

In Defence of Revealed Preference Theory

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Abstract

Revealed preference theorists interpret the preferences that feature in standard economic theory behaviourally, as mere descriptions of agents' actual and hypothetical choices. This paper defends revealed preference theory against a pervasive line of criticism, according to which the empirical success of revealed preference methodology ultimately relies on appealing to some mental states, in particular the agent's beliefs. This is then either taken to show that revealed preference theory is incoherent, or that it is unmotivated. Alternative interpretations of preference as a kind of mental state are proposed instead. What I aim to argue here is that all that is established by these arguments is that revealed preference theorists must accept a limited kind of mentalism in their theory of options, that is, their theory about how the options an agent is choosing between ought to be modelled. Such mentalism is consistent both with the behavioural interpretation of preference and with standard revealed preference methodology. I provide evidence that current economic practice is by and large consistent with the concession of a limited kind of mentalism about options, and argue that such a concession does not undermine the core motivations of revealed preference theory.

1 Introduction

The theory of rational choice that is at the heart of much of orthodox economics is formulated in terms of preferences. Economic models in most of microeconomics, as well as much of macroeconomics typically describe agents as expected utility maximizers. Methods for the empirical measurement of demand functions, the rate of inflation, and other important economic variables presuppose that agents are expected utility maximizers. What this has standardly been taken to mean, since about the middle of the 20th century, is that agents have preferences which fulfil various conditions, making it the case that the preferences can be represented as expected utility maximizing.

This paper is concerned with the interpretation of 'preference' in standard economic theory. Economists often profess to a behavioural understanding of preference, whereby

they equate preference with actual or hypothetical choice.¹ According to that understanding, what it means to prefer an option a over an option b is just that one does or would choose a over b from some specified choice set – for instance, that one does or would choose a over b when only those two options are available, or that one does or would not choose b in any choice situation where both are available.² Preferences are thus understood as choice dispositions, but in a thin sense. Preference ascriptions are not claims about dispositions as tendencies to ‘by and large’ choose in a certain way, and they are not claims about the potential psychological bases of such tendencies. They are simply claims about what agents actually or hypothetically choose.³ The behavioural interpretation of preference, together with a commitment to a methodology that allows us to construct a preference relation and expected utility representation from observations of an agent’s choices, are commonly known as ‘revealed preference theory’.

Insofar as it is committed to a behavioural understanding of preference, revealed preference theory is widely rejected in the philosophical literature. I wish to defend it here against a pervasive line of criticism. According to this line of criticism, the empirical success of revealed preference methodology in fact ultimately relies on appealing to some mental states, in particular the agent’s beliefs, and her own conception of the options open to her. This is then either taken to show that revealed preference theory is incoherent, or at the very least that it is unmotivated. Alternative interpretations of preference as a kind of mental state are proposed instead.⁴ What I aim to argue here is that all that is established by these arguments is that revealed preference theorists must adopt a theory of options, that is, a theory about how the options an agent is choosing between ought to be modelled, that requires economists to appeal to some mental states.

¹See, for instance, Savage (1972), Luce and Raiffa (1957), Harsanyi (1977), Mas-Colell et al. (1995), Binmore (2008), Gul and Pesendorfer (2008) and Gilboa (2009). For a defence in the philosophical literature, see Maher (1993).

²I will not take a stance here on which of these behavioural interpretations should be adopted. A potential problem with the first is that it is not clear whether it allows us to express indifference. A potential problem with the second is that it conceptually rules out various violations of standard expected utility theory.

³Note that according to this understanding of the behavioural interpretation of preference, if what an agent actually or hypothetically chooses when confronted with a particular choice set is not stable over time, then the agent does not have stable preferences – it is not the case that she fails to have preferences at all, or that she chooses counter-preferentially.

⁴This standard way of placing revealed preference theory in opposition to ‘mentalist’ interpretations of preference (which I will continue with for the rest of the paper, is complicated somewhat by the fact that dispositionalist accounts of mental attitudes have gained popularity in the philosophy of mind in recent years. See, for instance, Schwitzgebel (2013). According to such accounts, what it means to have a mental attitude such as a belief or a desire just is to be disposed to display certain outward behaviours. According to some such dispositionalist accounts, revealed preference theorists might count as ascribing mental states to agents after all. As I characterise it here, revealed preference theory does not commit to any particular view of mental attitudes, and is compatible with mentalism about preference only under suitably specified dispositionalist accounts of mental attitudes. Those who have defended mentalism about preferences have typically seen themselves in opposition to revealed preference theory, adopting a view of mental attitudes that includes the causal bases of choice dispositions or involves the inner storing of representational content.

Revealed preference theory is only empirically successful if we can attribute to the agents we wish to study preference relations that are generally consistent in the way the theory requires, and generally stable over time. This paper will concede that revealed preference theory can only hope to be empirically successful in this way if agents' options are described in a way that is consistent with how they present themselves to them. Getting the description of options right will thus often involve making assumptions about agents' beliefs. However, I will argue that this only amounts to mentalism in our theory of options, and a limited kind of mentalism at that. Such mentalism is consistent both with the behavioural interpretation of preference and with standard revealed preference methodology. In fact, I will provide evidence that current economic practice is by and large consistent with the concession of a limited kind of mentalism about options.

Moreover, I argue that combining a behavioural interpretation of preference with a limited mentalism about options does not undermine the core motivations its proponents have cited in favour of revealed preference theory. I take those core motivations to be that, by black-boxing the psychological processes that lead to choice, revealed preference theory achieves greater generality, avoids controversial substantive commitments about psychological processes we know little about, and preserves clearer disciplinary boundaries than expected utility theory would under more mentalistic interpretations of preference. In addition, revealed preference theory eliminates some fallible inductive steps in the measurement of utility and related economic variables, namely the inductive steps from choice to mentalistic preference and vice versa. Acknowledging a partly mentalistic theory of options does not detract significantly from these proposed advantages of revealed preference theory.

