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The effect of false-name bids in combinatorial auctions: new fraud in internet auctions ☆

Makoto Yokoo,* Yuko Sakurai, and Shigeo Matsubara

NTT Communication Science Laboratories, 2-4 Hikaridai, Seika-cho, Soraku-gun, Kyoto 619-0237, Japan

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Abstract

We examine the effect of false-name bids on combinatorial auction protocols. False-name bids are bids submitted by a single bidder using multiple identifiers such as multiple e-mail addresses. The obtained results are summarized as follows: (1) the Vickrey–Clarke–Groves (VCG) mechanism, which is strategy-proof and Pareto efficient when there exists no false-name bid, is not false-name-proof; (2) there exists no false-name-proof combinatorial auction protocol that satisfies Pareto efficiency; (3) one sufficient condition where the VCG mechanism is false-name-proof is identified, i.e., the concavity of a surplus function over bidders.

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1. Introduction

Internet auctions have become an especially popular part of Electronic Commerce (EC). Various theoretical and practical studies on Internet auctions have already been conducted (Monderer and Tenenholtz, 2000a, 2000b; Sandholm, 1996; Wurman et al., 1998). Among these studies, those on combinatorial auctions have lately attracted considerable attention (Fujishima et al., 1999; Klemperer, 1999; Rothkopf et al., 1998; Sandholm, 1999).

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* Corresponding author.
E-mail address: yokoo@cslab.kecl.ntt.co.jp (M. Yokoo).
URL: http://www.kecl.ntt.co.jp/csl/ccrg/members/yokoo/.

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Although conventional auctions sell a single good at a time, combinatorial auctions sell multiple goods with interdependent values simultaneously and allow the bidders to bid on any combination of goods. In a combinatorial auction, a bidder can express complementary/substitutable preferences over multiple goods. By taking into account such preferences, economic efficiency can be enhanced.

Although the Internet provides an excellent infrastructure for executing combinatorial auctions, we must consider the possibility of new types of cheating. For example, a bidder may try to profit from submitting false bids under fictitious names such as multiple e-mail addresses. Such an action is very difficult to detect since identifying each participant on the Internet is virtually impossible. We call a bid made under a fictitious name a *false-name bid*. Also, we call a protocol is *false-name-proof* if truth-telling without using false-name bids is a dominant strategy for each bidder.

The problems resulting from collusion have been discussed by many researchers (McAfee and McMillan, 1987, 1992; Milgrom and Weber, 1982; Milgrom, 2000). Compared with collusion, a false-name bid is easier to execute on the Internet since getting another identifier such as an e-mail address is cheap. We can consider false-name bids as a very restricted subclass of collusion.

A concept called *group-strategy-proof* is proposed to study another restricted subclass of general collusion (Muller and Satterthwaite, 1985; Moulin and Shenker, 1996). As discussed in Section 5, group-strategy-proof and false-name-proof are independent concepts, i.e., a group-strategy-proof protocol is not necessarily false-name-proof, and vice versa.

In this paper, we analyze the effects of false-name bids on combinatorial auction protocols. The obtained results can be summarized as follows:

- The Vickrey–Clarke–Groves (VCG) mechanism (Vickrey, 1961; Clarke, 1971; Groves, 1973), which is strategy-proof and Pareto efficient if there exists no false-name bid, is not false-name-proof.
- There exists no false-name-proof combinatorial auction protocol that satisfies Pareto efficiency.
- We identify one sufficient condition where the VCG mechanism is false-name-proof, i.e., a surplus function is *concave* over bidders.

In the rest of this paper, we first develop the model of a combinatorial auction in which false-name bids are possible (Section 2). Next, we examine the effect of false-name bids in combinatorial auctions (Section 3). Then, we show a sufficient condition where the VCG mechanism is false-name-proof (Section 4). Finally, we discuss the difference between false-name-proof protocols and group-strategy-proof protocols (Section 5).

2. Formalization

In this section, we formalize a combinatorial auction protocol in which false-name bids are possible. Our model is based on that presented in (Monderer and Tenenholtz, 2000a), but our model is modified to handle false-name bids.