

INCENTIVES TO INVEST IN THE EU TELECOMS MARKET: LESSONS FROM BROADBAND REGULATION

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INTRODUCTION

This report examines the impact of EU regulation of electronic communications on investment incentives, with specific reference to fixed-line communications. Section 1 briefly describes the regulatory framework for telecommunications in the EU, including its reliance on antitrust tools and network unbundling obligations. Section 2 contains an analysis of the telecommunications sector in the EU. This section reviews the empirical literature on the impact of regulation on incentives to deploy both narrowband and broadband networks in Europe over the past decade. Section 3 examines how developments in the telecommunications sector have led the European Commission to present a proposal for reforming the regulatory framework. Section 4 concludes. We find that wholesale access regulation may have resulted in static efficiency gains in the form of lower prices. However, this regulation has also likely contributed to dynamic efficiency losses in the form of reduced investment in broadband networks, and particularly new high-speed networks.

1. TELECOMS REGULATION IN THE EU

The liberalization of EU electronic communications began in 1998 with the “**First Telecoms Package**” and was later thoroughly revised with the “**Second Telecoms Package**” in 2002, and further amended through a series of regulatory measures that are commonly termed the “**Third Telecoms Package**” in 2009¹. The current set of rules includes the following features:

- **The framework provides a set of rules that apply to all electronic communications services**, including telecommunications and broadcasting. The rules are not supposed to favor any particular technology.

¹ See European Commission (2013), at page 17, Box 1.

- **Since 2002, the framework borrows extensively from EU competition law**, especially for key concepts such as defining the “relevant market” and “significant market power” (SMP)².
- **The framework features a multi-level governance structure that has the following main characteristics:**
 - **EU institutions** define the basic rules, definitions, principles and goals for the framework in a set of directives and related documents³.
 - **The European Commission** defines a list of relevant markets that might warrant *ex ante* regulation in a Recommendation (*i.e.*, a piece of soft law), which is sent to national regulatory authorities (NRAs) and contains a reference list of markets that potentially satisfy the criteria for regulation (the so-called “three criteria test”)⁴.
 - **National Regulatory Authorities** apply these rules in their domestic territories. They perform market analyses, identify operators that have SMP, and select remedies.
 - **NRAs notify the European Commission** of their market analyses, SMP decisions and remedies. The Commission can reject the market analysis and the finding of SMP, but can only “express concerns” about the remedies chosen by the NRA⁵.
- **The framework relies extensively on mandatory network sharing obligations.** Operators designated as having SMP are required to share their networks with competitors at regulated prices: this can occur at various access points in the network.

² SMP is equivalent to the concept of “dominance” applied in antitrust law (Art. 102 of the Treaty on the Functioning of the EU”. However, there are key differences between the application of those concepts in competition law and their application within the framework (e.g., the notion of essential facilities, see Renda 2010).

³ At the EU level, the European Commission has the right of initiative, but Commission proposals are subject to a co-decision procedure that involves the European Parliament and the Council of the EU.

⁴ See Section 1.3 for an explanation.

⁵ This possibility was introduced only in 2009 with the so-called “Third telecoms package”. The European Commission had long sought to extend its *veto* power to the remedies selected by NRAs, but eventually did not achieve this result due to the opposition of Member States.

1.1. Access regulation: economic rationale

One of the main pillars of the EU regulatory framework for telecommunications is wholesale access regulation. In 2012, all EU countries had some form of access regulation for the broadband market. As a consequence, entrant operators may be given **the right to access the incumbent's network** in various ways, such as through Local Loop Unbundling (LLU), bitstream, and resale.

Wholesale access regulation allows alternative operators to enter the broadband market. It is designed to lower entry costs and prevent the incumbent from foreclosing access to the market. Once entry has occurred, retail competition is expected to generate benefits for consumers mostly in the form of a downward pressure on prices (retail margins shrink due to the competitive pressure exerted by new entrants on the incumbent operator). Such competition may also result in higher quality, increased product differentiation and a reduction of the **incumbent's x-inefficiency** (Crandall *et al.*, 2013).⁶

Wholesale access regulation also has some costs as well as benefits. In particular, since wholesale access reduces the expected profits from the network asset, it can **reduce the incumbent operator's incentive to invest in maintaining and upgrading the network** (Jorde et al. 2000). Wholesale access regulation may also reduce the incentives for entrants to invest in their own standalone network, as long as the regulated fee is lower than the investment cost (Pindyck 2007).

