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Experience based dynamic choice: A revealed preference approach☆

Amnon Maltz

Department of Economics, University of Haifa, Mount Carmel, Haifa 3498838, Israel

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ABSTRACT

We use the revealed preference method to derive a model of dynamic choice where the agent's past experience may influence her current decisions. Our model generalizes the classical individual choice model which is rationalized by utility maximization, and reduces to that model in the absence of experience. As the agent gains experience her utility changes but only in a very restricted fashion. Every period, after an alternative is chosen, the utility of that, and only that alternative, may change while the utility of all other alternatives remains fixed. The model provides a platform on which many behavioral dynamic phenomena may be examined. We utilize it and look into the behavioral implications of bounded memory, status quo bias and variety seeking.

1. Introduction

Many empirical studies have established that decision makers are affected by their past experiences. Introspection also suggests that our preferences and choices change as we gain experience in a given market even when other choice related variables remain fixed. These changes may be due to information gathered through experience but other psychological effects, such as boredom, variety seeking or attachment, may also play a role.

One example of experience effects comes from the behavioral economics literature. It has been widely observed that individuals tend to stick to the current state of affairs, a phenomenon known as status quo bias (Samuelson and Zeckhauser, 1988).[1] This phenomenon illustrates one channel through which experience affects choices – that of the last experienced good. Other examples from marketing show that the sequence of past experiences (and not only the most recent one) may also affect choice. Brand loyalty refers to consumers' increasing likelihood of purchasing a good as the number of times it

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E-mail address: amaltz@econ.haifa.ac.il

[1] Knetsch (1989) as well as Knetsch and Wong (2009) study the phenomenon using every day ordinary goods. See Madrian and Shea (2001) and Choi et al. (2004) for a close examination of 401(K) retirement plans, Johnson and Goldstein (2003) for a study on organ donations and Kempf and Ruenzi (2006) for evidence from mutual fund markets.

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has previously been chosen increases. Variety seekers, on the other hand, try to avoid recently chosen alternatives.[2] The psychology literature provides further evidence of experience effects. The *mere exposure effect*, a change in consumer's preferences for a good by repeated exposure to it, was originally observed by Zajonc (1968). In his paper he describes this effect with respect to different types of stimuli such as music and visual images. Later, evidence for this type of behavior, as well as a negative exposure effect, has been found with respect to different types of food.[3]

In this paper we propose a unified framework of dynamic choice which can accommodate all of these behavioral tendencies and more. We view it as a theoretical foundation on which dynamic phenomena may be examined and developed. The model generalizes the classical utility maximization model and allows, at its most basic formulation, flexible behavioral dynamics. After laying down the foundations, we impose more structure on choice and observe in what fashion it narrows down the functional representation.

An agent described by our model maximizes a utility function which changes over time but only in a very restricted fashion. From one period to the next, the utility of the most recently experienced alternative may change while the utility of all the other alternatives remains fixed. Specifically, if the utility of the most recent alternative does not change either, the representation reduces to the standard utility maximization model with no experience effects. More generally, the agent may exhibit various dynamic effects such as learning, attachment or variety seeking. Moreover, the model has the flexibility to allow attachment to some goods and variety seeking with respect to others.

More formally, an agent who behaves according to our model can be described as if she has a utility function U defined over the set of alternatives and an (adjustment) function φ defined over lists of past experiences. In the first period, absent any experience, our agent acts as a standard utility maximizer. Thus, when facing a set S, her choice is the alternative that solves the problem:

$$\arg\max_{x \in S} U(x).$$

Now suppose that in this initial period she chooses alternative z and experiences it for a week. After the week has passed her utility U is "updated" to reflect her experience. According to our representation, this new utility function, which we denote by U_z is given by:

$$U_z(x) = \begin{cases} U(x) & \text{if } x \neq z \\ U(z) + \varphi((z)) & \text{if } x = z \end{cases}$$

The only difference between U and U_z lies in the utility level of the experienced alternative z. Thus, the utility of z is updated according to the agent's experience with it, which can be positive, negative or neutral. The actual change in its utility level is given by the function φ. The utility values of all other alternatives remain unchanged. In the second period, facing some set S', she chooses the best alternative according to U_z, i.e., she solves:

$$\arg\max_{x \in S'} U_z(x).$$

As time passes by and the agent gains experience, she keeps updating her utility function in the same fashion. Every period, she adjusts the utility of her most recently experienced alternative, and it alone, according to the value of the function φ which depends on the experience gained up to that period.

To illustrate our basic representation suppose we choose $\varphi \equiv 1$ for all past experiences. In this case our agent would exhibit "gradual addiction," i.e., she will become more and more attached to her endowment the longer she holds on to it. The addiction is gradual in the sense that she may switch away from her endowment to a different alternative with a higher utility (depending on the choice set) but as time passes by, the set of such alternatives shrinks.[4]

We use the revealed preference approach in a choice domain which is expanded to include not only the feasible choice set but also the decision maker's (DM) past experience. Thus, a choice problem facing our DM takes the form (S, λ) where S is the feasible choice set and λ is the list of previously experienced alternatives presented in the order in which they were experienced. We allow λ to be the empty list, interpreted as a problem in which the DM has no prior experience.

Our basic behavioral traits are captured by two axioms. The first is the *Weak Axiom of Revealed Preference* (WARP) imposed across all problems whose experience structures are identical. Our agent must act rationally in such problems. However, across choice problems with different past experiences, our agent's rationality may fail. Our second axiom imposes structure on the "level of irrationality" allowed across different experience lists. It states that adding a non-feasible alternative, i.e., an alternative that is unavailable for choice in the current choice set, to the existing experience will have no effect on choice. This assumption, which we call *Reference Independence* (RI) posits that a reference point has no effect on choice when it must be abandoned.

[2] See Kahn (1995) for a review as well as Kahn et al. (1986) and Bloemer and Kasper (1995).

[3] Pliner (1982), Crandall (1985) and Stevenson and Yeomans (1995) provide support for the "positive" exposure effect. See Rolls et al. (1981) for evidence of the opposite effect of exposure.

[4] This illustration is introduced more formally (together with the case of "gradual boredom") in Example 6 of Section 3, following the representation theorem.