refraining reduces the person's addiction level very little.

Applying a simple form of present-biased-preferences, and using a model originally developed by Phelps and Pollak (1968) and later by Laibson (1994, 1997), the intertemporal utility function would be:

$$U(u_t, u_{t+1}, \dots, u_T) = \delta^t u_t + \beta \sum_{\tau=t}^T \delta^{\tau-t} u_\tau$$

The parameter δ represents the "time-consistent" discounting, while the parameter β represents the "present bias". For $\beta = 1$ these preferences reduce (the discrete version) exponential discounting; when $\beta < 1$ these preferences will capture the time-inconsistent preference for immediate gratification.

By assuming that an optimal consumption path exists, the authors say that sophisticates and naïfs trace an "optimal" consumption path and, eventually, choose the current action that is part of that consumption path. However, if TCs are always attached to the consumption path prior chosen, naïfs often adjust their chosen consumption paths as their preferences change overtime.

One of the main purposes of the O'Donoghue and Rabin model is to find out whether self-control problems are a plausible source of severely harmful addictions and to draw some important conclusions on welfare grounds.

Are then people sophisticated or naïve²⁰?

A person could be sophisticated²¹ and knowing exactly what her future selves will be. Or, a person could be naïve and believe her future selves' preferences will be identical to her current self's, and not realizing that her preferences will change as the timing of the decision gets closer. Finally they admit there could be intermediate cases: for instance, an individual might be aware of his present-biased preferences, but he/she may underestimate the degree of present bias.

The theory says that to the extent a person is sophisticated, he may suffer severe harm due to the "feeling of inevitability", but to the extent that a person is naïve, he may suffer due to the delay in quitting an established addiction.

19 The parameter Y corresponds to $(1 - \delta)$ in the Becker and Murphy model (O'Donoghue, 2001).

20 The fact that most of economists who studied inconsistent preferences assumes sophistication is clearly justified by "rational expectations" implicit in the sophistication concept.

21 Sophisticates, like TCs, predict exactly how they will behave in the future. But, like naïfs, they discount the future cost from hitting by $\beta\delta$.



Finally the authors conclude while in real-world environments lifelong feelings of inevitability seem unlikely, temptation to consume addictive goods seems universal. Their analysis suggests that for realistic environments, self-control problems are a probable source of harmful addictions only in combination with at least some degree of naiveté (naïve self-control problems). There are, probably, elements of both sophistication and naiveté in the way people anticipate their own future preferences.

O'Donoghue and Rabin (2001) point out that "...an addicted person might suffer severe harm because she procrastinates quitting – she wants to quit, and always plans to quit in near future, but never gets around to it. Moreover, naifs might develop several harmful addictions in the first place because they naively give in, temporarily, to high temptations believing they'll just quit after the temptation subsides, when in fact they end up with long-term addictions".

The inclusion of time-inconsistency²² makes it possible to extend the role of government policy, which should depend not only on the externalities that addictive consumers eventually impose on others, but also on the "internalities" imposed by addicts on themselves (model of no-externality type²³).

5. Policy Implications

5.1. Rational addiction and the effect of prices

In a fully rational framework (BM) there seems to be no other reason for public policy to control risk consumption except where net external costs are present. Even though any individual addict can be making optimal choices, the utility of society as a whole is inevitably reduced by addiction. All of the theoretical models presented emphasize the role of price and the importance of past consumption and future price anticipation in current consumption. Empirical applications of the rational model proved, contrary to the conventional wisdom, that addicted consumers are actually responsive to prices²⁴. The key implication of the existence of a consumption stock in these models is the greater impact of any permanent price policy in the long-term than in the short-term, namely through excise taxes. Sizable long-run price elasticities were found and also they were much bigger than short-run elasticities²⁵. Empirical studies even provided strong support to differential government intervention oriented towards different groups, particularly among youth. This group, along with lower income groups, displays a higher sensitivity to the monetary component of full price.

Lower income earners and young people also appear to discount the future more heavily. It can also be shown that addicts with higher discount rates respond more to changes in monetary prices whereas addicts with lower rates of discount respond more to changes in harmful consequences (Becker *et al.*, 1991).