2 Revealed Preference Theory

Before evaluating the adequacy of revealed preference theory, it is important to get a sense of how preferences feature in economic methodology. First, preferences feature heavily in models of individual choice. As mentioned in the introduction, the standard economic model of individual choice describes agents as expected utility maximizers. Various representation theorems provide 'axiomatizations' of expected utility theory, showing that an agent's preferences can be represented as expected utility maximizing in the framework proposed if and only if they abide by a number of axioms. The representation theorem most commonly appealed to in economics goes back to von Neumann and Morgenstern (1944). Most importantly, von Neumann and Morgenstern require agents to have complete and transitive preferences over outcomes and lotteries (probability distributions over outcomes), and for these preferences to abide by the independence axiom. Von Neumann and Morgenstern's representation theorem assumes probabilities over outcomes to be given,

and shows that if and only if an agent's preferences abide by the axioms will there be some utility function over outcomes such that the agent prefers one lottery over another if and only if the expectation of utility associated with that lottery is higher. In contexts where probabilities cannot plausibly be assumed to be given, Savage's (1954) representation theorem is usually invoked, since it allows us to assign probabilities to the agent if her preferences abide by the axioms of the representation theorem. Savage starts with preferences over both outcomes and acts, where acts assign outcomes to a set of mutually exclusive and exhaustive states of the world. Savage shows that if preferences abide by a variety of axioms, again including completeness and transitivity, as well as the sure-thing principle, there will be some utility function over outcomes and some probability function over states such that the agent prefers one act to another if and only if it is associated with higher expected utility.

Since the rise to prominence of these representation theorems, economists have typically viewed utility as nothing more than a convenient device for representing an agent's preferences – cutting ties with the more substantive roots of the concept as a psychologically real quantity, such as happiness, going back to 19th century British moral philosophy. Revealed preference theory goes one step further in cutting ties with these mentalistic origins of utility theory by interpreting preference itself not as a mental attitude distinct from the behavioural patterns to which it gives rise, but rather equating it with the behavioural patterns themselves. Given such an understanding of preference, what the representation theorems show is that if and only if the agent's choice dispositions abide by the axioms of the theorem, can these choice dispositions be represented as expected utility maximizing.

The behavioural understanding of preference is bolstered by a further group of representation theorems, which show that if and only if an agent's choices over sets of options (including non-binary ones) abide by various consistency conditions can they be represented as optimizing according to some binary relation R which is complete and transitive over all options. Building on work by Samuelson (1938), this was first proven by Houthakker (1950), who introduced what is now known as the 'Strong Axiom of Revealed Preference'.⁵ If we interpret the relation R as the preference relation, we can reduce preferences to just a convenient representation of the agent's choices – just as utility is standardly interpreted to be just a convenient representation of preferences.

While these representation theorems are an exercise in pure theory, they form the basis for empirical methods that allow for the estimation of individual demand functions (relating the quantities purchased of some good to its price) and Engel curves (relating the quantities purchased of some good to income level) from a limited set of observations

⁵The revealed preference theorem most commonly appealed to today is due to Afriat (1967), which employs the 'Generalized Axiom of Revealed Preference'.

of purchasing decisions at different price points and income levels.⁶ Economists can use these methods to describe and explain the choices of real individuals they have observed as expected utility maximizing, and to make predictions of future and yet unobserved choices. In addition to the assumption that an agent's actual and hypothetical choices at any one point in time obey by the axioms of the representation theorems, these methods rely on the assumption that an agent's choice behaviours remain stable over time.⁷

The description, explanation and prediction of individual choice (be it of real or ideally rational agents) is an important part of microeconomics in particular. But much of economic research, and in particular work that finds policy application, is concerned with the description, explanation and prediction of larger scale economic phenomena, especially the movement of markets and the impact of economic policies. In the service of this project, revealed preference theory has been extended to allow the estimation of aggregate-level demand functions and Engel curves from aggregate choice data.⁸

Revealed preference theory, as I understand it here, is committed to the empirical methodology for imputing preferences and utility and demand functions from choice data just described, coupled with the conceptual claim that preferences are to be understood behaviourally.⁹ Importantly, this conceptual claim extends beyond parts of economics that use this empirical methodology. Indeed, we can also extend it to more theoretical parts of economics. Models in theoretical economics typically posit some expected utility maximizing agents, often with simple utility functions sensitive only to the agent's own profits or some combination of the agent's own wealth, consumption or leisure. Unlike in more empirical parts of economics, the assumption of expected utility maximization is not applied to real agents in the economy, but to theoretical entities that play a certain role in models, and that do not have a clear and definite analogue in the real economy. Akerlof's (1970) famous model of a market for used cars, for instance, features two types

⁶See, in particular, Afriat (1973) and Varian (1982).

⁷This assumption is sometimes treated as part of the behavioural interpretation of preference. See, for instance, Bermudez (2009). I want to resist this, since it would imply that agents whose choice behaviour is not stable over time fail to have preferences, making all of expected utility theory inapplicable to them. However, this would be throwing the baby out with the bath water. Such agents can still have choice dispositions that abide by the axioms at any one point in time, and indeed can have stable choice dispositions for the most part, over long stretches of time. Treating stability of choice dispositions not as part of the definition of preference, but as an additional assumption of the revealed preference approach implies that instabilities of choice dispositions make prediction of agents' choices with revealed preference methodology fallible, rather than in principle inapplicable.

⁸See, for instance, Blundell et al. (2003).

⁹Bernheim and Rangel (2008), p.158, provide an especially clear statement of this position: "Though we often speak as if choices are derived from preferences, the opposite is actually the case. Standard economics makes no assumptions about how choices are actually made; preferences are merely constructs that summarize choices. Accordingly, meaningful assumptions pertain to choices, not to preferences. Though the terminology suggests a model of decision making in which preferences drive choices, it is important to remember that the standard framework does not embrace that suggestion; instead, R is simply a summary of what the individual chooses in a wide range of situations." (as cited in Hands 2013)

of traders of used cars, both of which are portrayed as expected utility maximizers whose utility functions are sensitive only to wealth levels and some measure of the quality of any cars they own. These groups of traders are not plausibly understood to be direct representations of any real used car traders.

Exactly how and what we are supposed to learn from such theoretical models about the economy is a matter of dispute within philosophy of economics. I agree here with, e.g., Sugden (2000, 2009) and Gilboa et al. (2014) at least in what these models are trying to offer: Illustrations of a general type of mechanism that is instantiated in many different ways in different economic settings. Insofar as there are relevant similarities between the model and some economic setting or phenomenon, we are licensed to draw some inferences from the model. This is supposed to be possible even if the agents featuring in the model are not direct analogues of any particular real world agents. The conceptual claim of revealed preference theory, that preferences are to be understood as actual or hypothetical choices, applies to such theoretical models, too. According to this claim, positing expected utility maximizing agents in theoretical economic models amounts to positing theoretical entities that choose in a certain way. It does not amount to positing theoretical entities whose choices are caused by some internal state in a specific way. And so, whatever else we might infer from them, theoretical economic models featuring expected utility maximizing agents never license inferences about the mental causes of the choices of real agents.

