Telecommunications Policy ▮ (▮▮▮▮) ▮▮▮–▮▮▮

Contents lists available at ScienceDirect

Telecommunications Policy

URL: www.elsevier.com/locate/telpol

# Access regulation and geographic deployment of a new generation infrastructure

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ARTICLE INFO

*Keywords:*
Access regulation
Geographic deployment
Network industries
Telecommunications
Investment

ABSTRACT

This paper addresses the impact of regulatory policy on levels of infrastructure deployment and derived welfare in the telecommunications sector. The model considers two potentially coexisting and partially competing technologies (the "old generation network" – OGN – and the "new" generation network – NGN). This framework allows us to show that the "regulation defining access charge in order to maximize infrastructure deployment" is strictly equivalent to the case in which "no regulation applies". We also derive from the model that these two types of regulation induce higher social welfare, but lower numbers of NGN consumers, compared to the "*ex post* access prices" regulation. Finally, we show that the level of infrastructure deployment (as well as social welfare and number of NGN consumers) will be highest if both investment and access charge decisions are taken by the welfare maximizing regulator. This suggests that the social optimum will be achieved through a calls-for-tender process that includes deployment and access charge requirements.



## 1. Related literature

The impact of sector specific regulation on operators' investment began to be investigated in the early 2000s while the literature on the geographic dimension of NGN deployment is more recent. To our knowledge, Valletti, Hoernig, and Barros (2002), Hoernig (2006) and Foros and Kind (2003) are the main contributions analysing the geographic inequalities related to infrastructure deployment. These works deal with the regulation of retail prices and coverage constraints. The first shows that the effects of regulation policy depend very much on the "basket" of measures decided by the NRA. Valletti et al. (2002) stress that by linking otherwise unrelated geographic areas, "uniform pricing" can lead to lower coverage by the incumbent and the new entrants, while a "minimum coverage constraint" induces higher retail prices. In a "universal service" approach, Foros and Kind (2003) conclude that competition reduces welfare under uniform retail pricing. These authors show that this effect can be offset by fixing "a coverage requirement prior to competition" that solves the co-ordination problem. This requirement corresponds to a wider geographic coverage than that based on a free market. However, these contributions do not deal with the impact of wholesale price regulation (access regulation), which is one of the issues most heavily debated by NRAs and operators around the world.

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http://dx.doi.org/10.1016/j.telpol.2014.01.005
0308-5961 © 2014 Published by Elsevier Ltd.

The literature dealing with access regulation is mostly relatively new and addresses the static and dynamic efficiency of regulation. Lower attention is paid to the issues related to geographic coverage. The literature highlights that while a low access charge may favour competition (and, thus, reduce retail prices) from a static perspective, it may also reduce the incentives to invest in upgrading or deploying new networks. Therefore, dynamic efficiency gains will be reduced. This literature can be interpreted indirectly in relation to geographic coverage, although optimal regulation is not seen as a way to manage geographic deployment of the networks in these models (the thresholds beyond which operators will decide to invest are indeed related to deployment costs). The literature follows two main approaches.[1]

The first deals with *service-based competition* (SBC), where competition depends on the access allowed to competitors and new entrants to the incumbent's network. The question then becomes whether or not the incumbent will have an incentive to invest in improving its infrastructure in the face of the (asymmetric) regulation and thus a trade-off between promoting competition and investment (Foros, 2004; Jorde, Sidak, & Teece, 2000; Kotakorpi, 2006; Pindyck, 2007). This is true except if the access charge is set in order for competition and investment to be complementary (Klumpp & Su, 2010). The other approach deals with *facility-based competition* (FBC) and focuses mainly on the investment incentives of new entrants. In this field, Bourreau and Dogan (2005) show that it can be profitable for incumbents to set a low access charge in order to reduce the entrants' incentives to invest.