The problem with regulation deterring investment has been identified at the EU level (Renda 2013). **The European Commission's Guidance Paper** on the application of Art. 102 of the Treaty on the Functioning of the European Union (i.e. the rule on abuse of dominance) to exclusionary abuses states that:

“The existence of ... an obligation [to supply] — even for a fair remuneration — may undermine undertakings' incentives to invest and innovate and, thereby, possibly harm consumers. The knowledge that they may have a duty to supply against their will may lead dominant undertakings — or undertakings who anticipate that they may become dominant — not to invest, or to invest less, in the activity in question. Also, competitors may be tempted to free ride on investments made by the dominant undertaking instead of

⁶ Originally coined by Harvey Leibenstein in a 1966 paper, **the term “x-inefficiency”** refers to the situation in which a firm, being shielded from competitive pressure (for example, due to monopoly power), does not have incentives to control costs or maximize production, and hence behaves inefficiently.

investing themselves. Neither of these consequences would, in the long run, be in the interest of consumers.”⁷

However, this finding has not generally been applied to the regulation of the telecommunications sector. The EU has, instead, relied on mandatory wholesale access at various points in the fixed line network. This regulation has tended to undermine investment incentives for both existing and new networks.

Under wholesale access regulation, new entrants hold a risk-free option. Once new operators are established in the market and demand conditions are known, they can decide whether to invest in additional elements of the infrastructure. In contrast, the incumbent had to invest without possessing this information (Valletti 2003). Such an uneven distribution of risks can increase the cost of capital for the incumbent compared to what would have occurred in the absence of access regulation (Jorde et al. 2000; Katz 2013).

A particularly challenging issue under access regulation is the determination of the access fee level. Lower access prices may increase competition for some aspects of service in the short term, but they also reduce incentives for investment; higher access prices will limit static efficiency gains (Grajek and Roeller 2012).

Regulators have generally opted for using cost-based models that often do not adequately account for the full opportunity costs to the incumbent. Such models may not provide the appropriate economic signals for encouraging new entrants to invest. Cave (2010) notes that persuading a competing provider to invest requires that **“the access price must cover both the competitor’s cost of supply and the value of the option that the investment would destroy. If the option is not priced in the access charge the competitor’s incentives will be distorted against investment.”**

The issue of risky investment has recently resurfaced in the debate over the efficient price for access to next generation access networks (i.e. ultra-fast packet-based broadband networks). The idea of adding a risk premium to the usual formula for access pricing to remunerate investment in high-speed networks was suggested by the European Commission in its 2010 Next Generation Access (NGA) recommendation⁸. However, as will be shown below, available data suggest that Europe is lagging behind in terms of investment in NGA networks.

⁷ See Communication from the Commission: Guidance on its enforcement priorities in applying Article 82 of the EC Treaty to abusive exclusionary conduct by dominant undertakings.

⁸ See Commission Recommendation on regulated access to Next Generation Access Networks (NGA), 2010/572/EU, 20.9.2010.

Applying wholesale access regulation to an existing network may yield different economic results than if such regulation were applied to new networks. Owners of an existing network may reduce investments in maintenance or quality improvements when they are regulated. In contrast, potential investors in a new ultra-fast broadband network might not build that network at all if they anticipate they will be forced to share the network with rivals at regulated prices⁹.

In summary, the economic literature suggests that wholesale access regulation may promote static efficiency gains for consumers through lower prices; however, this regulatory approach can undermine investment incentives, especially for networks that have not yet been built.

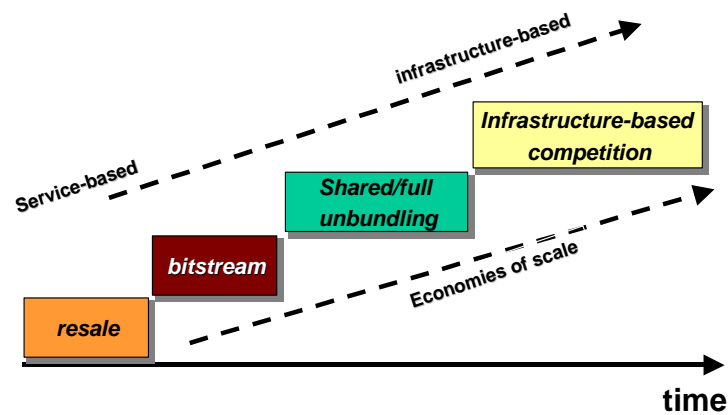
1.2. The “ladder of investment” model

EU regulators opted for wholesale access regulation of the telecommunications market based on the “Ladder of Investment” model, as developed by Cave (2006). The model is aimed at encouraging new entrants to move toward full-blown facility-based competition without having to incur significant upfront investment¹⁰.