3 Anti-Behaviourist Challenges to Revealed Preference Theory

Revealed preference theory is often described as an outgrowth of an outdated and discredited positivist philosophy of science, characterized by a general unwillingness to posit unobservable entities, in particular mental states.¹⁰ It is now generally acknowledged that no science can make progress without positing unobservable entities. Psychology, in particular, has largely abandoned behaviourism, the view that banished appeal to unobservable mental states in favour of analysis in terms of patterns of observable behaviour. Since positivism and behaviourism are untenable, it is argued, revealed preference theory must also be. Economics, just like any human science, cannot hope to offer meaningful explanations and reliable predictions without positing some unobservable mental states.

To illustrate the challenge for revealed preference theory, consider the following example. Suppose an economist and her friend visit a sushi restaurant for the first time. The economist has read about wasabi being very spicy and knows what it looks like. Her

¹⁰See, for instance, Rosenberg (1992), Craver and Alexandrova (2008), Hausman (2012), Dietrich and List (2016), Bradley (2017).

friend mistakes it for avocado and devours a whole spoonful. If the economist models her friend's options as "eating a spoonful of wasabi" and "not doing that", then as a revealed preference theorist, she will conclude that her friend prefers "eating a spoonful of wasabi" to "not doing that". As a revealed preference theorist, she may predict her friend will choose in the same way on future occasions. After all, as we have seen above, expected utility theory is committed to the claim that agents have preferences that are consistent in the way described by the standard axioms, and application of empirical revealed preference methodology used to impute demand functions requires an assumption that agents' preferences are stable. However, unless her friend has very unusual tastes, the economist will inevitably find that her prediction turns out false, and the revealed preference approach will have failed her.

Similarly, suppose the economist describes her friend's options in very general terms as simply "eating food" and "not eating food". Or suppose she is specific only in ways that capture only the superficial qualities of the options, for instance by describing her friend as choosing between "eating a thick green paste" and "not eating it". In both cases, she would again be unlikely to uncover a consistent and stable preference relation when she further observes her friend: She may observe her friend choosing to eat other food just moments later, and she may observe her eating a thick green paste with her tortilla chips just the next day.

In standard economic terms, in all of these cases, the decision problem has been 'misspecified'. This much is hard to argue with. If revealed preference theory is to be empirically adequate, then it must offer some standard for the specification of an agent's options that will imply that the options in the cases just described have been misspecified. Critics of revealed preference theory go on to argue that any adequate standard will have to make some reference to agents' mental states. Unless some reference to mental states is made, we have no hope of uncovering any kind of stable and consistent relation that can serve the role of preference in expected utility theory. And so a general kind of behaviourism, which disallows any reference to mental states, is untenable for revealed preference theorists. Let me sketch this argument applied to the cases just described.

To start with the first case, the economist's mistake in describing her friend as choosing whether or not to eat wasabi seems to be that she did not correctly take into account what her friend does or does not know about her options. Her friend does not know that the paste in front of her is wasabi. She might not even know what wasabi is, and that it is very spicy. It seems like, to avoid the above mistake, the economist must acknowledge somehow that her friend mistakenly thought the wasabi was something more delectable. Otherwise she will not be able to uncover a consistent and stable relation when observing her friend's future choices. Indeed, if the economist knew about her friend's mistaken beliefs, applying revealed preference methodology in the way described in the first scenario

would be silly. Of course, the economist may not know about her friend's mistaken beliefs, in which case the misspecified decision problem may be her best attempt at uncovering a stable and consistent preference relation. But all this shows is that the revealed preference methodology is fallible whenever knowledge of agents' beliefs is imperfect. The success of revealed preference methodology relies on getting the agent's beliefs right.

In the second and third case, the economist does come up with a description of the options that is at least consistent with her friend's beliefs about her options. After all, her friend very likely does believe the wasabi to be food, and she very likely does believe it to be a thick green paste. Here, the problem seems to be that the economist has not described the options in a way that captures everything relevant to her friend's choice. Again, we might think that, in order to capture everything that is relevant in the appropriate sense, we have to consider the agent's mental states. We might, for instance, think that the economist should include in the description of the options all the features of the options that the agent finds desirable, such as the thick green paste's taste.¹¹ Or we might think that the economist should try to describe options in the way and at the level of detail that the agent herself conceives of them.¹² This proposal would also take care of the problem of false beliefs, because part of how the economist's friend conceives of her wasabi-eating-option is as it involving eating something delicious and mild. Either way, the economist appeals to further mental states, such as desires and mental representations of options.

If this analysis is correct, revealed preference theory can only hope to be empirically adequate when agents' mental states are taken into account to some extent, making a general kind of behaviourism untenable for revealed preference theorists. There are two kinds of conclusions critics of revealed preference have drawn from this. First, if we define revealed preference theory in such a way that it is committed to behaviourism in general, revealed preference theory appears to turn out incoherent: It must endorse a mentalistic theory of options while being committed to behaviourism of a general kind.¹³ Second, even if revealed preference theory is not taken to be committed to behaviourism in general by definition, revealed preference theory allegedly loses its core motivation if it must concede appeal to some mental states.¹⁴

The next sections aim to establish that it is uncharitable to define revealed preference theory in such a way that it is committed to behaviourism in general.¹⁵ As the next section

¹¹Pettit (1991), for instance, argues that two outcomes (or, in the standard economic case, consumption bundles) should be distinguished from each other just in case they differ in terms of some property that is desired or undesired by the agent (p.165).

¹²We find this proposal, for instance, in Bradley (2017), p.60.

¹³Hausman (2012), for instance, takes revealed preference theory to be committed to the view that preferences can be inferred from choices "regardless of belief" (p.28). Examples such as the first wasabi case then show revealed preference theory, thus understood, to be untenable.

¹⁴See, for instance, Bradley (2017), p.60, Dietrich and List (2016).

