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Journal of Economic Theory 170 (2017) 385–416

JOURNAL OF Economic Theory

www.elsevier.com/locate/jet

The generic possibility of full surplus extraction in models with large type spaces ☆

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Received 6 July 2015; final version received 8 February 2017; accepted 17 May 2017
Available online 31 May 2017

Abstract

McAfee and Reny (1992) have given a necessary and sufficient condition for full surplus extraction in naive type spaces with a continuum of payoff types. We generalize their characterization to arbitrary abstract type spaces and to the universal type space and show that in each setting, full surplus extraction is generically possible. We interpret the McAfee–Reny condition as a much stronger version of injectiveness of belief functions and prove genericity by arguments similar to those used to prove the classical embedding theorem for continuous functions. Our results can be used to also establish the genericity of common priors that admit full surplus extraction.

JEL classification: D40; D44; D80; D82

Keywords: Mechanism design; Surplus extraction; Universal type space; Genericity; Correlated information; Strategic continuity

☆ This paper supersedes our earlier paper "On the Genericity of the McAfee–Reny Condition for Full Surplus Extraction in Models with a Continuum of Types", Preprint 08/2015, Max Planck Institute for Research on Collective Goods, Bonn. For helpful discussions, comments, and suggestions, we are grateful to an associate editor and two referees as well as Dirk Bergemann, Yi-Chun Chen, Olga Gorelkina, Alfredo di Tillio and the participants of the 2013 EEA–ESEM conference and of the 2013 Bonn Workshop on Advances in Mechanism Design.
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http://dx.doi.org/10.1016/j.jet.2017.05.009
0022-0531/

1. Introduction

A central theme in the economics of information concerns the ability of agents to earn rents because they have private information. For example, the buyer of a good may be able to obtain a surplus because the seller does not know how much the good is worth to the buyer.

However, Crémer and McLean (1988) have shown that, when there are multiple potential buyers for a good and these buyers have quasilinear utility functions with correlated private values, then, under certain conditions, in a Bayesian setting, a seller can extract all the surplus from the sale of his good, i.e. all information rents can be made to disappear. Specifically, if the potential buyers have only finitely many types, a Bayesian incentive mechanism that extracts all the potentially available surplus from buyers can be designed if and only if, for each agent i and each type t_i of this agent, the vector of probabilities that agent i assigns to different constellations of the other agents' types when his own type is t_i cannot be represented as a convex combination of the vectors of beliefs that he has at types other than t_i.

McAfee and Reny (1992) extended the analysis of Crémer and McLean (1988) to the case where each agent's type set is the unit interval and where each agent's beliefs about other agents' types are given by a probability distribution with a continuous density function. They showed that (approximately) full surplus extraction can be obtained if and only if the density functions that represent agents' beliefs satisfy a function space version of the Crémer–McLean condition.

Our paper makes three contributions to this literature. First, we extend the analysis of McAfee and Reny (1992) to allow for arbitrary abstract (Harsanyi) type spaces, rather than naive type spaces in which "types" and payoff parameters are the same so that beliefs depend only on payoff parameters. We give a necessary and sufficient condition for full surplus extraction in an arbitrary abstract type space (with arbitrary beliefs) and call it the generalized McAfee–Reny condition. This condition coincides with the McAfee–Reny condition if the mapping from abstract types to payoff parameters and beliefs is injective, but otherwise it is slightly weaker.

Second, we show that full surplus extraction is generic in the sense that, for a given type space T_i of agent i, the generalized McAfee–Reny condition holds for a residual set, i.e., for a countable intersection of open and dense sets, of continuous functions mapping types into payoff parameters and beliefs. For models with a continuum of types, genericity of full surplus extraction has been a matter of dispute.[1] On the one hand, Heifetz and Neeman (2006) have suggested that full surplus extraction is generically impossible.[2] On the other hand, Chen and Xiong (2013) have shown that in a particular class of models, approximately full surplus extraction is generically possible. Our result is both stronger and more general than that of Chen and Xiong (2013). It is also "topology-free" in the sense that we do not specify a topology on beliefs but only require the topology on beliefs to by induced by a metric that is a convex function.

We use ideas from embedding theory. An embedding is a continuous injective function from a space X to a space Y. The classical embedding theorem asserts that, if X is a compact finite-dimensional metric space and Y is a metric space with a sufficiently high dimension, the set of embeddings is residual in the space of continuous functions from X to Y, endowed with the uniform topology.[3] The McAfee–Reny condition for surplus extraction is similar to, but sub-

[1] For models with finitely many types, as in Crémer and McLean (1988), genericity of full surplus extraction is automatically obtained if the set of other agents' types is sufficiently large.

[2] Barelli (2009) also makes this claim, but Chen and Xiong (2011) show that his analysis involves an error.

[3] In Gizatulina and Hellwig (2014), we used this theorem to show that injective belief functions are generic in the space of continuous functions from agents' types to their beliefs. If a belief function is injective, then, regardless of how