The investment ladder approach became the dominant regulatory model adopted by NRAs in regulating wholesale fixed-line telecommunications markets (see figure 1 below for an example of the ladder of investment).

⁹ Devising an optimal access policy, including the optimal access fee level, for NGN is also complicated by the interplay with existing access policies on legacy networks. The European association of alternative operators (ECTA) and the European incumbents’ association (ETNO), have fiercely debated this point over the past two years. The European Commission has recently endorsed the need to “promote competition and enhance investments in high-speed networks by providing long-term stability of copper access prices”. See Connected Continent proposal, COM(2013) 627 final.

¹⁰ This approach was preceded by the “stepping stones” approach adopted in the US during the 1990s. See Farrell, J. (1997).



Source: ERG (2005)

The ladder of investment model has been subject to extensive research from a theoretical and empirical perspective. To make the ladder approach effective, national regulators are supposed to follow several steps¹¹, including:

- (1) Determine which network elements are clearly non-replicable;
- (2) Rank network elements according to whether they are replicable;
- (3) Locate entrants on the ladder;
- (4) Determine how, and how fast, entrants should climb the ladder¹²;
- (5) Choose the particular form of intervention. This means that intervention can take place **“either based upon rising access prices (relative to costs), subject to a short transition period where necessary, or upon the projected withdrawal of mandatory access”**¹³;
- (6) Specify a date on which mandatory access ceases; and
- (7) Make a credible commitment to the policy.

The ladder of investment approach has been subject to several critiques. Oldale and Padilla (2004) point out that the ladder of investment requires regulators to have the information, time and competence to govern the transition from service- to facilities-based competition¹⁴. Bourreau et al. (2010) note that, for

¹¹ Cave (2005).

¹² The ERG (05)23 clarifies what could happen if rungs are too close, or too distant.

¹³ See Cave (2007).

¹⁴ Facilities-based competition occurs whenever at least some of operators competing in the market possess their own network, and thus do not rely on another operator’s network.

the ladder of investment to work, it is necessary for short-term service-based profits to be constrained by the regulator. This can be done by including sunset clauses in access regulation or by increasing access prices.

As will be shown in Section 2, the empirical evidence with respect to ladder of investment is not encouraging, as regulators have often been unable to create a regulatory environment that encourages substantial investment by new entrants. Cross-country analysis typically confirms that entrants do not climb the ladder. Only in a few countries, such as France and Spain, are there signs of a movement toward higher steps on the ladder (e.g. Hausman and Sidak 2005; Distaso, Lupi and Manenti 2009); in some cases, entrants have actually descended the ladder (Crandall *et al.* 2013; Renda *et al.* 2013).

One additional challenge for regulators is that the structure of the ladder varies not only based on market features, but also on network technology. In particular, access points and conditions of replicability change dramatically from copper to all-IP networks¹⁵.

1.3. The list of relevant markets and the “three criteria test”

A necessary precondition of regulation in the EU Member States is the definition, by a national regulator, of a relevant product and geographic market in which there is at least one player with significant market power. In order to facilitate the work of the NRAs, the European Commission published lists of pre-selected relevant markets¹⁶. These are markets that, in the opinion of the Commission, might warrant *ex ante* regulation since they potentially meet three basic criteria (described in the 2003 and 2007 Recommendations on relevant markets). The criteria for identifying these markets include:

- (i) The presence of high and non-transitory barriers to entry;
- (ii) A market structure that does not tend toward effective competition within the relevant time horizon; and
- (iii) The insufficiency of competition law alone to adequately address the market failure(s) concerned.

NRAs are free to define relevant markets that differ from the ones included in the list. If they do so, they bear the burden of proving that the three criteria are

¹⁵ IP stands for Internet Protocol.