¹⁵I am largely in agreement with Clarke (2016) here, though I provide distinct reasons for thinking past

will argue, examples such as the ones just discussed do show that revealed preference theorists must adopt a kind of mentalism in their theory of what the options are that agents are choosing between – though the mentalism about options that must be conceded is more limited than critics claim. But this does not threaten the behavioural interpretation of *preference*, and this is the core commitment of revealed preference theory. In fact, I will argue that the concession of a limited kind of mentalism about options is by and large consistent with economic practice, and does not render revealed preference theory unmotivated.

4 Mentalism about Options

The representation theorems for expected utility theory, and generally any application of the theory, start with some model of a decision situation. Von Neumann and Morgenstern's representation theorem assumes that agents choose between outcomes and/or lotteries, and these are also the entities her preferences range over. Savage has agents choose between, and have preferences over assignments of outcomes to states of the world. The revealed preference theorems start with sets of options from which the agent chooses. Before we can apply economic theory to a real world choice situation, we thus have to describe the choice situation in those terms. There is always a possibility that the economist models a decision problem in a way that is either not consistent with how the options present themselves to the agent, or doesn't capture everything that is relevant to her choice. There may be such a divergence, for instance, because of false beliefs on the side of either the agent (as in our case), or the economist, or both.

For there to be a hope of uncovering a stable and consistent preference relation, as the revealed preference approach aims to do, there must be standards for the specification of agent's options that avoid the kinds of mistakes discussed in the last section, at least in cases where economists are in the right epistemic situation to avoid them. I want to suggest the following standards for the specification of an agent's options in the ideal circumstances where we have full knowledge of the agent's hypothetical choice behaviours, beliefs and perceptions:

1. The description of options should be consistent with how the options present themselves to the agent. More precisely, the description of options should be consistent with the agent's beliefs about the nature and consequences of the actions open to her, as well as with what she registers about them insofar as this does not lead to full-fledged belief, provided the agent's relevant beliefs and what she registers are

critics have been uncharitable.

consistent.¹⁶

2. A feature of a choice situation should be included in the description of the choice problem whenever that feature affects the agent’s choice behaviour, that is, when there are choice situations where the agent would make a different choice when that feature is present or absent respectively.¹⁷

Describing options in this way does not guarantee that standard revealed preference theory will be able to capture every agent’s choice behaviour and make correct predictions using the standard methodology. Even if we describe options in this way, agents may still fail to display stability in their choice behaviour, for instance if their fundamental tastes change. Insofar as revealed preference theory relies on a stability assumption it thus remains fallible. Moreover, even if options are described in this way, agents may still fail to abide by all the standard axioms at any one point in time. For instance, they may still have cyclical preferences.¹⁸ And so the above rule for specification under ideal circumstances does not make revealed preference theory infallible. However, it does rule out the problematic cases discussed in the last section.

The first rule is designed to avoid the problem of false beliefs as in the first wasabi case — here the economist’s mistake is that her specification of the options is not consistent with the friend’s beliefs about them. The economist should either describe the options in a way that is consistent with those beliefs, e.g. as “eating a delicious bite of avocado”, or refrain from inferring a preference at all. One way an economist might achieve consistency of the option specification with the agent’s beliefs is in offering either a very general, or a very superficial description of the agent’s options – for instance, by describing the economist’s friend’s wasabi-eating options as in the second and third cases above, that is, as “eating food” or “eating a thick green paste” respectively. However, doing so would violate our second rule, as we would be leaving out many factors that presumably make a difference to the agent’s choice, such as the food’s taste.

Economists are of course never in the ideal situation where they have full knowledge of the agent’s hypothetical choice behaviours and beliefs. And in fact, if they were, revealed

¹⁶I take no stance here on the special case where the agent’s relevant beliefs are themselves inconsistent.

¹⁷Various authors have proposed that rules for the specification of options should be preference-based, in the sense that two options should be distinguished just in case the agent’s preferences distinguish them (e.g. by the options being ranked differently against further options, or the agent having strict preferences between them). See, e.g., Joyce (1999), p. 52 or Dreier (1996). In effect, what I am proposing here is such a rule applied to a behavioural interpretation of preference.

¹⁸Indeed, this paper does not mean to offer a response to standard counter-examples to expected utility theory. However, insofar as alternatives to expected utility theory, built on less restrictive axioms (such as rank-dependent utility theories), have a better empirical fit with observed choice data, this paper can be read as providing arguments in favour of a behavioural interpretation of those theories, and the empirical methodology for predicting choice behaviour based on those theories. See, for instance, Harrison and Ross (2018) for an application of revealed preference methodology in a rank-dependent utility framework.

preference methodology would be of much less use. Given economists' actual epistemic limitations, the above standards can only be approximated. In practice, what economists should thus try to achieve is firstly, consistency with our best estimate of the agent's most relevant beliefs, that is, beliefs about features of the choice situation that we have reason to believe affect her choice the most. In the wasabi case, if the economist has good reason to believe that her friend cannot identify wasabi, and that, plausibly, this is highly relevant to her choice, then she should not describe her friend's option as "eating a spoonful of wasabi".

Secondly, given their limited knowledge of agents' beliefs and choice dispositions, economists should strive to include a feature in the description of a choice problem whenever they have reason to believe that the presence or absence of that feature significantly affects the agent's choice behaviour in the kinds of contexts the economists are interested in. Again, under normal circumstances, this will exclude describing the wasabi-eating option as "eating food" or "eating a thick green paste", as this excludes features of the options we know to affect choice. The last qualification to contexts of interest ensures that economists do not have to worry, for instance, about agents' choice behaviours being radically different in radically different economic systems, unless, of course, they are interested in studying the effects of the introduction of such an alternative system. And so they can omit a full description of the current economic background conditions in most applications.

I take the standards for the specification of options described here to adequately deal with the problematic cases introduced in the last section. These standards do concede that some appeal to mental states must be made in order to get the specification of options right. In particular, economists must make sure that the description of options is consistent with the agent's relevant beliefs. However, note that the standards I have proposed here are less demanding, in terms of the knowledge of or assumptions about mental states they require, than those suggested by critics of revealed preference theory. Consistency with the agent's relevant beliefs is all that is required in terms of direct appeal to mental states. To deal with the problematic cases I introduced above, we do not need to require that options are described in the way in which agents conceive of them, or in a way that captures all of their relevant desires. We only need to make sure we capture everything that significantly affects choice.

