Thoretical Economics Letters
International Journal of Game Theory   "Screening Contracts to Budget-Constrained Agents"

This research project pushed forward the existing results of the so-called mechanism design in contract theory and incentive theory in the framework of multi-dimensional private information possessed by agents.

I published a paper "Implementability by a Canonical Indirect Mechanism of an Optimal Two-Dimensional Direct Mechanism" in Theoretical Economics Letters 07(02), 187-192, January 2017 and "Two-Dimensional Mechanism Design and Implementability by an Indirect Mechanism" in Theoretical Economics Letters 07(06), pp1595-pp1601, October 2017.
I presented the paper "General Screening Contracts to Budget-Constrained Agents" at the Asian and Chinese meetings of the Econometric Society. I revised the paper several times and submitted it to top international journals, some of which rejected it and others requested revivions. The latest version has been submitted to the International Journal of Game Theory under the title of "Screening Contracts to Budget-Constrained Agents". The reviewers' opinions are very positive and the editor has requested a minor revision for publication.

Mechanism Design

Mechanism Design Revelation Principle Multi-dimension Budget Constraints

Problems in which agents have uni-dimensional private information have been widely studied and numerous are the results and characterizations of the optimal screening mechanisms by the principal (e.g.,Guesnerie and Laffont (1984), Maskin and Riley (1984) and Mussa and Rosen (1978)). By contrast, when agents have multi-dimensional information, the matter gets complicated to a great extent. In particular, it is widely known that the multi-dimensional problem involves quite a few technical complications (see Armstrong (1996) and Rochet and Chone (1998)).

This study considers one particular problem of multi-dimensional mechanism, namely, the optimal selling mechanism with the budget-constrained buyer who has as private information his taste and budget. This is an adverse selection problem in two dimensions. One method for circumventing the difficulties arising in the problem on multi-dimensional mechanism is to reduce the dimension of private information (Rochet and Stole (2003)). This implies that instead of using a direct mechanism, one draws upon an indirect mechanism. The first research conducted for the problem in the context of the present study is Che and Gale (2000), who, as an indirect mechanism, resorted to the nonlinear price scheme for the reduction of dimension of private information. Recently, Richter (2011) also refers to the same method. Kojima (2014) dealt with the same problem through another familiar mechanism: a standard "canonical" one-dimensional mechanism in the context where the agent has uni-dimensional information, that is, a map from the taste space to the quality and price space. One advantage of his is that it enables us to directly compare the structures of an optimal canonical mechanism in the standard one-dimensional setting without the budget constraint and those in the multi-dimensional context. Thus, one can highlight modifications to be brought about to a canonical mechanism by the very existence of the budget constraint and put them in contrast with a good many properties which have been accumulated in the past literature on mechanism design.

This research project carries forward the work conducted by Kojima (2014) in two directions. As written above, in the context of budget-constrained agents, the extant research resorted to indirect mechanisms including mine; for in our multi-dimensional setting, a direct mechanism is too complicated to analyze and does not allow characterization of an optimal solution. The use of an indirect mechanism, however, may contain a theoretically fundamental issue, or suboptimality to the principal's profit/utility. The revelation principle asserts that any outcome implemented by an indirect mechanism can be realized by a direct mechanism but the opposite is not generally true. Che and Gale (2000), and Kojima (2014) dispelled this concern by showing that their respective indirect mechanisms are indeed optimal but at one price. They could show it in the case where the principal-seller has a nil cost function. This is realistic for a situation like auction but the applicability is, otherwise, quite reduced.

The first objective of this project is to remove the assumption of zero cost for good and to put research on budget-constrained agents in the same lines of the past research without a

budget constraint as in Mussa and Rosen (1978). It, then, enables a great deal of applications as in Guesnerie and Laffont (1984). At the same time, it completes, at least, research on one-principal mechanism design with budget-constrained agents of a single taste parameter.