¹⁶ See suggestions by the ECORYS study (2013), which proposes to further reduce the list to four relevant markets.

met for these newly defined markets. In practice, NRAs have been reluctant to deviate from the list. In addition, the need to secure some consistency in the **application of the framework has led the Commission to often reject NRAs'** proposals to define relevant markets that are different from the ones included in the list.

2. INVESTMENT IN TELECOMMUNICATIONS AND THE IMPACT OF REGULATION

This section examines recent data describing the EU telecommunications sector, fixed broadband penetration, deployment and uptake. Section 2.1 identifies key market variables, including available data on investment in high-speed and ultra-fast broadband in various countries. Section 2.2 reviews the literature on the impact of access regulation on investment in both narrowband and broadband telecommunications infrastructure. Section 2.3 briefly concludes by summarizing our main findings.

2.1. The EU telecoms market: an overview

This section describes the most important market variables for broadband, including ultra-fast broadband, that can be delivered by next generation networks (NGNs). After a description of key statistics, such as penetration, concentration, retail prices and wholesale prices, we provide data showing a decline in revenues and a relatively low level of investment in high speed broadband in the EU.

2.1.1. The EU has similar levels of basic broadband penetration and uptake compared to the US, Canada and Japan

The EU single market serves about 500 million consumers. In terms of population, the EU is larger than the US (316 million) and Japan (127 million) **combined. In terms of GDP, the EU's \$16 trillion is comparable with the US and exceeds Japan by a factor of three.** In terms of penetration of basic broadband connections, the EU is on par with its international competitors, such as the US, Canada and Japan. However, there are differences in how broadband is measured across countries. The EU counts broadband connections for all service exceeding 144 Kbps, while in the US the FCC has recently revised the minimum speed upwards to 768 Kbps¹⁷. Yoo (2013) reports that at the end of 2012 the level of basic broadband coverage in the EU (exceeding 144 Mbps)

¹⁷ The OECD considers 256Kbps as the minimum threshold.

reached 99.4% of the territory, with the US exceeding 99.7% in services faster than 768 Mbps.

Also the percentage of the population subscribing to broadband is similar across Europe, Canada, the US and Japan. The number of broadband subscriptions in the EU is currently 28 per 100 inhabitants, slightly higher than the OECD average (25) and the US and Japan (27 subscriptions).¹⁸

2.1.2. The EU is lagging behind in fast and ultra-fast broadband (both fixed and mobile)

Compared with the results achieved in basic broadband, Europe is behind other regions in providing coverage for fast and ultra-fast broadband¹⁹. Yoo (2013) reports that fiber-to-the-premises (FTTP) coverage in the US had reached 23.3% of households, roughly double that of Europe (12.3%).²⁰ Ultra-fast cable (DOCSIS 3.0) covered 81.9% of households in the US compared to 39.3% of households in Europe. In Canada, the recent Communications Monitoring Report of the CRTC shows that fast broadband (at least 30 Mbps) was available in 2012 to 78% of households; whereas ultra-fast broadband (> 100 Mbps) was available to 32% of households²¹.

In terms of speed, Akamai (2Q 2013) shows that only two EU countries (the Netherlands and the Czech Republic, which can count on a significant presence of cable) feature a percentage of connections with speed above 4Mbps comparable to that of Canada. Only 5 of the 28 Member States had average connection speeds higher than those of Canada (The Netherlands, the Czech Republic, Sweden, the UK and Belgium)²².

¹⁸ OECD data are preferred as they ensure international comparability. However, not all EU member states are also member of the OECD. Hence, EU coverage of OECD data is limited between 19 and 21 member states (depending on the reference year); it is to be noted that the largest member states are all covered. More precisely, EU19 includes Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Poland, Portugal, Spain, Sweden, and United Kingdom; EU20 includes EU19 and the Slovak Republic; and EU21 includes EU20 and Slovenia.