And so at least one fallible inductive step is involved when economists infer a preference from observing behaviour. Economists must come up with a characterization of the agent's options that is consistent with her relevant beliefs about them, and more generally what she consciously or sub-consciously registers about them. If economists fail to do so, they may infer a preference the agent doesn't actually have. Moreover, this fallible inference involves the economist making a judgement about the agent's mental states –

about her beliefs about her options. However, while I think economists thus cannot escape a partly mentalistic theory of options, this does not mean that we cannot think of preferences behaviourally, as actual or hypothetical choices between options, rather than attitudes to those options. Below, I will argue that conceding a theory of options that is mentalistic in the limited sense described here preserves the main advantages economists have seen in revealed preference theory. For now, let me highlight that this concession is by and large consistent with economic practice.

5 Mentalism about Options in Practice

In choice situations involving uncertainty, the agent's beliefs will play the most apparent role in getting the description of options right. Revealed preference theory under risk and uncertainty either starts by describing agents as choosing between lotteries, that is, probability distributions over outcomes,¹⁹ or as choosing between acts, that is assignments of outcomes to states of the world.²⁰ In these applications, according to the theory of options sketched in the last section, the specification of probabilities of outcomes, states of the world and assignments of outcomes to the states of the world must be consistent with how the options present themselves to the agent in order for the revealed preference approach to identify stable and consistent preferences. That is, they must be consistent with the agent's beliefs about the choice situation.

Interestingly, revealed preference theorists working on the theoretical foundations of the theory under risk and uncertainty, at least, appear to be happy to accept this. Kim (1996), who applies revealed preference theory to the choice of lotteries, describes his approach as follows: “[T]he uncertainty modeled in this paper is limited to the situation where both the outside observer and the decision-maker agree on the probability distributions of the lotteries considered.” (p.464) It is hard to see how agreement on probabilities, where these are not themselves explicitly derived from choice behaviour, could be understood in non-mentalistic terms. It seems we must think of it either as an agreement in degrees of belief, or as agreement in judgement about objective probabilities. This phrasing also acknowledges the kinds of problems we have discussed: The success of the approach depends on economists accurately capturing how the options present themselves to the agent. More generally, when probabilities are presupposed by a revealed preference theorist working within the von Neumann-Morgenstern framework, probabilities are usually described to be ‘known’. In the spirit of the above quotation, I propose this should be understood either as saying that objective probabilities should be known to both the agent

¹⁹See, for instance, Green and Srivastava (1986), Border (1992) and Kim (1996).

²⁰See, for instance, Bossert and Suzumura (2012) and Echenique and Saito (2015).

and the economist,²¹ or that the economist independently knows the agent's subjective probabilities.²² Either way, assumptions about the agent's beliefs are made.

Further, consider Green and Osband (1991), who present a revealed preference model where probabilities of states of the world are shaped in response to evidence. They use the following example to illustrate their approach:

Imagine a doctor who must base each treatment decision on evidence from a medical history and an examination of the patient. Suppose that, after the treatment is done, a completely accurate diagnosis becomes available. If the doctor treats many patients, then the conditional relative frequencies of these diagnoses should associate a probability measure on states of nature to each medical history and examination outcome. For each of these probability measures, the doctor has a preferred treatment. That is, the doctor's choices can be represented by an empirical behaviour pattern that assigns actions to probability measures over states of nature. (pp. 678-679)

Green and Osband appear to think of probabilities as measuring epistemic states that reasonably respond to evidence. However, crucially, they still insist on the behavioural interpretation of preference.

Empirical literature that aims to estimate utility or demand functions from choice data mostly²³ models consumption choices as choices under certainty: Agents are taken to directly choose some outcome, or consumption bundle. And so reference to probabilistic belief does not come up there. The problem that description of commodity bundles needs to be consistent with agents' beliefs about them is however still relevant here, and is admittedly little discussed in the core revealed preference literature. I propose that one major reason for this is that in the case of market commodities, the market to a large extent defines commodities: It demarcates commodities from each other, and presents consumers with a carefully curated package of information about the product. Since producers have an interest in repeat business, the kinds of misunderstandings involved in our wasabi case are going to be rare. Widespread misinformation about commodities is going to be most likely in cases where commodities have long-term harmful effects that

²¹Chambers and Echenique's (2016) textbook, for instance, understands probabilities within the von Neumann-Morgenstern framework in this way: "There are times when probabilities can be thought to be objective and known, or observable. This is the case, for example, when outcomes are randomized according to some known physical device – such as a game in a casino, or a randomization device used by an experimenter in the laboratory." (p. 114)

²²This seems to be the way in which Green and Srivastava (1986) think of their framework, as they claim probabilities are both observable and subjective.

²³The exception are empirical studies of the demand for insurance or betting behaviour. See, e.g., Jullien and Salanié (2000), Cohen and Einav (2007), and Barseghyan et al. (2013).

are either yet unknown or hidden by producers. But in these kinds of circumstances, economists will often be in the same epistemic situation as consumers. And if they are not, I submit that they would in fact bring the appropriate caution to revealed preference approaches. No economist would conclude, e.g., from data on cigarette consumption in the 1950s that consumers have a revealed preference for carcinogenic substances.

In the literature on the valuation of goods that are not directly traded in markets, such as environmental goods, discussions about “commodity definition” are, on the other hand, very common. And indeed, part of what is acknowledged to make commodity definition in this area difficult is that agents often lack information on how environmental harms and benefits are brought about. One way in which revealed preference methods are employed in this literature is in trying to infer the value of a good not directly traded on the market from the market value of related market commodities. To take an example from Boyd and Krupnick (2009), economists may want to infer the value of wetlands to the inhabitants of an area from the premium paid for houses in the vicinity of the wetlands. However, house buyers may not know of all the environmental benefits of the wetlands. This is one of the reasons why Boyd and Krupnick argue that we may be able to infer from the premium paid a revealed preference for proximity to open spaces, but not a revealed preference for the abundance of wildlife and clean water. Or, in other words, supposing that the description of the options house-buyers are choosing includes a description of those environmental benefits would be a misspecification: This description of the options is not consistent with the agents’ relevant beliefs.

Related empirical methods include the use of contingent valuation surveys, where subjects are asked about what they would be willing to pay for various environmental goods. In this literature, it is generally acknowledged that subjects must be given as much information as possible about the environmental goods.²⁴ Again, this seems to be motivated by the thought that in order to legitimately elicit preferences over the options under the description we are actually interested in, we must ensure that that description of the options is consistent with the agents’ relevant beliefs.

