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Auctions to implement the efficient market structure

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Abstract

We consider a regulator who does not know how many firms should be granted a license to enter a market as he has limited information on their setup costs.

We propose two auction formats which implement the efficient market structure. In a "jumping English auction" the price for a license increases continuously most of the times, but jumps at pre-specified points. After each jump, the number of winning bids is increased by one. The second auction is a multi unit auction based on the design of the UMTS auction in Austria and Germany, where firms can bid on more or less packages.

JEL classification: D43; D44; D45

Keywords: Auction; Market structure; UMTS; Licenses

1. Introduction

Consider the recent series of UMTS license auctions in Europe. UMTS is the third generation of mobile phones. A company offering UMTS services to its customers has to build a huge infrastructure, the costs of which are about several billion Euros (at least in Germany). In this case, it is probably fair to assume that the regulator has less information on the size of these setup costs than the firms have themselves. The regulator then faces a dilemma, namely to determine the optimal number of firms in such a market. Increasing the number of firms has two opposing effects: More firms lead to more competition and thus to higher consumer surplus while at the same time more firms imply more inefficient duplication of the costly infrastructure.[2]

This problem under asymmetric information has already been analyzed by several authors (Auriol and Laffont, 1992; Dana and Spier, 1994; McGuire and Riordan, 1995; Grimm et al., 2003). The first three of these articles describe the optimal mechanism in a situation where the regulator cares about money as well as overall welfare in a situation where either one or two

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[2] Finding the optimal market structure is relevant in many economic environments beyond the telecommunication market. For example, an innovator has to decide on how many firms are to be granted a license (see e.g. Kamien, 1992; Katz and Shapiro, 1985), a procurement agency has to decide on how many firms should be allowed to enter the race and occur fixed costs of participating for becoming the desired supplier (Fullerton and McAfee, 1999).

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firms are optimal. Grimm et al. discuss implementation of the efficient market structure for an arbitrary number of firms.[3] In most of these papers the proposed mechanisms rely on message games.[4]

The open English auction has evolved as the de facto standard for most applications. The first contribution of this paper is, therefore, to propose a generalization of the open English auction that implements the efficient market structure.

The auction we propose will be called "jumping English auction". In the jumping English auction the participating bidders can only decide whether to remain in the auction or whether to exit. A price increases. If, before the price has reached a price level P^1, only one bidder is left in the auction, she obtains a monopoly license for the price at which the second last bidder exited. If, however, at $P=P^1$ more than one bidder is left, the price jumps down to $P=P_2$. Now the price increases again. If, before the price has reached a price level P^2, only two bidders are left in the auction, they both obtain a (duopoly) license for the price at which the third last bidder exited. If not, the price jumps from $P=P^2$ to $P=P_3$ and the procedure is repeated, where now three firms are sufficient to end the auction, and so on. If the jumps are defined appropriately, this auction implements the efficient market structure. The idea behind this auction is that few firms are optimal in the market only if most of the firms have high setup costs. In this case, firms make lower profits anyway and are thus less willing to pay for a license. This implies that they will exit the auction at an early stage, when only few firms can win a license. On the other hand, firms with lower setup costs will remain longer in the auction, which in turn leads to more firms winning a license.

The UMTS auctions held in Austria and Germany in 2000 are two of the rare examples where the market structure was determined endogenously. Both countries used a similar auction design, where twelve frequency blocks were auctioned off and each firm could bid for either two or three blocks. Thus either four, five or six firms could end up with a license to operate in the market. The second contribution of this paper is a positive analysis of the strengths and weaknesses of this auction format regarding the implementation of the optimal market structure.

We show that an auction design similar to the one used in Austria and Germany implements the first best if two additional requirements are satisfied: First, firms are not allowed to reduce their demand too early in the auction, and second, the prices of additional blocks of frequencies have fixed markups. If firms are completely free to decide when to bid on less blocks, they might strategically reduce their demand too early and, hence, too many firms will end up in the market (generating too little revenue for the government). The lack of mark ups makes it too cheap for a firm to buy other firms out of the market and may lead to too much concentration in the market.

Another aspect we introduce is that we consider the case where the regulator has even less information on the market structure, i.e. the profit functions are common knowledge among the firms only. We propose an extension of the jumping English auction that succeeds in eliciting this additional information.

The paper is structured as follows. In the next section we introduce the model and propose a Clarke–Groves mechanism to implement the efficient market structure. In Section 3, we analyze the jumping English auction and in Section 4 the pendant to the Austrian and German auction will be analyzed. Extensions will be presented in Section 5. We summarize and conclude in Section 6.

2. The model

2.1. The firms

There exists a sufficiently large number of potential firms, indexed by $i \in \{1, 2, ..., m\}$. Firms differ with respect to an unknown (cost) parameter c, which describes the setup costs. It is common knowledge that all c's are drawn from the same distribution $F(c)$ whose support is given by $[\underline{c}, \overline{c}]$. $F(c)$ is differentiable with density function $f(c)$[5]. Variable costs are the same for all firms.[6]

[3] Others have discussed the evolving market structure for a given auction design (Krishna, 1993, 1999; Rodriguez, 2002). Mougeot and Naegelen (2005) analyze the case where the regulator fixes the number of licenses in advance. The market structure might still be determined endogenously as firms with sufficiently high fixed costs might not enter the auction. Thus less firms than licenses might turn up.

[4] Dana and Spier (1994) propose a modified second price sealed bid auction to implement the optimal mechanism. We will comment on this below.

[5] The assumption of symmetry is innocuous for our main results. Symmetry is only required when we discuss that the proposed mechanism is revenue maximizing among the set of efficient mechanisms.

[6] In the cases of interest where a regulator has to decide on market entry, these assumptions seem plausible to the first order. These markets, like the telecommunication market, are characterized by very high fix costs and relatively low variable costs. We have found only indirect evidence on the cost structure of mobile phone operators. Nokia Corporation (2004), for example, presents a business case for geographical network expansion (p.9) that simply ignores per call costs. A similar assumption has been made by Grimm et al. (2000). In Section 5.4 we generalize the analysis to allow for different marginal costs.