Many NRAs, especially in European Union (EU) countries, have adopted the behaviour described by the "ladder of investment" theory (Cave, 2006; Cave & Vogelsang, 2003; De Bijl & Peitz, 2004b). According to this theory, the NRA first sets a low access charge to the incumbent's network in order to stimulate entry and facilitate new entrants in accumulating a critical mass of users. Second, the NRA increases the access charge in order to persuade the new operators to "climb the ladder" of investment by deploying their own infrastructures.[2]

The literature cited above focuses either on the investment made by the incumbent to maintain or upgrade its infrastructure, or on the investment made by entrants to bypass the incumbent's infrastructure. This literature assumes that access regulation is asymmetric in the sense that incumbents are always the access providers, and entrants are always access seekers. While this applies to the OGN market, in the context of NGN's, all operators (whether entrants or incumbents) can invest, and access regulation is inherently more symmetric. Within this framework, Gans (2001), Hori and Mizuno (2006, 2009) and Vareda and Hoernig (2007) propose models inspired by the literature on innovation races (Fudenberg & Tirole, 1985; Katz & Shapiro, 1987). The main question addressed is the impact of access regulation on the timing of investment. Due to the technical process, investment costs are supposed to be lower if the investment is made later. However, delayed investment reduces the total potential profits from the new infrastructure, for the operator. Moreover, firms risk being preceded by a competitor. Therefore, depending on the situation, each firm must decide whether to wait (choosing the investment date that will maximize net profit value) or preempt the market. In this context, the literature shows that the access regulation can incite firms to deploy their networks at socially optimal dates.

The deployment of NGN also raises the issue of the regulator's ability to commit to a policy. For the OGNs the regulators established the rules for access to the existing infrastructures. In the context of NGNs, the regulator is required to set the rules before the investment is made. Brito, Pereira, and Vareda (2010) consider the coexistence of an old and a new infrastructure, and the (in)ability of regulators to commit to a policy (i.e. to decide on access rules before operators invest). They show that, depending on the circumstances, two-part access tariffs or a regulation moratorium can solve the dynamic consistency problem characterizing the trade-off between static and dynamic efficiency in the context of rolling out a NGN. However, they assume that the old network is phased out when the new network is deployed, which does not allow them to study the effects of competition between likely coexisting generations of networks. Also, in their model (and in most of the models referred to above), the investment is a lump sum: all the territory is covered if the investment is profitable, otherwise no investment is made.

A recent stream of literature assesses the interplay between different types of regulatory regime and NGN levels of investment (or geographic deployment). Some of this work is empirical and analyses what happened in Europe and the world more than a decade after the telecommunications liberalization. Belloc, Nicita, and Alessandra Rossi (2012) use a dataset including 30 OECD countries and the period 1995–2010. They show the positive role of "supply-side" and "demand-side" policies. They also conclude that the stimulation of market competition has a positive effect. However, using data from the EU Progress Report and FTTH Council Europe databases Briglauer, Ecker, and Gugler (2012) show that SBC would have a negative impact on NGN investment and that the link between NGNs deployment and competitive pressure from broadband cable and mobile would take an inverted U-shaped relationship.

The theoretical literature on the transition to NGNs addresses three main issues (Bourreau, Cambini, & Hoernig, 2012a): (i) the question of migration from the legacy network to the NGN and how wholesale pricing regulation might affect this process; (ii) the issue of NGN deployment in relation to various (and possibly geographically differentiated) remedies; (iii) the impact of co-investment (risk-sharing) decisions on market outcomes and their relation to access regulation.

[1] For a more detailed literature review, see Guthrie (2006), Gans (2007, chap. 2) and Cambini and Jiang (2009). In particular, Guthrie (2006) points to the need for deeper consideration of the impact of access regulation on investment and welfare.

[2] See Avenali, Matteucci, and Reverberi (2010) and Bourreau and Dogan (2005). The literature on FBC also includes technical discussions on whether the access charges are relevant to make-or-buy decisions (see in particular De Bijl & Peitz, 2004a; Gayle & Weisman, 2007; Mandy, 2008; Sappington, 2005). It concludes that the access charge generally has a significant impact on the decision to bypass the incumbent's infrastructure.

Please cite this article as: Flacher, D., & Jennequin, H. Access regulation and geographic deployment of a new generation infrastructure. *Telecommunications Policy* (2014), http://dx.doi.org/10.1016/j.telpol.2014.01.005