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Spectrum fees and market performance: A quantitative analysis☆

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ABSTRACT

This paper aims at providing evidence on the impact of spectrum fees and spectrum availability on mobile operators' industry revenues by using an original dataset of firms operating in 24 Countries in the period 2005–2014. The analysis quantitatively identifies the relationship between mobile market revenue and their determinants, among which spectrum availability and license fees are included. The analysis provides evidence that spectrum availability and fees are not significantly correlated with mobile industry revenues suggesting that market expectations to extract additional revenues from the mobile service following new spectrum auctions are likely not to be respected.

1. Introduction

The auctions for 3G spectrum held in the UK and Germany in 2000 and 2001 raised approximately €35B in the UK and €50B in Germany making 2% of each country's GDP from just 11 companies and are usually considered as highly successful given the enormous revenues that governments were able to extract from mobile operators.

As a consequence of apparently disproportionate values, the impact of license fees on the market started being investigated by multiple researches, sparking a debate among policy makers and researchers in the telecommunication community on the optimality of such values for the market dynamics and for the social welfare. The main criticism is that such an increase in capex could, on one side, be translated into a higher price for the consumer and, on the other side, that it could jeopardize the willingness of the operators to innovate.

The debate renewed with the high prices paid in the recent wave of auctions which reassigned large portions of spectrum in valuable bands, with the objective of providing additional transmission capacity to the mobile service and of enabling a transition from 3G to 4G technology.

In the economic literature can be found supporting evidence for two opposite positions. Authors as Cave and Valletti (2000) and Park, Lee, and Choi (2010) consider license fees as sunk costs, i.e. expenditures that are unable to influence market dynamics; other researchers, such as Noam (1998); Bauer (2001); French (2008), Hazlett and Munoz (2009), point out that license fees have an impact on market development, and in particular on the operators' revenue and investments, on competition and market entry and on social welfare.

However, most of these studies bring limited empirical evidence supporting each position and do not analyze the impact on market dynamics of the spectrum availability on its own (and not of the price paid for obtaining the resource). The purpose of the research is to fill this gap by developing an empirical analysis with international breadth of the described effects to understand which

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position can be supported with the highest strength.

The empirical test is based on a dataset including macro-economic drivers, fixed and mobile operators revenues, market openness, spectrum assignment and licensing conditions for the years 2005–2014. The database has been built to take into consideration 3G and 4G spectrum assignments in 24 developed and developing countries.

Results show that, once the potential endogeneity of spectrum availability and fees is accounted for, spectrum availability and spectrum fees appear not to be correlated with the mobile operators' revenues, implying that spectrum resources and its value do not have significant impact on industry' performance and hence can be considered as sunk expenditures.

The paper is structured as follows. Section 2 presents a brief literature review on the impact of license fees and spectrum availability on firm and industry performance. Section 3 presents the model of mobile operators' revenues. Section 4 describes the data and Section 5 presents the results from the estimations. Section 6 concludes.

2. Literature review

An analysis of the available literature shows that few authors support the idea that spectrum license fees are sunk costs for mobile operators, claiming that the price paid in acquiring that input does not have any impact on ex post firm performance.

This suggestion is supported by Cave and Valletti (2000), who argue that mobile operators only adopt a forward-looking approach in defining their investment strategies, which considers future revenues, costs and the potential competition effects once the licenses have been assigned. This forward-looking approach implies that the license fee paid by any player is ex post considered as a sunk cost.

Similarly, Park, Lee, & Choi (2010) investigate the effect of spectrum auctions and their possible harmful effect on consumers. Performing a regression analysis, they empirically analyze the effect of license fees on consumer pricing, mobile investment and market concentration. Using a dataset of 21 OECD countries that assigned 3G spectrum both via auctions and via beauty contest, the authors do not find any statistically significant result that relates the level of license fees to an increase in consumer prices, to network development or to market concentration.

In contrast with the previous view, other researchers claim that license fees do have an effect on the market development especially in terms of reduced competition, increased level of prices in the market and reduced pace of network's development.

Bauer (2001) analyzes the relationship between market entry and the subsequent pricing and investment policies of the mobile operators, observing that the payment of license fees increases the price for mobile services in the market. The statement is based on the consideration that even though one-time fees do not change the marginal cost of providing the service, they increase the average cost of production, which, in the long term, is the minimum price at which a firm will be willing to provide the service.

Furthermore, the author argues that the financial burden imposed to mobile operators by excessively expensive license fees will force operators to adjust their investment strategies in terms of rollout of network capacity, due to tightened financial constraint and worse credit standing of the operators due to the upfront expenses incurred for the purchase of the licenses.

Noam (1998) also argues that the prices paid by the operators for the licenses will eventually be reflected in the service prices – impacting operators' revenue – due to the fact that a firm cannot survive in the long run if it sets prices disregarding these fixed costs. In his work Noam also analyzes the impact of license fees on competition, pointing out that when a license fee has to be paid upfront it introduces a barrier to entry in the market, especially for new firms and for unproven technologies, because the pool of possible entrants would be reduced. Moreover, the highest bid will arrive from those operators who can organize an oligopoly being then able to raise prices in order to cover the expenses incurred for the purchase of the license.

The effect of license fees on competition is also investigated by Gruber (2001), who analyzed the effects of spectrum scarcity on the market of mobile telecommunications. The author develops a model to evaluate the profit of firms competing in the market, keeping in consideration also fixed set-up costs and deriving the equilibrium number of firms in the market, such that in equilibrium the entrance of an additional firm leads the profits to be negative for the entire industry. Gruber (2001) shows that if there is competition for the spectrum the price paid for the licenses is likely to increase, creating a conflict between the number of licenses that will be granted by the government and the equilibrium number of firms that is affected by the fixed costs. Indeed, if the price paid for license fees by the operators is too high, the exit of some firms from the market is necessary to re-establish positive profits for the industry as a whole. From this argument it emerges that a monopolist would be able to pay the highest possible license fee but, then, a conflict arises between the goal of maximizing rent extraction from mobile operators and the desired level of competition in the market. In addition, if excessive license prices were paid in a situation of multiple players operating on the market, the only two possibilities for operators are either to exit the market or to collude in order to raise prices.

French (2008) analyzes the mobile operators' behavior during the auctions for 3G spectrum licenses. In his study he re-examines the auctions for 3G licenses held in UK and Germany in 2000 and 2001, arguing that the peculiarities of these auctions led bidding firms to behave in an irrational way, from a game theory perspective, significantly overbidding for the licenses in auction. Overbidding is here defined as when license fees exceed the level consistent with a zero profit condition for the industry. This would have therefore needed the exit of some players from the market. In his paper, the author links the overbidding behavior in the auctions with their fear of being excluded from the market if they weren't awarded with a license. To support this argument the author presents a case study related to an auction, held in 1980 in the United States, for federal timber rights, where the players involved believe that only two scenarios were possible: win the auction or liquidate their assets. The behavior led to incredibly high auction prices due to the fact that the bids weren't consistent with a rational valuation of the license due to the concern. The author relates the overbidding behavior to the bidders' uncertainty as to whether comparable assets were going to be auctioned again in the future, also given the non-fungible nature of these assets and their necessity for the bidders to continue their operations.