Competitive versus random search with bargaining: An empirical comparison ☆

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ABSTRACT

In this paper, we estimate and nest the canonical competitive search model of Moen (1997) inside a random search model with bargaining. The nesting allows us to compare the two models predictions, or comparative statics, using the same empirical estimation. Furthermore, nesting provides likelihood ratio tests that demonstrate the empirical differences between competitive search and random search with bargaining. The differences between the two models include whether workers search in different "sub-markets" with different levels of productivity, they direct the search to each firm/sub-market, and the wage they receive is split efficiently via Hosios (1990).

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1. Introduction

Models with directed search state that workers can choose to search longer for a job in return for a higher wage. On the other side of the market, it is usually assumed that firms post wages to maximize their profits. These two assumptions, often referred to as competitive search, is often important to a theoretical model's results. For instance, these two assumptions in the cannonical model result in an efficient allocation of resources, i.e., the Hosios condition is satisfied. In the standard random search with bargaining environment, the allocation of resources is typically inefficient and therefore may be improved with policies such as a minimum wage, hiring subsidies, and so on.

Given the importance of the competitive search assumptions, this paper compares the empirical implications of these restrictions and predictions using the same empirical strategy. To put it differently, we take a disciplined and identical approach in estimating a search model's parameters with and without these restrictions. As a result, we can compare how well they fit the data and how they alter a random search model's predictions.

The canonical competitive search model (Moen, 1997), nested within a random search model with bargaining,[1] is estimated using maximum likelihood estimation (MLE). The data used to compare the two models and incorporated into the likelihood function is wage and unemployment duration data taken from the Current Population Survey (CPS), job vacancies from the Job Openings and Labor Turnover Survey (JOLTS), and Internal Revenue Service (IRS) tax data on corporate earnings. The estimation strategy follows the work of Eckstein and Wolpin (1990), Flinn (2006) and others in terms of constructing the likelihood function. In addition, the estimation controls for region and education level using a segmented markets approach.

[1] The range of random search models our estimation could be compared to varies such as Albrecht and Axell (1984) or Pissarides (2000) with heterogeneous search intensity.

Given this limited dataset, we show how estimating the two models (a model with and without the competitive search restrictions) requires differences along at least three dimensions. Put differently, a researcher using a competitive search framework should require these differences when modeling a particular phenomena. These differences, in the words of the competitive search literature, are (i) workers search in different "sub-markets" with different levels of productivity, (ii) workers direct their search to a firm/sub-market, and (iii) the wage they receive is split to maximize the posting firm's profits, e.g., Hosios (1990). Obviously, the particular functional form of each restriction is dependent upon the particular environment. However, these are key when considering the empirical ramifications of the competitive search assumptions.

Now, what exactly are the empirical ramifications of these restrictions? The first restriction requires the discrete number of heterogenous, and "unobservable," job matching rates to have a one-to-one and onto mapping to the number of bins used in the domain of the estimated wage distribution. Furthermore, the mapping requires the proportion of individuals in each grouping (match rate and wage pair) to follow a specific rule. Given the mapping and constrained frequency/matching rate of the first restriction, the second restriction requires the wage of each bin to be negatively related to the matching rate it is mapped to. The relationship is determined by the workers' Bellman equations and indifference across sub-markets. The combination of these two restrictions are required if a researcher assumes workers direct their search. In the standard competitive model considered here, the restrictions are independent of the type of wage setting mechanism. The third and final restriction is determined by the wage setting mechanism. It requires the elasticity of the matching function to be related to the level of profits in a specific way, i.e., Hosios (1990).

We fail to reject these three competitive search restrictions when using cross-sectional data. In particular, the mapping between unemployed matching rates and wage data is not conditional on a particular type of worker, market, or observation. It is due to the fact the individual matching rates are unobservable, and thus a mixture distribution is used when estimating them. To put it differently, we don't observe the market an unemployed individual is searching in. As a result, we cannot estimate their matching rate conditional on the market. So, the mixture allows for significant latitude when determining the mapping. However, longitudinal data (wages and durations are observed for the same observation) changes the story. In particular, the mapping between matching rates and wages is built into each individual's contribution to the likelihood function conditional on the worker type, or market, rather than across the mixture. As a result, the negative relationship between wages and job finding rates has to hold at the individual, or market, level and not at the mixing, or unconditional, level.

