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Search for an object with two attributes ☆

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Abstract

This paper presents and analyzes a simple equilibrium search model. On one side, there is a population of searchers; on the other side, a population of objects. Searchers are strategic decision makers who are there to get matched to an object, while objects have no preferences or decisions to make. The main novelty is that an object is characterized by two attributes, but a searcher can observe only one at the point of decision. This generates some interesting phenomena such as multiplicity of equilibria, in some of which the searcher's payoff is a discontinuous function of the observed attribute and the adoption decision is not everywhere monotonic in the observed attribute.

JEL classification: D83; C78

Keywords: Search; Matching; Attributes

1. Introduction

This paper presents and analyzes a simple equilibrium search model. On one side, a population of identical searchers; on the other side, a population of heterogeneous objects. Searchers are strategic decision makers looking for an object. Their preferences over objects are common. Objects have no preferences or decisions to make. The main novelty is that an object is character-

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ized by two attributes, but a searcher can observe only one at the point of decision (which can be viewed as implicitly capturing an underlying cost structure or a time constraint). This generates some interesting phenomena such as multiplicity of equilibria, in some of which the searcher's payoff is a discontinuous function of the information observed and the adoption decision is not everywhere monotonic in that information.

Since our main objective is to expose some possible effects of imperfect information at the decision point in a search environment (rather than to study any particular market), we have opted for a lean model that is not guided by the details of a specific application. Nevertheless, it is useful to observe that the model captures some of the essential features of competitive search for ideas (R&D).

Other models of search with common values recognize the externalities that searchers exert upon each other through the adverse selection effect of their decisions on the quality of the equilibrium pool (e.g., Burdett and Coles, 1997; Davis, 2001; Chéron et al., 2011), or feature searchers who have only partial information at the point of decision (e.g., Chade, 2006), or recognize the endogenous interdependence between the observable duration of search and unobservable worker's quality (e.g., Lockwood, 1991). What distinguishes the present paper from that other work is the combined effect of adverse selection and different searchers observing different attributes. This creates an endogenous interdependence between the attributes, which adds another twist to the duration effect. Here too the expected value of the unobserved attribute is declining in the duration of an object in the process. But the latter is unobservable and enters indirectly through being negatively correlated with the observed attribute. Finally, the idea of search with multi-attributes appears in Neeman (1995) and Bar-Isaac et al. (2011), but their relation to the present paper is more through the general motivation than through the specific analysis.

2. Model

There are two populations of equal size: searchers and objects. Searchers are strategic decision makers looking to get matched to an object; objects have no preferences or decisions to make.

Each object is characterized by two attributes, $(x_1, x_2) \in [0, 1]^2$, whose magnitudes are independent, and differ across objects. A searcher's payoff from adopting an object, characterized by (x_1, x_2), is $u(x_1, x_2) = x_1 + x_2$.

Upon encountering an object, the searcher observes only one of the attributes.

Time is discrete. In each period, searchers and objects are matched randomly pairwise, so that the maximal number of pairs are formed each period. If a searcher accepts the matched object, both depart; otherwise, these searcher and object return to the pools of the unmatched.

A mass m of new searchers and a mass m of new objects enter the market in the beginning of each period. This mass does not depend on the mass of searchers and objects departing the market. Let H denote the CDF of the attributes of the entering objects. The attributes are assumed independent, $H(x_1, x_2) = H_1(x_1)H_2(x_2)$. The marginal distribution H_i has full support on $[0, 1]$ and is differentiable with density h_i. Searchers and objects stay in the process until they become a party to a successful match or "die". A fraction $d \in (0, 1)$ of all participants die each period. The payoff to a searcher who "dies" before adopting an object is 0.

A (Markov) *strategy* for a searcher is a choice of attribute $i \in \{1, 2\}$ to observe and an acceptance rule: $A(x) \in \{\text{accept}, \text{reject}\}$ as a function of the level x of the value of observed attribute i.