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RATIONAL CHOICE AND META-PREFERENCES

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Abstract: The theory of rational choice is one of the most important developments of classical microeconomics in the second half of the twentieth century. It was established on a firm basis by three Nobel prize winners Paul Samuelson, Kenneth Arrow and Amartya Sen. Later, it became gradually eclipsed by the rise of behavioral economics, which stresses the well-known fact that the choices which constitute our economic behavior usually are less than fully rational. Putting aside the issue about the descriptive adequacy of rational choice theory, it remains important from a normative point of view. Regrettably, all attempts to incorporate its lessons into a general theory of rational action are hindered by the fact that virtually any axiom of the theory, which functions as a part of the implicit definition of the concept of rational choice, can be juxtaposed with a relatively elementary counterexample. Many such counterexamples were formulated by Sen himself, and the future development of the theory seems possible only if we find a way to sidestep them. The present text proposes a novel solution to some of those counterexamples. It is organized as follows: (§1) introduces the conceptual apparatus of rational choice theory, paying special attention to the notions of feasible set, choice function and revealed preference; (§2) lists some of the popular "axioms" of the theory and sketches their informal meaning; (§3) elaborates on the reasons for Sen's dissatisfaction with those axioms, linking them with the well-known phenomenon of menu dependence; (§4) introduces a novel approach which employs not one but two relations of preference, the second one being interpreted as a relation of meta-preference since it grades not the alternatives belonging to some feasible set but feasible sets themselves. As we shall see, this allows us to circumvent some of Sen's criticisms.

Keywords: rational choice, choice function, revealed preference.

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§1. The foundations of abstract choice theory were laid by Kenneth Arrow in the 50s of 20th century, although he relied greatly on results obtained earlier by Samuelson (1938), Houthakker (1950), Chernoff (1954) and Uzawa (1956). The basic insight of the theory can be viewed as coming from the reversal of the apparent relation between a pair of key concepts – the concepts of choice and preference. We usually assume that our choices are completely determined by our preferences – if I prefer x to y, then I would choose x instead of y when both are available. Nevertheless, Paul Samuelson has rightly noted that other peoples' preferences are ghostly entities – they are not directly observable, therefore it is imposible to deduce from them their actual choice behavior. In other words, I cannot explain N's choices by means of N's preferences without initiating a vicious circle, since my only reliable sign for N's preferences are ... N's choices. As a matter of fact this remains valid if we are interested in the structure of our own choices – introspection is not a flawless source of knowledge which gives us an invariably true insight into our own preferences. This fact provides us with a sufficient reason to turn upside down the traditional rendering of the relation between choice and preference, thus trying to deduce the unobservable preferences from our publicly manifested acts of choice. If this project turns out to be successful, then preference would be completely transformed – from something external to the acts of choice into their inherent feature. Precisely this is the conceptual revolution which leads to the formation of rational choice theory.

Let us call those things x, y, z, ... which we are able to choose or reject, thus revealing our preferences, *alternatives*. The collection of alternatives which are relevant in the context of some choice situation shall be called choice *universe* and shall be signified as X. If we are shopping, then the alternatives would be the available commodities which we are able to buy; if we are travelling, then the alternatives would be the different routes or means of transportation; if we are performing an ethical deliberation then the alternatives would be our possible courses of action; if we are conducting a scientific research then the alternatives would be the proposed theories, which our data are able to corroborate, etc. All these examples aim to show that the concept of choice from some specified set of alternatives is virtually ubiquitous.

Any subset of the choice universe X which comprises alternatives that can be available simultaneously shall be called a *feasible set*. As we shall see feasible sets play an important role in the definition of the key concept of choice function. Which sets are feasible is determined by the specific nature of the alternatives which belong to X. In the classical version of abstract choice theory X is allowed to be (countably) infinite and in this case the feasible sets are simply the nonempty finite subsets of X whose collection is signified as [X]. If the collection of feasible sets, D(X), coincides with [X], then it is said that the choice space <X, D(X)> is *universal*, otherwise it is said that the choice space is *general*. One of the fundamental differences between the classical and the contemporary theories of rational choice is that the former treat of universal, while the latter - with general choice spaces. The justification for the application of general choice spaces is that sometimes we have an a priori justification to discard some feasible sets [**Suzumura, 1976a**: 149].