5.2. Regret and myopia as addiction consequences – information policies

The assumption that individuals are fully aware of the consequences of addictive goods consumption is one of the most criticized aspects of rational models. The learning and regret

²² For the quasi-hyperbolic discounters, discounted utility becomes.

$$U_t + \beta \sum_{i=0}^{T-1} \delta U_{t+i}$$

²³ The authors admit that one might look at the intra-personal conflicts that are generated by the hyperbolic model as intra-personal externalities.

²⁴ Either a higher price of the good (due perhaps to a large tax) or a higher future cost (due perhaps to greater information) reduces consumption in both the short and long-run.

²⁵ Becker, Grossman and Murphy (1991) refer cite empirical studies where the evidence from smoking, heavy drinking and hard gambling strongly supports the rational addiction model. For more recent empirical evidence see Chaloupka (1991) and Chaloupka and Wechsler (1997).



model, considering the initially uncertainty regarding the real possibility of becoming addicted, and the importance of subjective beliefs, brings a new insight to public policy goals.

Admitting that the government is in a better position to pass along better information, the theory regards as key policy elements the use of educational programs and advertising campaigns to discourage addictive consumption, especially among young people – those who are particularly exposed to the risk of addiction. This kind of argument also sustains legal restrictions like a minimum age for legal purchase.

The dissemination of information also plays an important role in curtailing the potentially harmful effects of peer pressure. Studies in social psychology have shown that peer pressure leads adolescents to systematically overestimate actual addictive consumption by their peers and thus underestimate the potential harm. Education programs could seek to rectify this misinformation problem “by showing young people that contrary to their own beliefs most of their peers do not use drugs”. When we also take into account the existence of significant quitting costs²⁶, price changes and health information dissemination can also be seen as powerful tools to prevent people from starting to consume or as an encouragement for current consumers to quit sooner. In this way, painful *cold-turkey* quits may be avoided.

5.3. Widening public intervention – addiction as a self-control problem

Self-control problems viewed as the source of over-consumption of addictive products imply a different public policy emphasis. The distinction between two extreme kinds of consumers, the sophisticates and the naifs, means that those self-control problems, as a source of harmful addiction, may emerge only in combination with some degree of naiveté. Naïf consumers may usually underestimate their future behaviour and so the theory expects that they would suffer a relatively small change in behaviour effect as a result of anticipating future prices, with regard to a time consistent consumer. In other words, while the qualitative effects of price changes are the same, smaller quantitative effects can be expected, and so less efficiency can be expected from price policies.

It is possible to perceive addiction as a market failure, in the sense that the market itself does not supply a convenient “self-control device”²⁷. The voluntary use of self-control is seen as crucial, for instance in attempts at quit smoking, and so public intervention could be devised to make the teaching and dissemination of self-control more effective. However, one cannot expect this policy to be efficient with naïve consumers. So, for consumers with some level of naiveté, public intervention corrects both a self-control problem and a misperception problem, since the naïve agent is incorrect in predicting his future behaviour due to cognitive limitations²⁸. Thus public interventions could also be justified because of internalities, leaving the way open for a more paternalist policy standpoint.

6. Concluding comments

In our societies market regulation policies are usually justified by market failures. Addiction, a phenomenon with negative social impacts, claims for public intervention that, assuming individuals pursuing rational decisions, could only deal with interpersonal externalities. This being so, taxation, for instance, should be designed in accordance with the size of external costs.

But people might develop harmful addictions due to rational uncertainty about the addictiveness of the product. Information policies are then necessary on the grounds of these goods’ special features and full information unawareness on the part of individuals, with special emphasis on the young.

²⁶ For a more detailed analysis see Suranovic, (1999)

²⁷ Even if firms do have a financial incentive to provide self-control to agents with self-control, other firms have a financial incentive to break it.

²⁸ For the results of an experiment to test addicts’ rationality see Fehr, E and Zych, P. (1998).

Finally, individual choice behaviour in general and risk consumption in particular does not always conform to the fundamental premises of rational choice theory. Addictions obey certain qualitative hedonic regularities like the saliency of present benefits and distributivity of future costs. The introduction of behaviour insights stemming from cognitive science into the modelling of risk consumption allows a better explanation of individual choices. Self-control problems may then be the source of addiction and policies designed to enhance self-control may be called for, even if they threatened consumer sovereignty.





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