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Optimal mechanism design with resale via bargaining ☆

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Abstract

In this paper, we examine the optimal mechanism design of selling an indivisible object to one regular buyer and one publicly known buyer, where inter-buyer resale cannot be prohibited. The resale market is modeled as a stochastic ultimatum bargaining game between the two buyers. We fully characterize an optimal mechanism under general conditions. Surprisingly, in this optimal mechanism, the seller never allocates the object to the regular buyer regardless of his bargaining power in the resale market. The seller sells only to the publicly known buyer, and reveals no additional information to the resale market. The possibility of resale causes the seller to sometimes hold back the object, which under our setup is never optimal if resale is prohibited. We find that the seller's revenue is increasing in the publicly known buyer's bargaining power in the resale market. When the publicly known buyer has full bargaining power, Myerson's optimal revenue is achieved; when the publicly known buyer has no bargaining power, a conditionally efficient mechanism prevails.

JEL classification: C72; D44; D82; D83; L12

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1. Introduction

In the traditional mechanism design literature, buyers cannot resell the objects they just won. For example, in his seminal paper, Myerson [11] characterizes the optimal mechanism of selling an indivisible object to many privately informed buyers. In that mechanism, the buyer with the highest virtual valuation is awarded the object, providing that it is higher than the seller's reservation value. However, the Myerson allocation may be *ex-post* inefficient among the buyers if the buyers are asymmetric, as the highest virtual valuation buyer may not have the highest valuation. Therefore, buyers may be able to benefit from trading among themselves. Thus, when this kind of inter-buyer resale cannot be prohibited, buyers will engage in resale upon the Myerson allocation. Given this, the final allocation of the object rolls away from the Myerson allocation, providing different incentives for the buyers in the mechanism. As such, the Myerson optimal revenue may not be achievable.

Many researchers have started to address this issue of resale in auctions and optimal mechanisms. These include Ausubel and Cramton [1], Calzolari and Pavan [2], Cheng and Tan [3], Garratt and Troger [4], Hafalir and Krishna [5], Haile [6], Virag [14], and Zheng [15], all of which we will discuss in this introduction. Markedly, Zheng [15] demonstrates that even if the seller cannot prohibit resale, she can still achieve the Myerson revenue under certain resale rules. He constructs a mechanism involving many rounds of resales, with the winner of each round reselling the object to the rest of the buyers, leading to the Myerson allocation in the end. The Revenue Equivalence Theorem implies that this mechanism generates the same revenue as the Myerson revenue, which is the upper bound revenue among all feasible mechanisms. (Note that from the Revenue Equivalence Theorem the seller cannot earn more revenue by allowing for resales.) As a result, Zheng's mechanism is optimal among all mechanisms with resale. One key feature in Zheng's mechanism is that the winner in each round has full bargaining power, dispensing a mechanism that is optimal for himself. In the case where the winner of each round has less than full bargaining power, Myerson's revenue may no longer be achievable.[1] In this case, Zheng's construction does not apply. We characterize an optimal mechanism when the winner has less than full bargaining power in this paper.

Our approach is to analyze the buyers' incentive compatibility constraints and participation constraints directly. We adopt the framework of Garratt and Troger [4] in our analysis. Even though the framework is used by them to study the equilibrium behavior in certain auctions with resale, we find it suitable for examining the optimal mechanism design problem as well. In our model, in addition to the seller, there are two buyers: one regular buyer, and one publicly known buyer whose valuation is commonly known. This publicly known buyer resembles a speculator or a dealer. The two buyers can engage in resale activities. The seller cannot control what happens in the resale market.

Departing from Zheng's and Garratt and Troger's assumption that the winner has full bargaining power, we model the resale market as a stochastic ultimatum bargaining game between the two buyers. With certain probability, the winner is picked as the proposer in the ultimatum

[1] As we shall show in this paper, when resale is permitted, the Myerson revenue can be achieved when and only when the winner has full bargaining power or when the publicly known buyer's valuation is equal to the seller's.