In the present context the concept of choice is formalized by means of a *choice function* (or, more precisely, choice correspondence) C(X), which assigns to any feasible set of the choice space some of its nonempty subsets. This may seem strange – couldn't we refuse to choose a particular alternative from those which are available in the feasible set? We can answer this question by stating that in this case the option to abstain from choosing should be viewed as an available alternative which is included in the feasible set. The *revealed preference* with respect to a given choice function can be interpreted as a binary relation R, i.e. as a subset of the Cartesian product X × X. Two modifications of this relation were carefully studied – weak and strict. If there is a feasible set A∈D(X) such that x∈C(A) and y∈A (i.e. if x is choosen when y is available), then it is said that x is *revealed weakly preferred* to y which is written xWy. On the other hand, if there is a feasible set A∈D(X) such that x∈A) and y∈A \ C(A) (i.e. if x is chosen when y is rejected), then it is said that x is *revealed strictly preferred* to y, which is written xPy. There are some fairly standard assumptions concerning these two relations. Weak preference is by definition reflexive, while strict preference is irreflexive; to these two properties are usually adjoined *completeness* (which claims that any pair of alternatives are comparable) and transitivity, which transforms W (P) into a weak (strict) ordering of X.

Thus far we've seen how, given a choice function C(X), we can derive a pair of preference relations. On the other hand, we can also proceed in the opposite direction – given a preference relation R we may define a choice function C(X). We shall say that C(X) is *optimal* with respect to R, if C(X) = {x∈X | for all y∈X, xRy} (i.e. an alternative x is chosen if and only if it is at least as good as any other alternative) and C(X) is *maximal* with respect to R, if C(X) = {x∈X | for all y∈X, not-yP(R)x} (i.e. an alternative x is chosen if it is not dominated by any other alternative; here P(R) signifies the asymmetric factor of R). There is also a third relation which features prominently in the standard axioms concerning rationalizable choice functions: given a pair of alternatives x and y, we shall say that x is revealed indirectly preferred to y, xP*y, iff there is a finite ordered set of alternatives $\{x_i\}$, i = 1, … , n, such that $x_0 = x$, $x_n = y$ and for any j = 1, …, n, $x_{j-1}Px_j$ (plainly, P* is simply the transitive closure of P – this is the smallest transitive relation which contains the relation of strict preference).

§2. In his classic paper "Rational choice functions and orderings" Arrow discusses several "axiomatic" assumptions [**Arrow, 1959**: 123]. Historically the first was the so-called weak axiom of revealed preference (WARP) which was introduced by Samuelson. It states that if there is a feasible set A such that some element of A is strictly preferred to some other element of A, then there should be no other feasible set where the second alternative is revealed strictly preferred to the first. This means that no change in the list of available alternatives can possibly overturn a strict preference. As suggested by its name, this axiom is "weak", i.e. in general it is not sufficient to prove that there is an ordering R on the set of alternatives which generates the considered choice function. That is why, Houthakker introduced a modified version of WARP, called strong axiom of revealed preference (SARP). It states that if there is a feasible set A such that a pair of alternatives are chosen simultaneously, then neither one of them should be even indirectly revealed to be preferred to the other. As is easily seen, these two axioms are relatively complicated; three other, much simpler assumptions, were studied later. They bear the names of Chernoff, Uzawa and Arrow:

(C2, axiom of Uzawa) for all A, B⊆D(X), if A⊆ B, then A \ C(A) ⊆ B \ C(B) (if one feasible set, A, is contained in another, B, then it is impossible some alternative, which was rejected in A, to be chosen from B; i.e. dispreferred alternatives remain such when we introduce additional alternatives);

(C3, Chernoff's postulate) for all A, B$\subseteq$D(X), if A $\subseteq$ B, then C(B) $\cap$ A $\subseteq$ C(A) (if one feasible set, A, is contained in another, B, then it is not possible among the chosen elements of B to discover an alternative, which was rejected in A; this condition is clearly connected with the previous one);

(C4, Arrow's axiom) for all A, B$\in$D(X), if A $\subseteq$ B and C(B) $\cap$ A $\neq \varnothing$, then C(A) = C(B) $\cap$ A (if one feasible set, A, is contained in another, B, and moreover some of the alternatives chosen from B belong to A, then these are the only alternatives which are chosen from A; i.e. a chosen alternative should not be rejected if we remove some of its concomitant alternatives).[1]

It is easily discernible that C3 and C4 are symmetric – this is the reason why they are usually regarded as *consistency postulates*, requiring expansion and contraction consistency of the choice function. Another pair of axioms were introduced by Richter [**Richter, 1966**]; they constrain the behavior of C(X) by means of the derived relations P and P*:

(WCA) for all x, y$\in$X, for all A$\in$D(X), if x$\in$A, y$\in$C(A) and xPy, then x$\in$C(A) (if in the context of some feasible set the alternative x was revealed strictly preferred to y, then x should be chosen in all cases when y was chosen).

