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Measuring broadband in Europe: Development of a market model and performance index using structural equations modelling

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ABSTRACT

This contribution reports on the development of a performance index and underlying market model with application to broadband developments in the European Union. The Structure–Conduct–Performance paradigm provides the theoretical grounding. Structural equations modelling was applied to determine the statistically significant factors and components in the path model. The data set was derived from public sources combined with a questionnaire completed by the national regulatory authorities. The data collection took place in the period May 2012–December 2012. In this contribution we focus on fixed broadband. The Broadband Performance Index resulting from the analysis consists of: the cumulative broadband uptake (across all technology platforms); the average monthly revenues per user; and the percentage of broadband households with a data rate above 10 Mbit/s on the down link. The most important factor representing firm conduct and the main driver of broadband performance is the level of investment, which is in turn driven by GDP/capita. The factor best representing market structure is a modified Herfindal Hirschman Index (HHI*) capturing the platform-based competition (PSTN, CATV, FttH, and the market shares of access-based competitors). The HHI* is in turn driven by the wholesale price for unbundling and by the degree of urbanization. The resulting performance index values range from 73 to 121, with the EU average set at 100.

1. Introduction

The performance of infrastructure industries, such as energy, telecommunications and transport are important determinants for the level of performance of the economy at large. In this context, the performance of the telecommunications industry – including the Internet – takes a central role as economic and social activities are increasingly electronically mediated and transacted on-line. Therefore, it is important to have available the appropriate measurement instruments and to provide on a regular basis reliable measurement inputs to the policymaking process. These instruments should not only provide a temperature-like reading, but also provide an understanding of the underlying cause(s) of the level of performance. Such understanding is important in the evaluation of policy and regulation.

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This contribution describes the development of an instrument for the monitoring of fixed broadband markets, which is fully data-driven. First a composite index of broadband performance was created. Subsequently, the theory on industrial organization informed the development of a broadband market model aimed at capturing the driving forces behind broadband performance. The statistical technique applied was structural equations modelling. The application thereof is considered novel in the field of telecommunications performance measurement.

Recognizing that this is not the first contribution on the development and application of broadband measurement, the research is positioned in the broader context of broadband policy and of broadband measurements.

This contribution is structured as follows: In Section 2 the policy context for broadband developments is discussed. In Section 3 the literature on broadband performance measurement is reviewed and the objectives for the development of the broadband performance index (BPI) and broadband market model (BMM) are defined. Section 4 provides the theoretical framing of the research. In Section 5 we discuss the definition and measurement of performance, as well as the statistical modelling which was used to arrive at a parsimonious broadband market model. In Section 6 we conclude with the first set of measurement results and the inferences with respect to policy. Furthermore, we identify the topics for future research.

2. Broadband policy context

Depending on the position taken by governments there is a stronger reliance on either market forces or on governmental support in the development of broadband, in particular in the development of ultra-fast broadband. This affects the framing of the research.

In Japan, for instance, the government provided financial support for Fibre to the Home (FttH) deployments in the form of financing support and tax incentives (Jaag, Lutzenberger, & Trinkner, 2009). The Korean government made FttH roll-out a part of its industrial policy (Kushida & Oh, 2006; Oh & Larson, 2011). In Australia, New Zealand and Singapore, there has been significant government intervention, both in the allocation of subsidies for FttX roll-out and in determining the structure and ownership of the companies supplying high speed broadband (see e.g., Beltrán, 2013; Jaag et al., 2009; Van der Wee, Beltrán, & Verbrugge, 2014).

At the other end of the spectrum, in the USA, the Federal Communications Commission (FCC) declared forbearance on unbundling of FttH with the aim to stimulate fibre deployments by incumbent operators (Cornell, 2005; Washburn, 2005). This could be characterized as an extensive reliance on market forces.

In the European Union, the approach towards the broadband market and supply of next generation access (NGA) has been largely market driven complemented with sector specific regulation (Cawley, 2014). The broadband objectives were originally agreed upon by member states as part of the Lisbon Agenda (EC, 2000). These goals were updated with the publication of the Digital Agenda for Europe in 2010 (EC, 2010), which reflects ambitious targets for coverage and take-up of high-speed broadband. The role of the state is limited to providing state aid in accordance with DG Competition Guidelines (EC, 2013) in support of broadband deployments in rural areas. The targets are expected to be realized by a combination of fixed and wireless broadband, the latter in particular in the rural areas.

Whether governments are relying on market forces or on industrial policies in realizing broadband, performance measurements are equally important in evaluating policy effectiveness. However, the drivers of performance are in part different and hence the broadband market models will also be different. As our research is focused on the European Union, our broadband market model is to capture market drivers and the role of sector specific regulation.

3. Measuring broadband performance

The assessment of broadband performance and the development of performance indices have evolved over time and they reflect differences in the underlying purpose of collecting and presenting the data, moreover, they show a wide spectrum in the explanatory variables being used.[3]

The investigations by Chaudhuri and Flamm (2007) are an example of early econometric studies investigating the socio-economic factors in the decision of households to move from dial-up Internet access to subscribe to broadband. This is a typical example of research with one dependent variable (broadband adoption) and multiple independent variables (income, education, gender, demography, etc.).

In arguing that policy makers need a broadband performance indicator that goes beyond the simple ranking of countries on the basis of penetration per capita, Ford et al. (2007) introduced a broadband performance index which indicates whether actual broadband penetration in a country meets, exceeds or fails to meet its expected performance level. Using multivariate regression they calculated how a country performed in translating its economic and demographic endowments into broadband adoption. They used as specification: price; GDP/capita; GINI – income distribution index; education level; age; population density; phone subscriptions; household size; and business size. On the basis of their index they concluded that Korea and Japan were not broadband 'miracles', but like the USA they were 'average performers' in translating their available endowments into broadband lines. In their 2008 paper Ford et al. extended the earlier research by applying stochastic frontier analysis to assess the level of efficiency (Ford, Koutsky, & Spiwak, 2008).

[3] See for an overview of studies Ford, Koutsky, and Spiwak (2007) and for a discussion Cawley (2014).