Introduction

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Since Gaspard Monge formulated the problem of finding an optimal transportation plan for piles of soil in his 1781 “Mémoire sur les déblais et remblais”, the problem of transporting a given distribution of mass from one location to another distribution of mass in a different location, while minimizing a certain cost of transportation, has become a major field of study in mathematics and operations research. That it also provides a powerful and versatile tool for a wide range of economic applications is now becoming apparent. Mass transportation duality is useful in formulating the problem of existence, uniqueness and purity of equilibrium in hedonic models. It lies at the heart of improvements of estimates of monotone functions (such as cumulative distribution and quantile functions), and of the problem of testing economic model specification, to name only a few applications.

The symposium that took place in Columbia University on 25 June 2007, with financial support from the National Science Foundation Award SES-0532398, was aimed at bringing together researchers at the forefront of developments of research on economic applications of the mathematical theory of optimal transportation. Its main goals were to increase their awareness of each other’s work, to identify the most important unexplored problems and pave the way for collaborations. It has also become the first of a series of annual meetings in rotating venues. The second annual

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meeting took place in the University of British Columbia under the auspices of the Pacific Institute of Mathematical Sciences between 14 and July 18 2008, and the third meeting is planned for 6–8 July 2009 at the École des Mines de Paris.

The present issue is comprised of seven chapters. Six of them are contributions to the symposium, and in the seventh, “Notes on optimal transportation” (in this issue), Ivar Ekeland gives an overview of current results in the theory of optimal transportation insofar as they seem relevant for economic applications. The first two contributions, Ivar Ekeland’s “Existence, uniqueness and efficiency of equilibrium in hedonic markets with multidimensional types” (in this issue) and Pierre-Andre Chiappori, Robert McCann and Lars Nesheim’s “Hedonic price equilibria, stable matching and optimal transport” (in this issue) bring together the literature on hedonic pricing, where goods are modeled as bundles of qualities and the literature on the assignment problem, where producers are matched with consumers. They show how mass transportation duality allows for the formulation of conditions for existence and uniqueness of equilibrium in hedonic models and the equivalence between hedonic and matching models.

The third contribution, Ivar Ekeland, Alfred Galichon, and Marc Henry’s “Optimal transportation and the falsifiability of incompletely specified economic models” (in this issue) shows that the question of correct specification of an economic model has an optimal mass transportation formulation, which is particularly useful for empirical evaluations of game theoretic descriptions of economic interactions, where multiple equilibria often invalidate traditional statistical methods.

The next two contributions, Robert McCann and Maxim Trokhimtchouk’s “Optimal partition of a large labor force into working pairs” (in this issue) and Guillaume Carlier and Ivar Ekeland’s “Matching for teams” (in this issue) are closer to the assignment tradition. The former applies optimal transportation theory to solve a productivity maximizing assignment problem. The latter shows the application of mass transportation duality can be extended to hedonic models where the production of the differentiated good requires a team of producers. This extension also applies to the study of optimal group matchings, when group members belong to disjoint populations.

The final contribution, Victor Chernozhukov, Ivan Fernandez-Val, and Alfred Galichon’s “Rearranging Edgeworth–Cornish–Fisher expansions” (in this issue) shows that rearrangement, a tool from optimal transportation, leads to systematic improvements of the classical Edgeworth–Cornish–Fisher expansions of distribution and quantile functions of sample statistics.

The symposium ended with an open discussion, where a need was recognized for more research on the identification of hedonic models, and the relation between pure equilibria with unobserved consumer heterogeneity and mixed equilibria without unobserved characteristics. There is a potential for insights provided by geometric interpretations of optimal transportation problems, especially in the problem of higher-dimensional rearrangements and in the relation between the Spence–Mirlees condition for purity of hedonic equilibria and a curvature based on transportation cost. It was also noted how strikingly different the uses of the duality principle are in microeconomics and in econometrics. In the former, duality corresponds essentially to market decentralization, whereas in econometrics, it serves as a bridge between strong and distributional representations.

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