(SCA) for all x, y$\in$X, for all A$\in$D(X), if x$\in$C(A), y$\in$A and yP*x, then y$\in$C(A) (if in the context of some feasible set A the alternative x was revealed weakly preferred to y and moreover y is indirectly revealed to be preferred to x, then y should also belong to the choice set of A).

Somewhat later appeared another famous list of potential "axioms" - Sen's "alphabet soup" [**Sen, 1971, 1977a**] Here, along with Chernoff's postulate (dubbed „α") are featured the following claims:

(β) for all A$\subseteq$B $\in$ D(X), for all x, y$\in$C(A), x$\in$C(B) $\leftrightarrow$ y$\in$C(B) (if a pair of alternatives are chosen among the elements of some feasible set A, then one of them can be chosen among the elements of another feasible set B, containing A, iff the other alternative is also chosen; that is to say, if we are unable to decide in favor of one of them, this remains impossible if we introduce additional alternatives;

(γ) for all M $\subseteq$ D(X), for all A$\in$M, x$\in$C(A) $\rightarrow$ x$\in$C($\cup$M) (if one alternative is chosen among the elements of any feasible set, belonging to the family M, then this alternative should be also chosen among the union of the elements of M).

Clearly, axiom (γ) introduces another type of intuition which relates to the way our preferences, revealed in the context of some set, relate to the preferences, revealed in the context of its subsets. This leitmotif is developed in another rationality postulate, studied by Charles Plott, which is known as path independence postulate [**Plott, 1973**]:

(PIP) for all A, B$\in$D(X), C(C(A) $\cup$ C(B)) = C(A $\cup$ B) (we shall get the same result if we choose from some set, or we partition it in some way, choose independently from the members of the partition and then choose among the survivors).[2]

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[1] Although it is relatively simple, Arrow's axiom has some interesting corollaries someof which can also be regarded as axioms. Such are the so-called Expansion postulare (C(A) $\cap$ C(B) $\subseteq$ C(A $\cup$ B)) and Aizerman's axiom (A $\subseteq$ B and C(B) $\subseteq$ A implies C(A) $\subseteq$ C(B)) [**Moulin 1985, 152, 154**].

[2] This seemingly innocuous assumption turns out to have interesting (from purely mathematical point of view) consequences; cf. [Danilov and Koshevoy, 2005].

Another standard postulate with a long history behind it is the so-called generalized Condorcet postulate (Blair et al. 1976): [**Blair et al., 1976**]: (GCP) for all A∈D(X), x, y∈A, x∈C({x, y}) → x∈C(A) (if the alternative x is chosen in a pairwise comparison with all the members of some feasible set, then it should be chosen from the feasible set, taken as a whole).

Alternative approach was developed in the last thirty years by Kotaro Suzumura [**Suzumura, 1976b**]. It suggests that we can indirectly characterize the choice function by directly assigning some properties to the revealed preference relation generated by it, i.e. transitivity, acyclicity, or Suzumura consistency (the second condition prohibits the existence of preference cycles, while the third prohibits the existence of cycles containing at least one strict preference). Furthermore, Thomas Schwartz has studied the orderings generated by several weakened versions of WARP [**Schwartz, 1976**]. This line of research – looking for weakened versions of the classical axioms which admit the existence of incomplete preferences, or of incomparable alternatives, flourished in the last decade; cf. [**Bandyopadhyay and Sengupta, 1993**] , [**Kfir and Ok, 2006**].

The list of rational choice postulates which have some claim to be considered as "axioms" can be further expanded *ad nauseam*, here I've limited my attention to the most popular ones which have a relatively elementary form and some clear intuitive backing. Their very multiplicity suggests that our intuitions are not completely stable and have compartmentalized field of applicability. As a matter of fact, the only reason for the introduction of some of the above-mentioned axioms is that the (weak or strict) preference relation they are able to generate has some desirable (from mathematical or intuitive point of view) properties. It turns our however, that most of these properties seem problematic in a context where the availability of alternatives affects the choice function and our intuitive understanding of its rationality. In other words, when a phenomenon which economists have called "menu dependence" is clearly manifested, then those properties which we usually treat as desirable, turn out to be insufficient or even problematic.