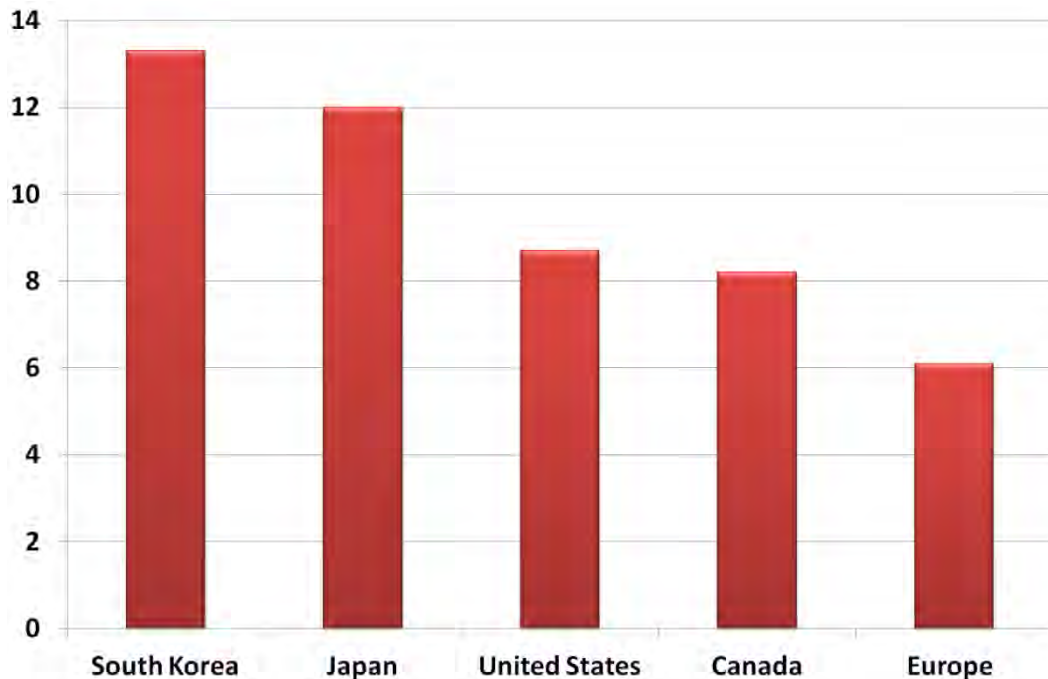
¹⁹ Fast broadband represents fixed-line network technologies capable of delivering broadband at a downstream speed of at least 30 Mbps. Ultra-fast broadband represents fixed-line network technologies capable of delivering broadband at a downstream speed of at least 100 Mbps.

²⁰ **With ‘coverage’, we intend the number of homes passed by an infrastructure.**

²¹ See <http://www.crtc.gc.ca/eng/publications/reports/policymonitoring/2013/cmr6.htm>, table 6.1.4.

²² Canada features a vast territory and a much lower population density compared with countries like South Korea, Japan, and also the Netherlands and the Czech Republic.

Figure 2 – Average delivered broadband speed (Mbps), 2013



Source: Akamai State of the Internet 2Q 2013 (figure for Europe from Bernstein research)²³

Overall, European countries – and in particular, Western European countries – seem to rely extensively on DSL and, increasingly, VDSL as broadband technologies²⁴. The relative coverage of FTTx connections is very low and (mostly for historical reasons) also cable infrastructure is relatively under-developed.

