

Matching Theory, Competitive Search, and Competing Mechanism Design

Economics 712
Spring 2009

PHILIPP KIRCHER

451 McNeil, 215-898-6777, kircher@econ.upenn.edu

Office Hours: Wednesday 1.30-2.30 or by appointment.

Course URL is linked from: www.ssc.upenn.edu/~kircher/teaching

This course is intended as a joint learning experience for the students and myself. It deals mainly with the allocation of resources in two-sided matching models. This might sound boring, but it does include a number of applied topics (such as the allocations of students to public school, the assignment of medical interns to hospitals, competition in the labor market, competing auction models, job search of couples ect).

The idea is to present to introduce students to this literature, with an eye on the question: "Why have people written this paper?" This is one of the most interesting questions, and since it cannot be directly taught, it will be part of the discussion. To achieve this, below I list a number of papers. Papers indexed by (*) are taught by me. Parts of the other papers will be presented by students in class. Among those papers I marked by (\$) those that I find particularly promising for future research or find particularly instructive, but it is your choice what to present. While the presenters (me or the students) are responsible for the main content, the idea is that EVERYBODY has read AT LEAST THE INTRODUCTION and THE BEGINNING PART OF THE MODEL (otherwise it is impossible to discuss why this is or is not an interesting contribution).

The class will meet Tuesdays and Thursdays from 9.00 - 10.30am in McNeil 410. Additional material will be posted on the course website. A tentative course outline is listed below.

Course Outline

The course will have two sections:

1. Frictionless Matching.

Here the book *Two-Sided Matching - A Study in Game-Theoretic Modeling and Analysis* by Roth and Sotomayor is important. We will learn the basics of standard frictionless matching theory. We will apply them to the allocation of students across schools, and to the allocation of kidneys to donors. The standard models deal with "a lot of" heterogeneity. If one limits the scope of heterogeneity, one arrives at more classical models, such as Becker's (1973) marriage market matching model. We will analyze when good types match with other good types. And we will also talk about what this means for the labor market.

- (a) The Two-Sided Matching Problem in a Finite Population - non-transferable utilities
 - i. Stable Matching

ii. Men and Women - optimal matchings

Discussion:

How can we figure out which matching is played.

Incomplete information: (\$)CHAKRABORTY, ARCHISHMAN, ALESSANDRO CITANNAY AND MICHAEL OSTROVSKYZ (2007): "Two-sided matching with interdependent values," mimeo.

iii. Truthful revelation

In the end we discuss:

(\$)ABDULKADIROGLU, ATILA AND TAYFUN SONMEZ: "School Choice: A Mechanisms Design Approach, American Economic Review", 2003, 93/3

(\$)ERDIL, AYTEK AND HALUK ERGIN: "What's the matter with Tie-Breaking? Improving Efficiency in School Choice." American Economic Review 2008, 98/3, pp. 669-689.

(b) Brief excursion to "single-sex" pairwise matchings (the house exchange model)

In the end we discuss:

(\$)ROTH, ALVIN E., TAYFUN SONMEZ AND M. UTKU UNVER: "Kidney Exchange", Quarterly Journal of Economics, May 2004

(c) The Two-Sided Matching Problem in a Finite Population - transferable utilities

i. Stable Matchings

ii. Maybe (but probably not): The Core, Truth-telling, Multi-Object Auctions

(d) The Two-Sided Matching Problem in a Continuum Model with Aligned Preferences

In the end we discuss two of the following:

(\$)KREMER, MICHAEL: "The O-Ring Theory of Economic Development," Quarterly Journal of Economics, 1993

(\$)CHAKRABORTY, A. AND A. CITANNA: "Occupational Choice, Incentive and Wealth Distribution". Journal of Economic Theory, 122, 206-224.

BESLEY, T. AND M. GHATAK: "The Economics of Lending with Joint Liability: Theory and Practice," American Economic Review, 95/3, 616-636.