§3. Although Sen was one of the scientists who greatly contributed to the development of rational choice theory, later he turned out to be one of its most outspoken critics. In his paper "Rational fools" he has launched an assault on the very foundations of this theory: "A person's choices are considered "rational" in this approach if and only if these choices can *all* be explained in terms of some preference relation consistent with the revealed preference definition, that is, if all his choices can be explained as the choosing of "most preferred" alternatives with respect to a postulated preference relation" [**Sen, 1977b**: 323]. But, in some cases our preferences are not able to determine our choice, since it depends on other factors, which the traditional theory of rational choice is unable to take account of[3] As a matter of fact, "we cannot determine whether a choice function is or is not consistent on purely "internal" grounds (i.e., without bringing in the context that takes us *beyond* the choice function – into motivations, objectives, principles, etc.)" [**Sen, 1993**: 499]. In order to prove this, Sen

[3] Cf. also [**Packard 1982**] and [**Sugden 1985**].

propounded several counterexamples which aim to show that our actual choice behavior is not simply a function of our preferences but is influenced by the availability of alternatives in the feasible set [**Sen, 1993**: 501-502].[4] Below we shall consider two of them:

Case 1 (The apple lover). Let us imagine a man who likes apples. He is a guest at a dinner party and the hostess, who is also known to like apples, offers him a choice from a fruit basket. If the choice is between an apple and another fruit, the guest would take the other fruit, because in this way he would leave to the hostess the opportunity to have the last remaining apple. In the same way, if he was offered a choice between a bigger apple and some other fruit, he would take the other fruit. But, if he was offered a choice between a pair of apples and some other fruit, he can take the smaller one without being impolite. Thus if we let x = apple, y = grapefruit, z = a bigger apple, we shall have the following system of choices: C({x, y}) = {y}, C({y, z}) = {y}, but C({x, y, z}) = {x}. From the point of view of revealed preference theory, such choice behavior is clearly irrational, since the first two choices reveal a strict preference for y at the expense of x, while the pooling of their corresponding feasible sets displays a clear case of preference reversal. According to Sen, this shows that "We cannot determine whether the person is failing in any way without knowing what he is trying to do, that is, without knowing something external to the choice itself … the person who chooses an apple when another one is around (but not if it is the *last* one), or the person who tries to get as large a cake slice as possible (subject to its being *not the very largest*), is, in some basic sense, a *maximizer*. The ordering of the alternatives on the basis of which he or she is maximizing varies with the menu, but this does not deny that for *each menu* there is a clear and cogent ordering – the basis of the maximizing decisions" [**Sen, 1993**: 501].

Case 2 (The indecisive guest). Let us imagine a gentleman of the old stamp who is invited to have a tea by a distant acquaintance. Let us suppose also that initially he has to choose between a pair of alternatives: x – to have tea with his distant acquaintance, y – to decline the invitation and stay home. As he would like to get to know his prospective host better, our vacillating guest accepts the invitation, i.e. C({x, y}) = {x}. Let us now change significantly the initial situation – the options shall include having not only tea (x), but also cocaine (z). In this setting, our gentleman's choice is completely different - C({x, y, z}) = {y}. Plainly, this example demonstrates that "What is offered for choice can give us information about the underlying situation, and can thus influence our preference over the alternatives, *as we see them*" (Sen 1993, 502). [**Sen, 1993**: 502].

Now its time to examine what is the impact of these two counterexamples on the axioms we have listed above. The answer of this question is short and clear – completely destructive. Already the first of them eliminates almost all of the rationality postulates we have dealt with. It is relatively easy to check that Samuelson's WARP, together with the axioms of Uzawa, Chernoff and Arrow

[4] Sen's conunterexamples are not purely destructive – they have initiated the search for alternative formations dealing with the phenomena of menu dependence: cf. for example [**Sen 1997**] and [**Bossert and Suzumura 2011**].

are incompatible with the choice function suggested by the apple lover case. The same applies to the pair of congruence axioms, Sen's (γ), Plott's path independence and the generalized Condorcet postulate. Suzumura consistency and acyclicity are also clearly violated. What is more important, similar thought experiments are able to destroy any of the postulates proposed thus far. The reason for this is that rational choice theory identifies rational choice as a procedure which generates specific revealed preference patterns, while menu dependence suggests that sometimes our choice does not depend solely on the intrinsic desirability of alternatives. Therefore, two routes lay open for us: to try to formulate new axioms in the classical framework, paying attention to menu dependence, or to admit that revealed preference is not the only factor which should be considered when we try to single out the class of rational choice functions. Below we shall explore the conservative strategy, suggested by the first option; of course, this does not imply that I'm completely satisfied by the notion of revealed preference, or that other solutions are not justifiable.

