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Journal of Economic Theory 157 (2015) 236–254

JOURNAL OF Economic Theory

www.elsevier.com/locate/jet

Rational bargaining in games with coalitional externalities ☆

Peter Borm [a], Yuan Ju [b], David Wettstein [c,*]

[a] *CentER and Department of Econometrics and Operations Research, Tilburg University, The Netherlands*
[b] *Department of Economics and Related Studies, University of York, Heslington, York, YO10 5DD, UK*
[c] *Department of Economics, Ben-Gurion University of the Negev, Israel*

Received 2 October 2011; final version received 14 July 2014; accepted 30 December 2014

Available online 16 January 2015

Abstract

This paper provides a flexible strategic framework to analyze bargaining and values in environments with coalitional externalities. Within this framework we propose a new value that extends the Shapley value to partition function form games, the so-called Rational Belief Shapley (RBS) value. We investigate the strategic foundation of the RBS value by constructing an implementation mechanism. This mechanism extends existing models of multilateral bargaining by allowing players a higher degree of freedom to form coalitions. The same framework of bidding and renegotiation allows for natural variations of the RBS-mechanism. In this way, alternative "Shapley-like" values are obtained, and a unified platform to analyze and compare these solutions is provided.

☆ This paper was previously circulated under the title "Coalitional Externalities, Strategic Bargaining, and Efficient Values". We thank Matthew O. Jackson for an inspiring conversation, as well as Roberto Serrano, Yair Tauman and Juan Vidal-Puga for helpful discussions and suggestions. We also appreciate the comments from the audience of the seminars at Keele University, Tilburg University, Queen's University Belfast, University of York, Haifa University, the Hebrew University of Jerusalem, the Technion, Tel Aviv University, the Tinbergen Institute, the University of Bayreuth, Seoul National University, National Tsing Hua University, Academia Sinica, National Taiwan University, the 3rd World Congress of the Game Theory Society in Evanston, the Workshop on Implementation of Cooperative Solution Concepts – the Nash Program at Stony Brook, the 27th Arne Ryde Symposium on Mechanism Design in Lund, and the 10th World Congress of the Econometric Society in Shanghai. In particular, we are grateful to the associate editor and two anonymous referees. Their valuable comments and constructive suggestions contributed to a significant improvement of the paper. Of course, any remaining error is ours. Yuan Ju thanks for the financial support of the RIS Fund from the University of York.
* Corresponding author.
E-mail addresses: p.e.m.borm@uvt.nl (P. Borm), yuan.ju@york.ac.uk (Y. Ju), wettstn@bgu.ac.il (D. Wettstein).

http://dx.doi.org/10.1016/j.jet.2015.01.011
0022-0531/

JEL classification: C71; C72; D62

Keywords: Externalities; Bargaining; Partition function form game; Rational belief Shapley value; Implementation; Bidding mechanism

1. Introduction

The paper aims to provide a uniform and flexible strategic framework to analyze the interaction between agents, as well as the appropriate sharing of surplus, in economic environments with coalitional externalities, modeled as *partition function form games* by Thrall and Lucas [36]. The model of partition function form games incorporates both internal factors (the coalition actions) and external factors (the coalition structure), and thus, it provides a basis for a general analysis of cooperation and sharing issues.

Thus far, axiomatic studies have dominated the research of the area and resulted in the solution concepts proposed by Myerson [26], Bolger [8], Albizuri, Arin and Rubio [3], Pham Do and Norde [31], Ju [19], Macho-Stadler, Pérez-Castrillo and Wettstein [23], Xue [41] and Dutta, Ehlers and Kar [11]. de Clippel and Serrano [9] offer an insightful study by analyzing the structure of the games and identifying the bounds on players' payoffs as well as by comparing the properties of several solution concepts.

We believe the strategic approach to partition function form games is equally important. But it is not surprising why so little has been done on the non-cooperative foundations of the solution concepts[1] for partition function form games, given its highly combinatorial structure that significantly complicates the problem. Maskin [24] is the first one taking the non-cooperative approach, and a follow-up discussion is provided in de Clippel and Serrano [10]. Besides that, so far this issue is only partially investigated in Macho-Stadler, Pérez-Castrillo and Wettstein [22] where an implementation of their value (Macho-Stadler, Pérez-Castrillo and Wettstein [23]) is derived in environments with either purely non-negative externalities or purely non-positive externalities.

Part of the difficulty in addressing the non-cooperative foundation is the inability to make a sharp prediction of the worth of a coalition. The players outside a specific coalition can generate different types of externalities by forming different coalition structures, and moreover, the specific coalition itself can partition in several ways. In this paper, we analyze the determination of the worth of a coalition explicitly, propose the corresponding value solution concepts, and study the underlying bargaining foundations. Unlike most of the existing literature that adopts a simultaneous move perspective when determining the worth of a coalition, we explore the effect of sequential moves. A major advantage of the sequential approach is that it eliminates the coalition structures that are unlikely to be adopted by rational players. Furthermore, an intriguing aspect of our bargaining model is that the sequential procedure together with the endogenous choice of proposer in renegotiation will give rise to a value that is defined from a simultaneous move perspective. Thus, it successfully maintains the flavor of simultaneity in bargaining and its outcome.

In addition to proposing new solutions and studying their bargaining foundations, the paper delivers a general modeling framework where the bargaining procedures and game forms under consideration share a basic common structure. This helps to pin down the differences between the various sharing methods from a strategic point of view. Moreover, we also contribute to the

[1] For set value solutions to partition function form games, we refer to Huang and Sjöström [15,16].