According to the second part of my proposed rule for the specification of outcomes, economists should try to include in their description of outcomes everything that makes a significant difference to agents’ choice behaviour. Does this cohere with economic practice? Ultimately, the core interest of revealed preference theory is the determination of demand functions and Engel curves for various commodities, which can then be used to predict and explain market behaviours and guide policy-making. The question of the appropriate description of outcomes, in this context, is the question of when commodities should be explicitly distinguished from each other. Along the lines I just suggested, the revealed preference theorist should make this decision by asking herself whether two commodities

²⁴See, e.g., Carson (1998) on the valuation of tropical rainforests.

are different in a way that may affect agents' choice behaviour in the kinds of contexts in which we aim to predict and explain, namely, whether market demand is going to behave significantly differently for the two commodities. Indeed, these seem to be exactly the kinds of considerations driving the ways in which commodities are described in the empirical literature.

Many revealed preference studies utilize national expenditure surveys which generate data on household expenditures on various commodity groups. Blundell et al. (2003), for instance, use data from the British Family Expenditure Survey from 1974 to 1993, grouped into 22 commodity groups, including beer, wine, spirits, leisure goods and leisure services. The question of whether such categories are too coarse-grained is discussed extensively in the empirical economics literature as the question of 'disaggregation'.²⁵ Disaggregation is generally taken to allow for more accurate forecasts when a commodity group is disaggregated into smaller commodity groups for which consumer demand behaves significantly differently. But there may be practical limitations to the extent to which we can do so, and it is generally acknowledged that the desirable level of disaggregation depends on the purpose of the exercise, that is, whether we wish to predict and explain economy- or industry-wide phenomena, or rather movements within specific industries.²⁶ Suppose, for instance, we grouped all alcoholic beverages together, and estimated that share of expenditure spent on alcoholic beverages decreases with rising income. While this may accurately predict industry-wide phenomena as incomes rise, the prediction will not hold for all alcoholic beverages, with quality wines, spirits and craft brews potential exceptions.

How do we know that consumer demand behaves significantly differently for two commodities? Speculation about consumers' desires or mentalistic preferences may give us some indication here. Intuitively, it makes sense that people's demand for wine should react differently to changes in price and income than consumer's demand for beer. However, decisions about the right level of disaggregation in revealed preference studies on consumer demand are usually driven by empirical considerations. For instance, there are many studies suggesting that demand for beer, wine and spirits respectively behaves quite differently in most countries.²⁷ For some commodity groups, differential demand behaviour may not be quite as intuitively obvious. For instance, it may be not as clear why demand for leisure goods and leisure services should behave differently. Here, evidence on choice behaviour will be especially helpful: Where the data has been disaggregated in the past, were significant differences found? If so, and unless we have good reason to think that conditions are different in the context of a present study, we have good reason to treat two commodities as different.

²⁵For an edited volume dedicated to the issue, see Barker and Pesaran (1990).

²⁶See, e.g., Barker and Pesaran's introduction in Barker and Pesaran (1990).

²⁷See Fogarty (2010) for a review of the literature.

Of course, evidence on people’s mental states, for instance from surveys, may also be helpful in determining what features of commodities make a difference to consumption choices, and we may lament such alternative data is not used more in economics. However, it is important to note that in the context of revealed preference theory as I defend it here, this evidence would be more indirect than past choice data, since it requires us to not only make the fallible inference from one context to another, but also to make the fallible inference from the presence of a desire relating to some feature of a commodity to differential choice behaviour. In fact, more generally, non-choice evidence about agents’ mental states is not irrelevant to revealed preference theory as I defend it here. Under the behavioural interpretation of preference, this evidence is not direct evidence of preferences and utilities. However, it can provide indirect evidence of how agents will and would choose, and thus of what their preferences are.

I have argued that, in order to identify an at least potentially stable and consistent preference relation from an agent’s choice behaviour, economists must describe the options an agent is facing in a way that is consistent with her beliefs and more generally how the options present themselves to her. Moreover, they must aim to include in the description of options any factors that they have reason to believe significantly affect the agent’s choice behaviour in the contexts of interest. This means a fallible inductive step is involved in inferring preferences from choice behaviour, as economists may fail to correctly characterise the agent’s options. The success of this inference relies, amongst other things, on economists correctly identifying the agent’s beliefs. What the foregoing examples of economic practice show, I think, is that economists working within the revealed preference framework are not in principle opposed to appealing to mental states in precisely this way. Indeed, in the areas where they are most relevant to getting the analysis right – preferences over non-market goods, and choice under uncertainty – beliefs are explicitly discussed. Importantly, however, none of this is taken by these economists to show that preferences themselves aren’t to be understood behaviourally, and rightly so. We can combine a partly mentalistic theory of options of the kind I have described here with a behavioural interpretation of preference.

6 The Appeal of Revealed Preference Theory

In a prominent paper, Gul and Pesendorfer (2008) defend revealed preference theory as “mindless economics”, and assert the irrelevance of non-choice data to economics. What I have argued so far implies that both claims are overblown. Even revealed preference theorists should admit that non-choice evidence can be relevant as indirect evidence of choice

behaviour, and for the explanation of preference, should we be interested in offering one.²⁸ Moreover, the success of revealed preference theory depends on a theory of options that is at least partly mentalistic: The ways in which options are described should be consistent with agents' beliefs about them. But, Gul and Pesendorfer's rhetoric notwithstanding, this appears to be recognised in practice in the applications where explicit discussion of agents' beliefs is most relevant.²⁹

Even if a limited appeal to mental states is recognised to be necessary in practice by economists working within the revealed preference framework, critics of revealed preference theory might now argue that this recognition undermines the key motivation for this approach. For instance, having noted the problem that choice reveals preference only once we have identified what the objects of choice are, and that verbal communication would be one natural way of finding out what the objects of choice are, Bradley (2017) asks, "if recourse must be had to verbal communication then why not simply ask the subjects what they prefer and dispense with the pretence of purely behavioural evidence?" (p. 60) More generally, if the only motivation for revealed preference was supposed to be strict behaviourism, that is, a general rejection of non-behavioural evidence and the presupposition of mental states not reducible to choice behaviour, then revealed preference theory now looks to be unmotivated. If the key goal was to get rid of appeal to mental states altogether, then what we have shown is that this goal is unattainable.