§4. In my view the best way to tackle these problems can be derived from a novel approach, developed by Nehring and Puppe [**Nehring and Puppe, 1998**]. They have studied orderings which relate not simply the alternatives available in some feasible set but feasible sets themselves. Moreover, any preference relation R, defined on the Cartesian product X × X, induces a relation of meta-preference Q, defined on the Cartesian product D(X) × D(X); to get Q from R it is enough to let $AQB =_{df}$ for all b∈B, exists a∈A, aRb. On the other hand, not all meta-preference relations should be viewed as obtainable in such a direct manner from elementary preference relations. In order to see this, let us return to the apple lover case. In the scenario presented above, he was presented as a passive consumer, whose choices are constrained by a previously fixed menu. On the other hand, the true apple lovers are generally more active when they are prone to be deprived from their favorite fruit. Usually, they actively try to shape the choice situation so that the accessibility of apples is guaranteed. Indeed, if initially the menu was {x, y, z} and the choice was offered to another guest, then in a more realistic scenario our hero would have done anything to choose first, or, if this is inappropriate or impossible, to make the other guest choose the other fruit, for example by discussing its perfect taste and indisputable nutritional value. This would let the attentive observer to conclude that the witty guest prefers the feasible sets {x, y, z} and {x, z} instead of {x, y} and {y, z} (of course, the reason for this meta-preference is that these feasible sets allow him to choose the optimal alternative x, while the other two feasible sets force him to choose the suboptimal alternative y). In other words, what we do and how we choose make manifest not only which alternatives we like most, but also which are our preferred choice situations. The apple lover likes apples and this is the reason why he prefers such choice situations which give him the opportunity to taste his favorite fruit. That is why the choice from a fixed range of alternatives is usually not something we simply stumble upon, it is the outcome of active search in the space of feasible sets. The situation with the other counterexample is similar. In general, the vacillating guest would try to learn more about his prospective host before accepting his invitation. That is why, he would prefer {x, y, z} instead of {x, y}, because the availability of z provides some specific and at the same time utterly important information about the host's way of life.

What are the properties of the meta-preference relation Q? In my view, the answer of this question if much simpler than we could expect. We can distinguish two types of choice situations: *positive* (i.e. such choice situations which allow the choice of an optimal alternative) and negative (i.e. such choice situations which force the choice of a suboptimal alternative). That is why, for a pair of feasible sets A and B just three cases are possible: 1. A and B are both positive or both negative, hence are equally preferred (AQB and BQA); 2. A is positive and B is negative, hence A is preferred to B but B is not preferred to A (AQB and not-BQA); 3. A is negative and B is positive, hence B is preferred to A but A is not preferred to B (not-AQB and BQA). Plainly, the first case corresponds to weak meta-preference, while the second and the third are definitional for strict meta-preference. Furthermore, we can introduce a pair of preference relations on the choice universe X by letting for given $A \in D(X)$ and a pair of alternatives $x, y \in A$, $x \geq_A y =_{DF} x \in C(A) \wedge y \in A$, and analogously $x >_A y =_{DF} x \in C(A) \wedge y \in A \setminus C(A)$ (these are relativized versions of the relations of weak and strict preference which we have introduced above by means of existential quantification). Then, given a weak meta-preference relation Q on the Cartesian product $D(X) \times D(X)$) we shall say that x is *revealed weakly Q-preferred* to y ($x \geq^Q y$) iff exists $A \in D(X)$, $x \geq_A y \wedge$ for all $B \in D(X)$, $y >_B x \rightarrow AQB$. Analogously, given a strict meta-preference relation Q on the Cartesian product $D(X) \times D(X)$) we shall say that x is *revealed strictly Q-preferred* to y ($x >^Q y$) iff existsts $A \in D(X)$, $x >_A y \wedge$ for all $B \in D(X)$, $y \geq_B x \rightarrow AQB$. In other words, x is revealed weakly Q-preferred to y iff there is a choice situation (feasible set) A such that x is revealed weakly preferred to y in A and for every choice situation B such that y is revealed strictly preferred to x in B, then A is at least weakly meta-preferred to B. In the same way, x is revealed strictly Q-preferred to y iff there is a choice situation (feasible set) A such that x is strictly preferred to y in A and for any choice situation B, such that y is even weakly preferred to x in B, then A is strictly meta-preferred to B. In the light of this new definition everything seems as it should – the apple lover prefers an apple (but not the largest one), and the vacillating guest prefers to stay home (since he prefers to know his host better).

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In my view, the history of rational choice theory confirms the fruitfulness of the concept of revealed preference but also makes manifest that it needs to be further developed. Our choices in a given situation reveal (at least to some extent) our preferences but at the same time our striving to place ourselves in a particular choice situation manifest our meta-preferences. In order to be able to discriminate between the apparently desired from the truly preferred we need to take into account all the information which provides people's behavior.

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