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Analysis of spectrum auctions in India—An application of the opportunity cost approach to explain large variations in spectrum prices ☆

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ABSTRACT

The remarkable growth of mobile communication has reinforced the significance of the radio spectrum for mobile network operators. The availability of spectrum varies considerably between different countries due to national regulatory decisions. The focus in this paper is on India where operators have access to a limited amount of spectrum. This paper analyses the value of spectrum by estimating the opportunity cost, which is calculated by the savings that can be achieved by acquiring appropriate amount of spectrum rather than investing in additional base stations. The applied approach combines network deployment, user demand levels, cost, and capacity issues, which are integrated in the application in the opportunity cost approach for spectrum. The opportunity cost of spectrum is compared with prices paid at spectrum auctions. The analysis includes a discussion of drivers that determine the willingness to pay for spectrum. The results show that the opportunity cost of spectrum in relation to auction prices is lower than prices operators paid for 3G spectrum in the metro circles (service areas) while the value derived from the opportunity cost is higher than auction prices in the remaining circles.

1. Introduction

1.1. Spectrum allocation and prices

In October 2011, the Government of India (2011) published a National Telecom Policy that set out to reach broadband speeds of 2 Mbps by 2015 and at least 100 Mbps thereafter. Mobile communications will be instrumental in reaching these targets as the fixed network in India is limited and the deployment of fibre in the access network is minimal.

Access to spectrum varies considerable between different countries. For example, operators in Pakistan and India on average have access to 2×15 MHz, while operators in Germany and Sweden in average control 2×70 MHz. The enhanced role of spectrum turns spectrum allocation and auctions into decisive events for mobile operators (Fig. 1).

The outcome of spectrum auctions varies between countries and spectrum bands. For attractive bands like 800 MHz, operators in Germany paid EUR 1.54 per MHz/pop,[2] while spectrum in the 2.6 GHz band reached considerably lower price

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[2] The amount and price of spectrum is presented using the metric "price per MHz normalised with the size of the population" (EUR/MHz/pop).

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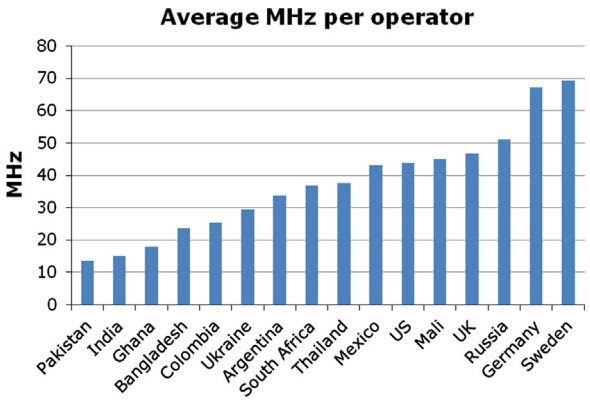

Fig. 1. Average amount of spectrum per operator (downlink). (The numbers presented are based on the total amount of spectrum mobile operators have in the different countries, and then calculated as a market share weighted average.)
Source: NRAs, Cullen-International, operator reports, authors' calculations.

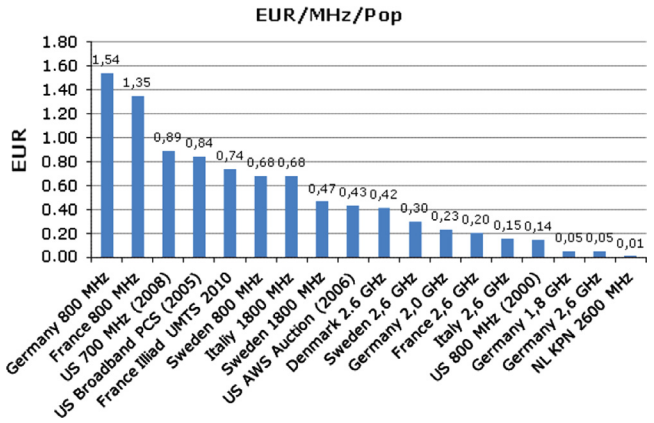

Fig. 2. Prices paid per MHz/pop in auctions in Europe and US.
Source: NRAs, Cullen-International, authors' calculations.

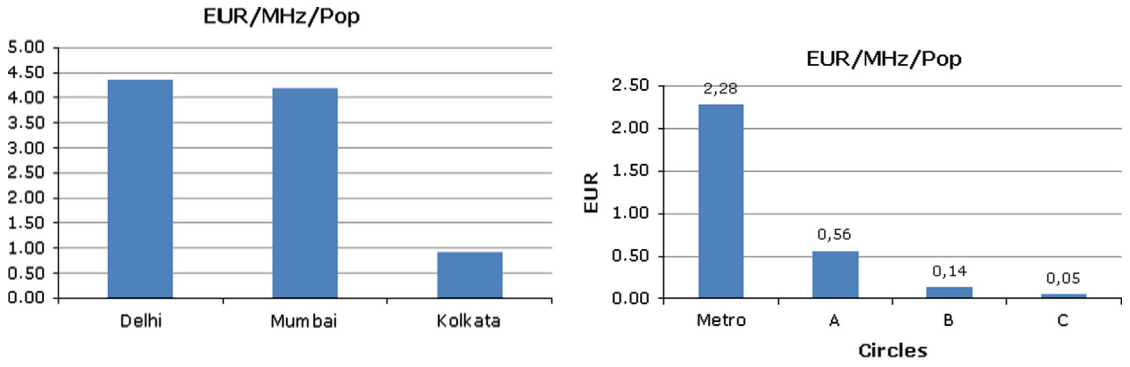

Fig. 3. Prices paid per MHz/Pop for 3G licences 2010 in the four circles in India.
Source: Department of Telecommunications (DoT) India.

levels (see Fig. 2). Interestingly enough, prices paid at the Indian 3G auction in 2010 for the two main Indian cities were not far off from prices paid at the 3G auctions in the UK and Germany in the year 2000.

Prices paid at the 3G auction in India in 2010 varied significantly between the different circles. The Indian market is divided into 23 circles (service areas), divided into metro, A, B, and C circles, structured according to the economic level. The average prices in the circles were in the range of over EUR 2.00 per MHz/pop in the metro circles, with prices in Delhi and Mumbai topping EUR 4.00 per MHz/pop, down to EUR 0.05 per MHz/pop in the C circles (see Fig. 3).