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Facility- and service-based competition and investment in fixed broadband networks: Lessons from a decade of access regulations in the European Union member states

Wolfgang Briglauer ^{a,*}, Klaus Gugler ^b, Adhurim Haxhimusa ^b^a Centre for European Economic Research (ZEW), Mannheim, Germany^b Vienna University of Economics and Business (WU), Research Institute for Regulatory Economics, Vienna, Austria

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ABSTRACT

This paper employs firm-level panel data of 57 incumbent and entrant firms for 23 European countries in the decade from 2003 to 2012. We examine the impact of service- and facility-based competition on firm-level investment as well as the strategic effects underlying infrastructure investment decisions. At the same time we explicitly model the structural dynamics of broadband investment by means of a flexible accelerator model. The empirical specification employs dynamic panel estimation techniques which allow us to account for various sources of endogeneity. We find that facility-based competition exerts a positive and significant impact on both incumbents and entrants implying that incumbents' and entrants' investment decisions are strategic complements. Moreover, we find that intermodal competition in terms of fixed-mobile substitution exerts different effects at the firm level. Finally, we show that service-based competition appears to have no significant impact on the investment decision of incumbents and entrants. However, with respect to the later phase of market liberalization, service-based competition exerts a negative impact on entrants' investment. Our results thus also provide relevant policy guidance on the role of service-based competition in regulating emerging high-speed broadband infrastructure.

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1. Introduction

Following the liberalization of electronic communications markets in 1997/1998, the European Commission (EC) issued several guidelines to introduce competition in those markets by means of mandated wholesale access obligations. Typically, these obligations were asymmetrically imposed on formerly state-owned “incumbent” operators who were deemed to have significant market power related to the possession of monopoly-like legacy infrastructure. In particular, the EC in its Directive 2887/2000 has foreseen mandated wholesale access to the local loop ([European Parliament & Council, 2000](#)) and thus enabled new market operators (“entrants”) to offer retail narrowband voice and broadband services directly to customers. Service-based competition that hinges directly upon a set of pre-defined access regulations and cost-oriented wholesale access charges, in particular, allows the entrant to offer competitive retail services without getting engaged in timely, costly, and risky roll-out of own access network infrastructure, if access obligations are effectively implemented by the national regulatory authorities (NRAs). In the early stages of

* Corresponding author. Tel: +49 (0)621 1235 279; fax: +49 (0)621 1235 170.

E-mail addresses: briglauer@zew.de (W. Briglauer), klaus.gugler@wu.ac.at (K. Gugler), adhurim.haxhimusa@wu.ac.at (A. Haxhimusa).

market liberalization service-based competition massively increased price competition and thus had an immediate and positive welfare effect in terms of static efficiency.

The EC also emphasized in its Directive 2002/19/EC that mandated access should not reduce the incentives of entrants to invest in alternative infrastructure (European Parliament & Council, 2002). The latter, in turn, would be essential to foster competition in the long-run in terms of dynamic efficiency. Moreover, infrastructure- (or facility-) based competition involves a much lower degree of industry micro-management and hence lower administrative costs. However, the EC has never explicitly mandated the entrant to start investing in its own access network after a certain period of time, with a formal requirement to enter facility-based competition. Consequently, the decision to invest in own facilities is up to the entrant contingent, *inter alia*, on regulatory investment conditions. As a result, wireline communications markets are still characterized by two different types of entrants, those who remain service-based competitors, and those who gradually self-deploy network infrastructure and thus also enter facility-based competition becoming at least partly independent network operators. The latter development adheres to the so-called “ladder of investment” (LoI) hypothesis (Cave, 2006; Cave & Vogelsang, 2003). According to this hypothesis, regulatory-induced service-based competition serves as a stepping stone for entrants to engage progressively in backward integration and ultimately to self-deploy access infrastructure.¹ The former, however, still represents by far the predominant group of entrants.²

One of the most controversial questions is which mode of competition is preferable in order to lower prices and to achieve high investment at the same time. This issue becomes even more important in view of the deployment of fiber-based next (or second) generation communications infrastructure; in particular, it is hotly debated whether emerging communications infrastructure should be subjected to a similar set of sector-specific access regulations and whether service-based competition is essential, in a similar way as in the beginning of liberalization of first-generation broadband networks, or if it rather diminishes *ex ante* investment incentives.³ Infrastructure-based operators argue that service-based competition via mandatory access regulations restricts their ability to generate sufficient revenues and would thus be detrimental to *ex ante* investment incentives and network innovations. Conversely, for NRAs and service-based entrants a potential threat of new and possibly more intense monopoly areas arises in the course of the deployment of new fiber-based infrastructure, which entails the need to have again an appropriate access regulation in place.

Utilizing the experience of a decade of regulating first-generation broadband networks, our paper intends to draw lessons from the impact of both modes of competition on investment in fixed broadband markets. In addition, we examine the impact of wireless (“intermodal”) competition from mobile networks on investment activities of fixed broadband operators. In answering this, we employ an unbalanced panel data set of 57 operators from 23 European Union (EU) member states for the years from 2003 to 2012. The period of analysis thus covers the beginning of service-based competition in broadband markets up to the early phase of transition to next generation infrastructure deployment that has been initiated only a few years ago in most EU member states. We therefore exploit information over a whole decade of market liberalization and regulation involving all relevant sources of competition in order to have a sound basis to derive reliable recommendations for future (de-) regulatory policies to be imposed on new communications infrastructure.

Our empirical specification incorporates: (i) generalized methods of moments (GMM) and bias-corrected fixed effects estimators to account for the endogeneity bias due to the dynamic specification of the investment equation, omitted variables and reverse causality patterns; (ii) strategic firm-level effects regarding investment decisions, and finally, (iii) the structural dynamics of adjustment costs in terms of a dynamic investment accelerator model.

The remainder of the paper is organized as follows: Section 2 reviews the related and recent empirical literature. Section 3 outlines our basic hypotheses. Section 4 describes the data set underlying our empirical investigation. Section 5 presents the empirical baseline specification and our identification strategy. Section 6 describes and interprets the main results of the empirical analysis. Section 7 summarizes and compiles important assessments for future regulatory policies.

2. Empirical evidence

In this section we review the most related and recent contributions from the empirical literature. In doing this, we build on the well-cited survey by Cambini and Jiang (2009) who review the older literature on investment and regulation. The authors conclude that the majority of the contributions find that service-based competition in terms of different forms of cost-based access regulations discouraged both incumbents and entrants from investing in fixed networks. In the following we also consider empirical studies that employ measures of broadband penetration which is output-related and hence might provide a better proxy for consumer welfare.

¹ Hence in the U.S. the LoI hypothesis is known as the “stepping stone” hypothesis.

² In principle, there might be a continuum between pure service-based competition and facility-based competition (Guthrie, 2006). However, in broadband/telecommunications markets one has basically observed the following categories of operators during the entire period of market liberalization: (i) incumbent firms that were subject to sector-specific and asymmetric *ex ante* regulations imposed on legacy infrastructure, and (ii) entrant firms either with own access infrastructure, such as cable TV networks (“infrastructure- or facility-based operators”) or without (“service-based operators”) relying on wholesale access obligations.

³ The reader is referred to Telecommunications Policy special issue published in 2013 (Volume 37(10)) which collects controversial papers on the topic “Regulatory approaches and investment in new communications infrastructure”.

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