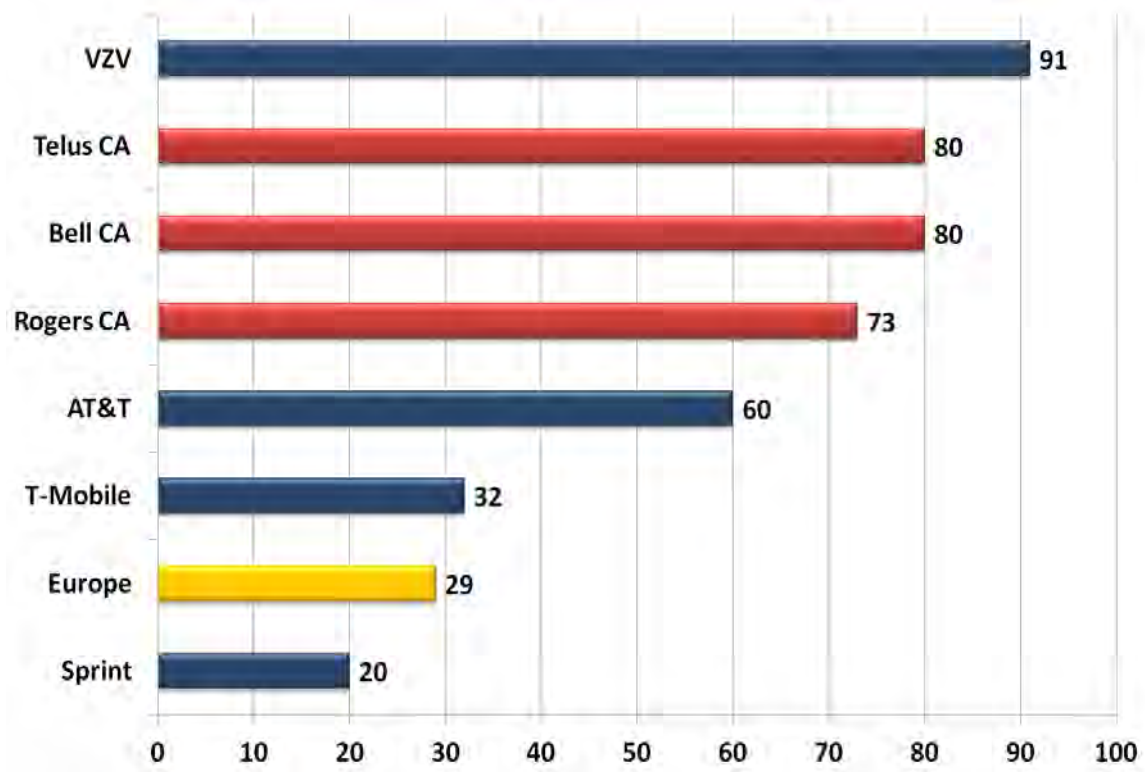
The data from wireless broadband reveal a similar picture for Europe relative to major regions, with Europe lagging behind. Figure 3 shows that coverage with 4G in Europe is significantly lower than that provided by individual operators in the United States, such as Verizon Wireless and AT&T; and also lower than that provided by the three main Canadian wireless operators, Telus, Bell Canada and Rogers. Overall, Yoo (2013) reports that at year-end 2012 LTE coverage was available for 85.6% of US households against 27% of European households. In Canada in 2012, CRTC (2013) reports that HSPA+ coverage was available for 99% of households, and LTE coverage for 72% of households²⁵.

²³ See also <https://www.rtr.at/en/komp/SchriftenreiheNr12013/Band1-2013.pdf>

²⁴ Very-high-bit-rate digital subscriber line (VDSL) is a digital subscriber line (DSL) technology providing data transmission faster than ADSL over a single flat untwisted or twisted pair of copper wires, and on coaxial cable.

²⁵ LTE (long term evolution) technology is a standard for fourth generation (4G) wireless communications. It is an evolution of the GSM/UMTS standards that supports HD video

Figure 3 – LTE population coverage



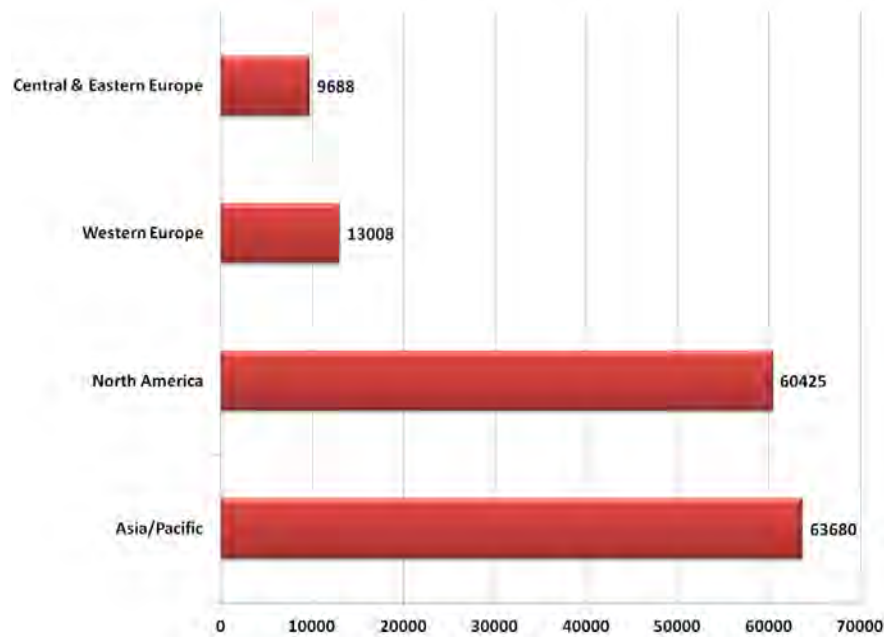
Source: Sanford C. Bernstein, based on company reports, Eurostat, US Census Bureau & Bernstein Analysis. Data for Canadian companies are derived from their websites. The figure for Rogers is an estimate contained in their [Q3 report for 2013](#).