In this section, I aim to show that coupling a partly mentalistic theory of options with a behavioural interpretation of preference still guarantees most of the core advantages economists have attributed to revealed preference theory over more mentalistic views, from the originators of the view to, indeed, Gul and Pesendorfer (2008). Conceding a partly mentalistic theory of options thus does not detract from revealed preference theory's appeal.

Revealed preference theory goes back to a 1938 paper by Paul Samuelson. Writing in the heyday of logical positivism and behaviourism, he and other prominent early re-

²⁸It should be added here that there has been quite a bit of interest in explaining preferences amongst those working at the intersection of economics, philosophy and psychology. See, e.g., Dietrich and List (2013) on 'reason-based choice', or Lichtenstein and Slovic's (2006) volume *The Construction of Preference*. Some of the work in neuroeconomics that Gul and Pesendorfer wish to criticize can also be seen in that light. In engaging in such work, economists will have to give up the agnosticism about the mental causes of choice that motivates revealed preference theory. Even if economists are increasingly willing to do so, the behavioural interpretation of preference lets us treat that as a separate kind of inquiry. And then large parts of economic theory can still proceed agnostic about the mental attitudes that cause choice. In line with what I argue here and in the following, a completely "mindless" economics is not possible or desirable, but the influence and discussion of assumptions about mental states can be contained. Also see Guala (2017) on the separation of these explanatory projects.

²⁹That Gul and Pesendorfer's rhetoric does not do full justice to economic practice is also evidenced by the fact that Chambers and Echenique (2016), in the first comprehensive textbook for revealed preference theory, declare in their preface that revealed preference theory does not preclude the use of data other than choice data (p. xv).

vealed preference theorists were no doubt influenced by those intellectual currents. Most explicitly, Samuelson subscribed to a kind of operationalism. In the introduction to his *Foundations of Economic Analysis* (1947), he declares the book restricts itself to the “derivation of operationally meaningful theorems.” (p.3) Samuelson considered concepts and theorems to be meaningful if they can be empirically tested, and in operationalist fashion, aimed to define concepts by a set of measurement operations.³⁰ He later declared that revealed preference theory was a prime example of this approach: “The doctrines of revealed preference provide the most literal example of a theory that has been stripped down to its bare implications for empirical realism.” (Samuelson 1964, p.738) Samuelson here claims that defining key economic concepts in terms of observable choice behaviour makes those concepts operationally meaningful.

Still, what arguably made operationalism and behaviourism attractive to economists at the time was scepticism about mentalistic notions of utility and preference specifically. Samuelson was also writing in the context of the marginal and then ordinal revolution, which was itself inspired by scepticism of the hedonic notion of utility common in the 19th century. The early statements of the revealed preference approach all focus specifically on utility and preference. Samuelson (1938) famously wrote:

For just as we do not claim to know by introspection the behaviour of utility, many will argue we cannot know the behaviour of ratios of marginal utilities or of indifference directions. I propose, therefore, that we start anew in direct attack upon the problem, dropping off the last vestiges of the utility analysis. This does not preclude the introduction of utility by any who may care to do so, nor will it contradict the results attained by use of related constructs. It is merely that the analysis can be carried on more directly, and from a different set of postulates. (pp. 61-62)

By still appealing to ratios of marginal utilities and indifference relations, the marginal revolution did not go far enough for Samuelson – it still used mentalistic terms he was sceptical of in the context of economic theory. And Samuelson was sceptical of a mentalistic notion of utility because he thought that we do not know of its behaviour even by introspection.

It is important to note here that Samuelson did not advocate for the interpretation of preference as choice yet. What he aimed to show is that we can dispense with talk of preferences and utilities altogether by directly deriving demand curves from choice data. Yet, with the formal results described in Section 2 establishing the equivalence of consistent choice behaviour with expected utility theory under a behavioural interpretation

³⁰Also see Hands (2001) and Cohen (1995) on Samuelson’s operationalism.

of preference, such a reinterpretation of preference became popular. The behavioural interpretation of preference is explicitly invoked by Little (1949), who writes:

The verb ‘to prefer’ can either mean ‘to choose’ or ‘to like better’, and these two senses are frequently confused in economic literature. The fact that an individual chooses *A* rather than *B* is far from being conclusive evidence that he likes *A* better. But whether he likes *A* better or not should be completely irrelevant to the theory of price, which can concern itself solely with market behaviour, and not with motives. (pp. 91-92)

Like Samuelson, Little is concerned specifically with a behavioural interpretation of preference. Notably, neither denies the existence of motives, of mental states that cause an agent’s choices. Little explicitly claims that consumer choice theory simply should not concern itself with them. He also admits that choosing one option over another is some kind of evidence (if far from conclusive) that an agent ‘likes’ one option more than another – he just claims that it is the choice, and not the attitude that economists should be interested in. This is not something that a thorough-going behaviourist would grant.

It is thus not entirely clear that early revealed preference theorists were thorough-going behaviourists. Ross (2011), for instance, is sceptical, even in the case of Samuelson. He argues that the goal for early revealed preference theorists was to continue with a process of eliminating psychological foundations from economics that started earlier than behaviourism. Apart from scepticism about mentalistic notions of utility and preference, this was motivated by a desire to study aggregate economic dynamics and to be able to “ignore idiosyncrasies of individual consumers.” (p.221)

Later defences of revealed preference theory echo several of the motivations that were driving early revealed preference theorists. I take the two core motivations of contemporary revealed preference theory to be the following: On the one hand, for the purposes of consumer choice theory, revealed preference theorists wish to black-box, as far as possible, the mental attitudes that cause choices. This black-boxing is attractive to economists for several reasons. First, it allows them to retain a clearer disciplinary boundary to psychology and related disciplines. This desire is apparent in the vigour in which Gul and Pesendorfer (2008), for instance, fend off criticism of standard economic theory from psychology and neuroscience. Second, black-boxing is attractive in the face of scepticism about the specific psychological processes that would be presupposed under more mentalistic interpretations of expected utility theory. Third, even if we weren’t sceptical about those psychological processes correctly describing at least some agents, black-boxing can help expected utility theory achieve greater generality, as it could apply even to agents who make decisions differently.³¹ In fact, it has no problem extending the analysis to choices

³¹Also see Ross (2011) on this claim: “Economists prefer reduced-form models of choices when they can

driven by addiction, behavioural cues or subliminal advertising, or even the behaviour of non-human animals, as has in fact been done.³² All we need for the theory to be fruitfully applied is that agents respond consistently to what they believe or register about their environment.