2. Directed Search and Competing Mechanism Design

(a) A Small Overview

Background: Search theory has become important during the realization that standard Walrasian Theory might have a hard time explaining some important phenomena in the labor and product market. The most important ones are the presence of price dispersion for seemingly homogenous products and wage dispersion for seemingly identical labor services (see Stigler (JPE 1961, JPE 1962) and subsequent literature), as well as the lengthy duration that the trading process takes. Selling house seems to require time, as does finding a job. For economists interested in unemployment and unemployment duration, it is important to have a model that delivers it. Search introduces stochastic opportunities to trade, and the lack of opportunities trivially introduces extended periods of unemployment.

The difficulty of models in which agents randomly meet a partner is the question how to divide the surplus from trade. Usually only few people meet, and there is no large market that determines the split of the surplus according to demand and supply conditions. Among the few people that meet the split is in general inefficient (see e.g. Hosios (REStud, 1990)).

The main novelty of directed search is to reverse the order: First, firms commit on the split of the surplus. In simple environments this means that they commit to the wage. Workers observe the wages, and then

decide where to trade. Only then something goes wrong and trading "frictions" preclude perfect trade. While competition drives the division of the surplus, the last element introduces prolonged unemployment. The theoretical interest of these models stems from the ability of agents to target the seller they are looking for, but still elements of search theory prevail.

(b) Foundations

(*)Burdett, Kenneth, Shouyong Shi and Randall Wright (2001): "Pricing and Matching with Frictions," *Journal of Political Economy*, 109, 1060-1085. (The basic teaching paper to see how directed search can come about)

compared with

PETERS, MICHAEL, "Ex Ante Pricing in Matching Games: Non Steady States", *Econometrica* **59(5)**, 1991, 1425-1454. (Provides the first limit theorem for this literature when the number of traders becomes large.)

(*)PETERS, MICHAEL, "On the Equivalence of Walrasian and Non-Walrasian Equilibria in Contract Markets: The Case of Complete Contracts", *The Review of Economic Studies* **64**, 1997b, 241-264. (Lays out a limit theorem when the number of traders becomes large. As a preparation for class, find out what is wrong in the discussion of two-sided heterogeneity.)

PETERS, MICHAEL, "Limits of Exact Equilibria for Capacity Constrained Sellers with Costly Search," *Journal of Economic Theory* **95**, 2000, 139-168. (extends Peters 1997 to have limits of real equilibria)

MONTGOMERY, JAMES D. (1991): "Equilibrium Wage Dispersion and Interindustry Wage Differentials," *Quarterly Journal of Economics*, 106, 163-179. (simple exposition paper about wage dispersion)

(c) Efficiency:

(*)MOEN, ESPEN, "Competitive Search Equilibrium", *Journal of Political Economy* **105(2)**, 1997, 385-411. (The main paper about efficiency)

HOSIOS, REStud 1990 (first mentioning of the efficiency of directed search)

(*)SHIMER, ROBERT, "The Assignment of Workers to jobs in an Economy with Coordination Frictions," *Journal of Political Economy* **113(5)**, 2005, 996-1025.

Other papers: MORTENSEN AND WRIGHT IER 03, ...

(d) Applications at Several Firms

(*)ALBRECHT, JAMES, PIETER A. GAUTIER, AND SUSAN VROMAN. "Equilibrium Directed Search with Multiple Applications." *Review of Economic Studies*. (workers apply to multiple firms without full commitment or recall)

(*)KIRCHER, PHILIPP, "Efficiency of Simultaneous Search", UPenn mimeo, 2008. (multiple applications: Efficiency under full recall and full commitment, note: restricted mechanism space)

GALENIANOS, MANOLIS AND PHILIPP KIRCHER, "Directed Search with Multiple Job Applications," UPenn mimeo 2006. (multiple applications with commitment but no recall)

