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Random decentralized market processes for stable job matchings with competitive salaries ☆

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Abstract

We analyze a decentralized process in a basic labor market where finitely many heterogeneous firms and workers meet directly and randomly in pursuit of higher payoffs over time and agents may behave myopically. We find a general random decentralized market process that almost surely converges in finite time to a competitive equilibrium of the market. A key proposition en route to this result exhibits a finite sequence of successive bilateral trades from an arbitrary initial market state to a stable matching between firms and workers with a scheme of competitive salary offers.

JEL classification: C62; D72

Keywords: Decentralized market; Job matching; Random path; Competitive salary; Stability

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1. Introduction

Adam Smith's Invisible Hand captures the self-regulating nature of a decentralized market where self-interested market participants, making independent decisions freely, can settle the market on a competitive equilibrium outcome. Traditionally a fictitious Walrasian auctioneer has been used to match the supply and demand of each commodity (service) at its competitive price (wage). However, many competitive markets, labor markets being a leading example, involve mainly uncoordinated bilateral trades and are typically decentralized. The purpose of this paper is to analyze the long-run behavior of a general random market process in a basic labor market where transactions take the form of bilateral trades so as to mimic the decentralized behavior of the labor market.

We consider a labor market where finite heterogeneous firms and workers meet directly and randomly to search for higher payoffs over time. In the market, all agents make their own decisions independently and can behave myopically, perhaps because information is dispersed and agents may not have a complete picture of the entire market. When a worker and a firm match as partners, they generate a joint surplus which is then split within the matched pair. Each agent can dissolve her current partnership unilaterally if standing alone becomes a better option. A worker and a firm, currently not matched, can form a new partnership as long as doing so makes none of the two worse off and at least one strictly better off — in this case the firm fires its previous worker and the worker abandons her previous firm, if any, and the deserted parties can be worse off. We call such transactions bilateral trades or pair improvements. In such a market process, quits and layoffs routinely arise as a result of agents seeking better matches and it is also possible that workers eventually return to their previous employers but with different contracts. The random process proceeds spontaneously and is decentralized, in that every agent acts only according to her own interests without any centralized coordination, and unforeseen and unexpected market outcomes can emerge from the agents' actions under imperfect information about the market.

The basic question we consider is whether the above random, chaotic, and dynamic decentralized process eventually leads the market to efficient assignments of workers to firms and in particular to a competitive equilibrium.[1] We establish that this market process converges with probability one to a competitive equilibrium of the market in finite time, so long as each possible bilateral trade conditional on the current market state arises with an arbitrary but positive probability in the process (Theorem 1). An interpretation of this positive probability is that although information is imperfect and dispersed among all market participants, it flows sufficiently freely so that the agents are informed about and can therefore respond to newly arrived opportunities. A crucial step for establishing Theorem 1 is to show that the random process is not trapped in trading cycles indefinitely. To this end, we demonstrate via a novel algorithm the existence of a finite sequence of successive bilateral trades from an *arbitrary* initial market state to a competitive equilibrium (Proposition 1).

[1] There are many different types of market processes. See, for example, Gale and Shapley (1962) for marriage matching problems, Shapley and Scarf (1974) for housing markets, Crawford and Knoer (1981) for job matching problems, Demange et al. (1986) for auction markets, and Abdulkadirğlu and Sönmez (2003) for school choice problems. By a centralized process, we mean that individuals make decisions independently but a "clearing house" or a central planner coordinates all activities. For instance, in auctions, an auctioneer collects the demands of all bidders and then adjusts prices. In a decentralized process, individuals make decisions independently and locally without any coordination from a central planner or organization.