In terms of total LTE subscriptions, Europe seems to lag behind other regions of the world. As shown in Figure 4, North America and Asia/Pacific have higher numbers of subscriptions²⁶.

streaming, download speed as high as 299.6Mbps. HSPA+ is 4G technology that allows download at slower rates than LTE (up to 168Mbps).

²⁶ While these numbers represent totals, we think a comparable picture would emerge if one were to convert to percentages.

Figure 4 – LTE subscriptions (thousands)



Source: IDATE DigiWorld 2013

2.1.3. EU broadband markets: concentration and fragmentation

The reliance on access policy and the ladder of investment has gradually led to a significant entry of new operators in Europe. Europe features several hundred telecommunications operators, many of which hold a very small share of their national market. At the same time, despite the outstanding number of operators in the region, the market share held by incumbents is on average still relatively high: the leading operators, which usually correspond to the former telephone monopolist company, control 42% of the broadband market on average across the member states.

The market in NGN services is distinctly different from the market for general broadband in the EU in terms of who provides this service. Given the very low level of investment in NGNs by incumbent players, entrants today provide about 78% of the ultra-fast access lines. These include cable operators, alternative operators and municipalities that invest in the NGN infrastructure (ITRE 2013). Overall, however, the amount of investment is very low.

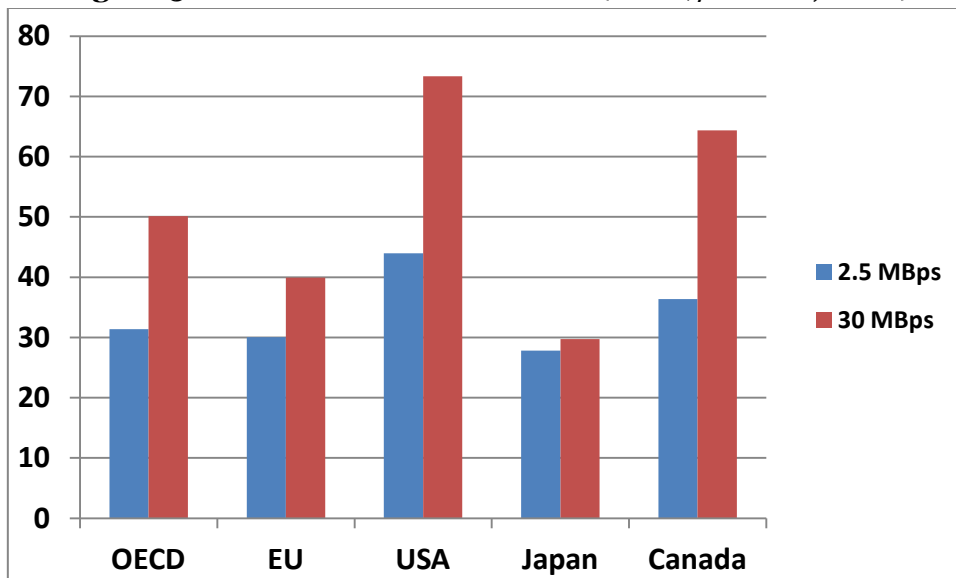
In summary, the wire line broadband markets in the EU are characterized by very little competition between alternative infrastructures. The regulatory policy has resulted in many firms competing for retail customers within the same network structure. This means that the share of traffic that relies on the **incumbent's network (either directly or through wholesale interconnection)** is

still considerable. The NGN market is still in its infancy, and incumbents have generally not been major players.

2.1.4. Declining wholesale and retail prices

The EU's attention to static efficiency and short-term consumer welfare is reflected in lower retail prices compared with many of its peers. Figure 5 shows that average EU broadband prices are below the OECD average for low-speed and high-speed broadband services in 2012. US prices are substantially higher than those in the EU, while Canada is between the US and the EU. At the same time, Japanese customers enjoy average prices that are substantially lower than those offered in the EU. For a 30 Mbps connection the price gap between the EU and Japan is roughly \$10 per month²⁷.