The second core motivation of contemporary revealed preference theory is to establish a tight connection between the main data available to economists, namely data about market choices and contingent choice data (where consumers are asked to report how they *would* choose under various hypothetical circumstances), and the theoretical constructs of their theories. Again, this is a core theme of Gul and Pesendorfer's (2008) defence of revealed preference theory. This motivation echoes Samuelson's operationalist concerns. We also find operationalism echoed in Chambers and Echenique's (2016) textbook on revealed preference theory, who claim that the point of revealed preference theory is to establish what economic models say about economic data, and in particular choice data. However, we can also give the concern for a tight connection to choice data an empiricist reading: It is taken to be desirable to eliminate a fallible inductive step about mental states when using choice data to predict and explain market movements.

What I want to argue here is that neither of these two core motivations are crucially undermined by the acknowledgement of a partly mentalistic theory of options. The mentalistic theory of options requires economists to make assumptions about agents' beliefs. As we have seen, this is inconsistent with strict behaviourism, and a strictly "mindless economics" as Gul and Pesendorfer (2008) seem to advocate it. However, it is consistent with black-boxing most of the motivating factors that bring about choice. It does not require us, for instance, to take a stance on whether choices are ultimately caused by expectation of hedonic utility, by an all-things-considered judgement of choice-worthiness, by impulses triggered by our environment, or by application of some rule of thumb. All we need to take a stance on is the agent's beliefs about her options. Doing so does not require integrating economics with full psychological theories of how agents make choices, and thus allows a greater disciplinary separation. It is consistent with scepticism about mentalistic notions of utility and preference playing a role in what causes choice. And it preserves the generality of the theory that allows it to capture choice behaviour brought about by a variety of different psychological mechanisms.

What about the second core motivation? Even with a partly mentalistic theory of

establish confidence that they handle robust ranges of data well, because like all scientists they favour maximum generality so long as general formulations do not just re-state relationships taken to be obvious. When models in reduced form are empirically adequate, they allow identification of equilibria in abstraction from the processes that bring them about." (p.222)

³²See Becker and Murphy (1988) on "rational addiction", and Kagel et al. (1995) for applications to non-human animals. Angner (forthcoming) reviews further such applications of the theory to the decision-making of less than fully rational and reflective agents.

options, revealed preference theory preserves at least a tighter connection between the data available to economists and their theoretical constructs than a mentalistic interpretation would. Granted, acknowledging a mentalistic theory of options means that preferences cannot be directly inferred from observation of choice behaviour, as economists must make fallible assumptions about beliefs. However, the inductive step from observation of behaviour to the existence of a preference is still much safer under revealed preference theory than it would be if preferences were mental attitudes. On the account presented here, the economist may make a mistake in her characterization of the agent's options. But if she doesn't, her inference from observed choice behaviour to preference is going to be correct.³³ On the alternative picture, on the other hand, economists not only have to get the characterization of the choice problem right. They then also make a further fallible inference from choice to whatever mental attitude preference is interpreted to be.

Whether a strict operationalist about preference is going to be happy with this depends on whether she is willing to accept a process that involves assumptions about mental states as an 'operation'. Such operations would certainly be laden with (mentalistic) theory – and the unavoidable theory-ladenness of observation is generally taken to undermine strict operationalism. In any case, operationalism in its strict form, as implying that all non-operationalisable scientific concepts are meaningless, is largely abandoned today. In fact, Dietrich and List (2016) accuse Gul and Pesendorfer (2008) of an 'evidence/content conflation'. However, what remains attractive to philosophers of science is the attempt to at least increase empirical content of scientific concepts, unless this undermines key explanatory goals, as this generally increases the extent to which theories are empirically testable.³⁴ What we can say about the behavioural interpretation of preference is that it has greater empirical content in terms of the main kind of data that is currently available to economists, namely choice data and contingent choice data.

7 Conclusion

This paper has aimed to show that, by characterising revealed preference theory as tied to a strict kind of behaviourism, and then showing this behaviourism to be untenable, critics have been uncharitable towards revealed preference theory. Revealed preference theory, at its core, should be understood as an empirical methodology for estimating utility and demand functions from choice data, coupled with an interpretation of preference as actual or hypothetical choice. I have argued that strict behaviourism is indeed untenable for revealed preference theorists. But this does not undermine revealed preference theory.

³³In the case of contingent choice data, a further fallible step involves the assumption that consumers correctly state how they would choose.

³⁴See Chang (2009).

Revealed preference theory must and does take some mental states, namely beliefs, into account. However, I have argued that the extent to which it has to do so is fairly limited: It is restricted to taking beliefs into account in the interpretation of options. Such a partly mentalistic theory of options is not only consistent with retaining a behavioural interpretation of preference. Economic practice within the revealed preference framework is also by and large consistent with pairing a partly mentalistic interpretation of options with a behavioural interpretation of preference. Moreover, the main motivations economists have cited for the behavioural interpretation of preference are not undermined by adopting a partly mentalistic theory of options: Namely that economic theory can achieve greater generality by black-boxing the variety of psychological processes that may lead to choice, and that the concept of preference, when understood behaviourally, has greater empirical content in terms of the main data available to economists.

Of course, there may be reasons to question the standard motivations for revealed preference theory I have presented here. Moreover, there may be independent reasons to favour a mentalistic interpretation of preference over a behavioural one. For instance, one might think that, only under a mentalistic interpretation of preference can we view expected utility theory as providing rationalising kinds of explanations. I believe that these arguments ultimately fail to provide a justification for adopting a mentalistic interpretation of preference, and that the ability to black-box multifarious psychological processes, at least, is a good reason to favour the behavioural interpretation of preference. This is the subject of a separate paper. Clarke (2016) also provides a compelling defence of the behavioural interpretation of preference within economics that is not based on an objectionable kind of positivism or behaviourism. Here, I merely aimed to show that revealed preference theory should not be dismissed merely on the grounds that strict behaviourism must be abandoned, and to delineate more clearly where and how revealed preference theorists must appeal to mental states.

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