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Transaction vs. switching costs—Comparison of three core mechanisms for mobile markets

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ABSTRACT

The fast growth in demand of mobile Internet urges mobile network operators (MNOs) to rapidly increase the wireless network capacity. For this purpose, governments are allocating large parts of the valuable low frequency spectrum to MNOs. This expansion also adds pressure to better optimize the intra-MNO and inter-MNO spectrum usage. Regulators are concerned about problems such as network blackouts, coverage disparities and congestion. Latest technology developments provide new mechanisms to address these problems through two alternative evolution paths, operator-driven and user-driven. The operator-driven path permits operators to trade network capacity and spectrum through, for instance, *national roaming* and *dynamic spectrum access* mechanisms, respectively. On the other hand, the user-driven path enables users (and traffic) to rapidly switch between networks through an *end-user multihoming* mechanism which intensifies retail competition. MNOs are reluctant to adopt these mechanisms if they involve risks. However, regulators can facilitate the deployment of these mechanisms by guiding the level of inter-MNO transaction costs and end-user switching costs. This paper analyzes the market dynamics of these three core mechanisms by employing agent-based modeling. Initial results indicate that each mechanism improves allocative efficiency on a dynamic basis and that such mechanisms become necessary if the current static market model based on vertically integrated MNOs is not able to meet the requirements of service quality, capacity and coverage. One promising use case of the proposed mechanisms is the indoor femto-cellular deployment which suffers from coverage disparity due to static single-MNO base stations. Moreover, either end-user multihoming or national roaming may provide MNOs a feasible business case for building indoor infrastructure by solving coverage disparity problems, by means of competition or cooperation, respectively. Dynamic spectrum access may work as an extension of the previous mechanisms for solving congestion; however, it requires higher technical and business coordination.

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1. Introduction

The mobile Internet market is presently characterized by a rapid traffic growth due to an increase in demand for new services and higher quality. Mobile network operators (MNOs) respond not only by building new infrastructure but also by exploring new mechanisms which improve network and spectrum utilization by matching network supply with user demand. MNOs on the same domestic market could increase their joint utilization level through *national roaming*,[1] *dynamic spectrum access* (DSA),[2] or *end-user multihoming*.[3] The motivation of industry actors, including device vendors, MNOs, and end-users, to choose a certain mechanism depends on the structure of the mobile market and on the level of inter-MNO transaction costs and end-user switching costs. Regulators have an interest and power to guide the evolution of market mechanisms and the related transaction and switching costs.[4]

So far, MNOs have not been active in deploying these new mechanisms because of the risks each one involves. On the other hand, even though the mobile market in many countries is considered competitive, the allocative efficiency may not be optimal yet. Regulators are concerned about problems such as network blackouts, coverage disparities and congestion, which frequently occur in every market. These problems can be understood as market failures, since they prevent assigning network resources to users who value them most. This paper investigates emerging mechanisms having the potential to decrease such market failures.

The economic theory suggests that a scarce resource, such as spectrum or network capacity, achieves its maximum allocative efficiency when the price of the last sold unit equals its marginal costs (Markovits, 1979), and therefore the production represents end-user preferences. To achieve this optimum and respond to the above failures, regulators can stimulate retail competition[5] by decreasing end-user switching costs through e.g., mobile number portability (MNP) or handset unbundling. On the other hand, regulators may favor cooperation[6] between MNOs to improve network coverage and quality through wholesale trading mechanisms, which decrease inter-MNO transaction costs, such as national roaming, infrastructure sharing and mobile virtual network operators (MVNO). Latest standard and technology development include end-user multihoming and dynamic spectrum access as possible future mechanisms of interest.

In the telecommunications field, a number of authors have investigated the relation between competition and cooperation. Markendahl (2011, Chap. 3) analyzes the competition and cooperation mechanisms between MNOs, while Hazlett (2006) studies the dynamics of competing networks with compulsory infrastructure sharing. In general terms, the studies indicate that even though competition is usually favorable, an excessive competition may lower the level of investments, because it lowers retail prices and reduce MNO profits.[7] In practice, a regulator can mandate incumbent MNOs to provide competitors with access to their facilities or encourage facilities-based competition. In any case, legislators regulate the wholesale trading between MNOs to avoid the risk of anti-competitive behavior (i.e. collusion).

The role of wholesale trading and its connection with retail trading is still poorly studied in the mobile market literature. One exception is Cricelli, Grimaldi, and Ghiron (2011), who claim that symmetric reduction of mobile termination rates at wholesale level force MNOs to reduce retail prices. Other interesting analysis was performed by Poyhonen et al. (2007), which compares terminal centric versus network centric strategies for handovers in heterogeneous mobile network deployments. However, this work investigates the technical rather than the market perspective. In other markets, this issue has been more widely addressed, in particular in the electricity and energy markets. A number of authors emphasize the importance of competition at retail level and the role of wholesale trading in the market performance. For instance, Bohi and Palmer (1996) report that while retail competition brings lower electricity prices, wholesale trading may encourage higher investments. Mirza and Bergland (2012) emphasize the role of user prices as a signal for attaining efficiency in energy allocation, while Goulding, Rufin, and Swinand (1999) claim in this same line that a lack of true retail competition results in wholesale prices providing wrong signals. Finally, Polo and Scarpa (2013) suggest that an introduction of a compulsory wholesale market generates retail competition. Even though mobile telecommunications and energy markets are very different, the previous references suggest that further study of mobile market dynamics at wholesale and retail levels, may be especially beneficial for regulators and policymakers.

[1] National Roaming is a service whereby an user equipment (UE) of a given public land mobile network (PLMN) is able to obtain service from another PLMN of the same country, anywhere, or on a regional basis. The availability of National Roaming depends on the home PLMN of the requesting UE and the visited PLMN; it does not depend on subscription arrangements (3GPP TS 22.011 V13.1.0, 2014-09).

[2] Dynamic spectrum access is a general term, which refers to a set of technologies enabling two or more parties to coexist in the same frequency band, either at different time or location. The original concept was introduced by Mitola (2000) with the name of Cognitive Radio (CR), in which users are able to access dynamically the spectrum. Cognitive Radio Systems (CRS) refers to a general framework defined by ITU.

[3] End-user multihoming refers in this context to any mechanism, solution or protocol enabling the user to maintain several concurrent and active subscriptions to different MNOs. For a detailed explanation on multihoming mechanisms, see Suomi (2014).

[4] For the purpose of this study, transaction costs refer to inter-MNO and switching costs refer to end-user.

[5] Competition is herein understood as the effort of two or more parties acting independently to secure the business of a third party by offering the most favorable terms (Merriam-Webster Online dictionary).

[6] Cooperation is understood as similar or complementary coordinated actions taken by firms in interdependent relationships to achieve mutual outcomes or singular outcomes with expected reciprocation over time (Anderson & Narus, 1990).

[7] According to Schumpeter, there is a positive relationship between monopoly power and technological innovation. This conjecture was criticized by Scherer (1967), who introduced the idea of an inverted U-shape relation between competition and innovation. Aghion, Bloom, Blundell, Griffith, and Howitt (2002) formalized this relation.