Given the stronger link when using longitudinal data, we reject the second and third restriction. It isn't surprising. The literature has found the relationship to be positive - higher job finding rates go with higher wages. As a result, we find the random search with bargaining model fits the data better than assuming a stylized, homogeneous and risk neutral agent who directs their search. That being said, we fail to differentiate whether workers search in different sub-markets with a particular level of productivity, i.e., a directed search assumption. With these facts in mind, note we do not incorporate (1) heterogeneous agents (2) on-the-job search, (3) asymmetric information when hiring, (4) moral hazard in search effort, (5) firm size, (6) alternative matching functions outside of the Cobb-Douglas form, and all the other extensions to the canonical model present in the large competitive search literature. In particular, introducing heterogeneous agents would

completely relax the second restriction. As a result, our work is an empirical comparison of two baseline search models - competitive search and random search with bargaining.

In addition to considering each model's empirical fit and ramifications for future research, we also compare the predictions, or comparative statics, of each model. In general, we find the elasticity of welfare to changes in underlying parameters to be greater in the random search model relative to competitive search. Furthermore, we find the job finding rates differ in meaningful ways as workers' search behavior is different in each model.

The primary purpose of our work is to empirically compare the competitive and random search models using a disciplined estimation strategy. The work is important not only for determining the future of research on search, but for policy as well. Specifically, we are comparing models where the efficiency of the labor market, a property often inherent in the competitive search literature as outlined in Moen (1997), is at stake. If this line of research finds important empirically based differences between the two models, then the results require economists to consider carefully which model to use and whether the aim of distorting the bargaining power between workers and firms, as discussed in Flinn (2006), is useful. Furthermore, it suggests unemployment insurance could be beneficial as analyzed in Acemoglu and Shimer (2000). Whatever the final conclusions, it is important to understand whether an assumption about workers directing their search, and an assumption about how the surplus from employment is split, is empirically meaningful.

Besides determining the future path of the search literature and labor market policy, our work makes several other methodological contributions to the estimation of search models. First, earlier papers in this line of research, such as Flinn and Heckman (1982), make a parametric assumption on the distribution of productivity (typically a log-normal distribution) in order to identify the parameters of the model. We take a different route and estimate the productivity distribution using conditions from the directed search model with multiple markets, which introduces a new identifying restriction–that people are indifferent between searching in different markets. As a result, we estimate a non-parametric productivity distribution using a semi-parametric approach. The approach eliminates the necessity of assuming a parametric distribution of productivity and thus is free of misspecification regarding its form. In this regard, our work is more similar to Bontemps et al. (2000) and Postel-Vinay and Robin (2002), but distinctly different from papers such as Eckstein and Wolpin (1995) or Engelhardt and Fuller (2012). Furthermore, our work stands apart from Bowlus et al. (1995) and others who use the lowest wage (which is often trimmed) to estimate the reservation wage. Besides estimating productivity, the Cobb-Douglas matching function, and in particular the elasticity of the matching function, has been a difficult object to estimate because the arrival rate of jobs and the number of unemployed individuals is not enough to identify the elasticity. Of course, this is a key parameter if one wishes to consider efficiency in terms of the Hosios condition. As a result, we introduce vacancy data from JOLTS that can directly identify the elasticity of the matching function, without having to identify it indirectly from a restriction in the model or variation in the minimum wage as in Flinn (2006). Finally, we note more flexible, reduced form tests, have compared variations of the two models. Moen and Godøy (2011) and Braun et al. (2015) are examples. Our work ties into this literature.

2. Model

In our comparison, we use the standard competitive search model based on Moen (1997) including the extension of