(*)DELACROIX, ALAIN, AND SHOUYONG SHI, "Directed Search on the Job and the Wage Ladder," *International Economic Review* **47**, 2006, 651-699. (directed on the job search)

(\$)MENZIO, GUIODO AND SHOUYONG SHI "Efficient Search on the Job and the Business Cycle," mimeo (estimable version of an on the job search model)

SHI, SHOUYONG "On the job search with wage-tenure contracts" ECTR.(as the title says)

(e) Heterogeneity and Mechanism Design

(*)MCAFEE, R PRESTON, "Mechanism Design by Competing Sellers," *Econometrica* **61(6)**, 1993, 1281-1312. (First paper on competing mechanism design)

(*)EECKHOUT AND KIRCHER, "Sorting and Decentralized Price Competition", 08 (Sorting under Heterogeneity)

SHI, SHOUYONG, "Frictional Assignment. 1. Efficiency," *Journal of Economic Theory*, 98, 2001, 232-260. (also on sorting and heterogeneity)

SHI, SHOUYONG, "A Directed Search Model of Inequality with Heterogeneous Skills and Skill-Biased Technology," *The Review of Economic Studies* **69**, 2002, (more general contracts when looking at heterogeneity)

PETERS AND SEVERINOV, 1997, JET (teaching version of competing mechanism design)

PETERS, MICHAEL, "A Competitive Distribution of Auctions", *The Review of Economic Studies* **64(1)**, 1997a, 97-123. (more complex version of previous paper)

(*)Something on Common Agency (mechanism designer ask about the other mechanisms)

(\$) More on common agency (to discuss with me if someone is interested)

COLES, MELVYN AND JAN EECKHOUT (2003a): "Indeterminacy and Directed Search," *Journal of Economic Theory*, 111, 265-276. (Directed Search with finite number of homogeneous agents and more mechanisms than price posting)

COLES, MELVYN AND JAN EECKHOUT (2003b): "Heterogeneity as a Coordination Device," mimeo. (Uses heterogeneity to screen agents apart.)

(f) Applications

(\$)Unemployment: ACEMOGLU, DARON, AND ROBERT SHIMER, "Efficient Unemployment Insurance," *Journal of Political Economy* **107**, 1999a, 893-928. (paper that considers efficiency improvements by increased unemployment insurance)

Cheap Talk: MENZIO, GUIDO (2007): "A Theory of Partially Directed Search," *Journal of Political Economy*, 115, 748-769 (prices are no commitment)

KYUNGMIN KIM (2008) (prices are no commitment)

(*)Learning: SHI 2008 (workers learn about labor market chances)

Housing Market: ALBRECHT AND VROMAN 2008 (search in the housing market)

Heterogeneous Buyers: PETERS, MICHAEL, "Unobservable Heterogeneity in Directed Search", mimeo UBC, 2007. (looks at equilibria when workers have some non-contractible differences in productivity)

(\$)Mechanisms when agents are ex-ante heterogeneous: SHOUYONG SHI..., GUERRIERI, SHIMER, WRIGHT

Partially Directed Search: ACEMOGLU AND SHIMER, REStud, 99 (exposition that shows not only price but technology dispersion)

technological change: SHI, SHOUYONG, REStud 2002 (see above under heterogeneity)

(\$)macro-economic fluctuations by RUDANKO, LEENA (mimeo 2008) (how past wage commitments affect future wage offers)

agency problems and macro-economic fluctuations by MOEN AND ROZEN (mimeo 2007) (how to deal with agency problem)

monetary economics by ROCHEATEAU AND WRIGHT (ECTR 2005) (directed search in monetary economies)

(\$)inefficiencies in dynamic environments with agency problems: GUERRIERI, JPE 08

(\$)which side of the market should search: HALKO, MARJA-LIISA, KLAUS KULTTI AND JUHA VIR-RANKOSKI (2008): "Search Direction and Wage Dispersion," *International Economic Review*, 49, 111-134.