The second objective of this project is to extend Kojima (2014)'s canonical mechanism approach to budget-constrained agents with multi-dimensional taste. For multi-dimensional screening problem, since inception by the works by Armstrong (1996), Rochet and Chone (1998)) and Rochet and Stole (2003), the question on budget-constrained agents is still totally uncharted waters let alone existence of cost on the part of the principal. Considering this project intends to use a multi-dimensional canonical indirect mechanism a la Chone-Rochet, it might be worth noting a recent work by Manelli and Vincent (2006). They consider a principal-seller's optimal mechanism faced to a multi-dimensional type of agents --- but without a budget constraint. Instead of Rochet and Chone (1998)'s direct mechanism approach, they resort to a non-linear price scheme as Che and Gale (2000). Again as do the latter, they assume zero cost and show that in quite a limited context, a non-linear price scheme can attain optimality of a direct mechanism. Thus, in this second research agenda, the challenge is to show that as in the first, our canonical mechanism can attain optimality and, if possible, even in existence of a non-zero cost function. After clearing this issue, I intend to characterize an optimal indirect canonical mechanism by means of calculus of variations.

As is described in the previous section, I consider one indirect mechanism called a "canonical mechanism"in the context of budget-constrained agents of uni-dimensional and multi-dimensional taste. There are mainly two issues for conducting this research.

The first one is to ensure that our canonical indirect mechanism can attain the level of an optimal direct mechanism. Thus, one has to "defeat"the revelation principle. In the case of one-taste parameter agents, I deal with this question only for a case where the principal has a non-zero cost function. The answer for a case of zero cost is already given in Kojima (2014). In the case of multi-dimensional-taste parameter agents, one is still on the unbeaten path and unable to say much whatsoever. I may have to consider the cases of existence and absence of cost separately. For the absence of cost, I am quite positive that optimality is assured but for the other case, I am more uncertain.

The second one is to characterize the principal-seller's optimal canonical selling mechanism. The principal tries to construct a selling mechanism which brings in the greatest profit while reckoning how the agent makes a decision of purchase choice. Here, one technically needs to use optimal control for a uni-dimensional taste case and calculus of variations for a multi-dimensional taste case and setting the problems in those frameworks may require some ingenuity.

I published a paper "Implementability by a Canonical Indirect Mechanism of an Optimal Two-Dimensional Direct Mechanism" in Theoretical Economics Letters 07(02), 187-192,

January 2017. While carrying out research, I hit on an idea which is pertinent to the project.

I drafted another paper "General Screening Contracts to Budget-Constrained Agents", which bears directly on the project and is the first paper proposed in the project. I got it accepted by the 2017 Asian and Chinese meetings of the Econometric Society. It is a paper dealing with the principal with cost faced to budget-constrained agent-buyers

I published a paper titled "Two-Dimensional Mechanism Design and Implementability by an Indirect Mechanism" in Theoretical Economics Letters 07(06), pp1595-pp1601, October 2017.

In 2017, I presented a paper "General Screening Contracts to Budget-Constrained Agents" at the Asian and Chinese meetings of the Econometric Society.

 I revised the above paper "General Screening Contracts to Budget-Constrained Agents" several times and I submitted it as "Screening Contracts to Budget-Constrained Agents" to the International Journal of Game Theory. It is returned with a request for minor revision. Overall, the research project progressed according to plan in the first part of the project. In the second part, I could not produce concrete research output as yet but I have been in investigation.

(1)PRESENTATIONS

China Meeting of the Econometric Society, Wu-Han, China, 2017

Asian Meeting of the Econometric Society, Hong-Kong, China, 2017

(2)PEER-REVIEWED PUBLICATIONS

"Two-dimensional Mechanism Design and Implementability by an Indirect Mechanism" Naoki Kojima, Theoretical Economics Letters, Vol. 7, No. 6, October 2017, pp.1595-1601

"Implementability by a Canonical Indirect Mechanism of an Optimal Two-Dimensional Direct Mechanism" Naoki Kojima, Theoretical Economics Letters, Vol. 7, No. 2, February 2017, pp.187-192

(3)PREPRINTS

"Screening Contracts to Budget-Constrained Agents" Naoki Kojima, Minor Revision Requested by International Journal of Game Theory, 2019

Naoki Kojima	7
Two-Dimensional Mechanism Design and Implementability by an Indirect Mechanism	2017
Theoretical Economics Letters	1595-1601
DOI 10.4236/tel.2017.76107	

Naoki Kojima	07(02)
Implementability by a Canonical Indirect Mechanism of an Optimal Two-Dimensional Direct Mechanism	2017
Theoretical Economics Letters	187-192
DOI 10.4236/tel.2017.72016	

Naoki Kojima
General Screening Contracts to Budget-Constrained Agents
Asian meeting of The Econometric Society
2017

Naoki Kojima
General Screening Contracts to Budget-Constrained Agents
Chinese meeting of The Econometric Society
2017

o