Figure 5 – Broadband Retail Prices (PPP \$/month, 2012)

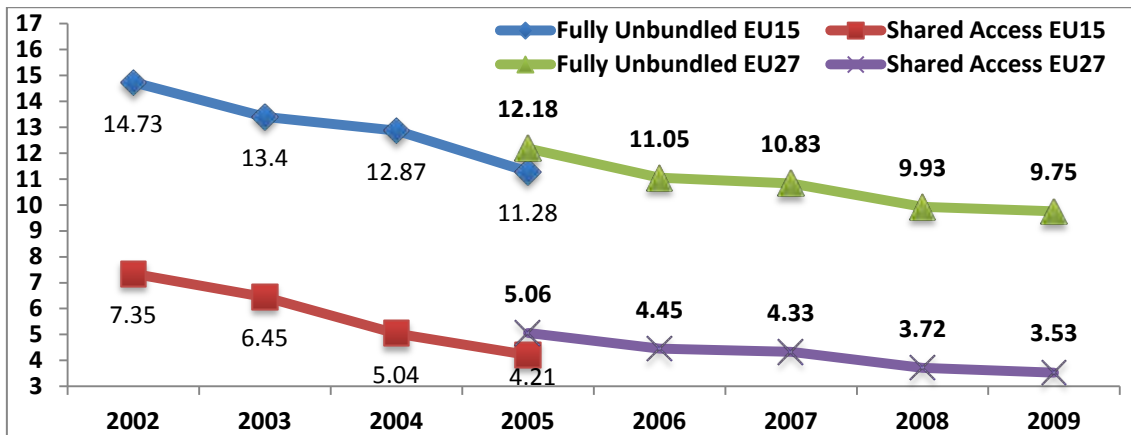


Source: OECD (2013). Note: EU21

Figure 6 shows the wholesale prices in the EU in nominal terms between 2002 and 2009. There has been a steadily declining regulated wholesale price, for both fully unbundled and shared access lines.

²⁷ A full assessment of differences in broadband provision across regions would not only examine price differences, but also would look at differences in quantity and quality of the product.

Figure 6 – Wholesale Access Prices (2002-2009)



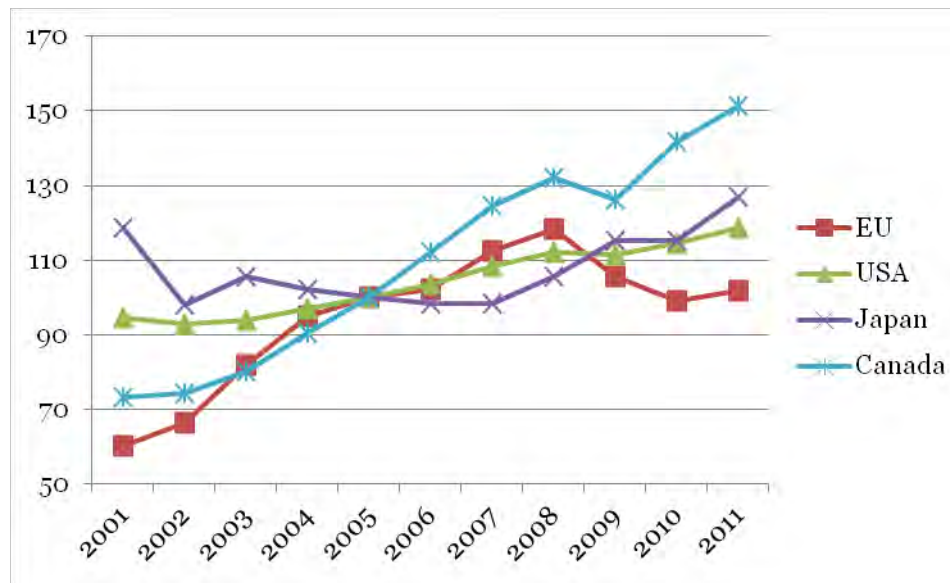
Source: Pelkmans & Luchetta (2012). Note: EU15 includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom. EU27 excludes Croatia.

The fall in wholesale prices, which is associated with access regulation, has contributed to the overall decrease in the revenues of telecommunications companies in Europe. This, in turn, can help explain why European telecommunications operators have not managed to sustain high levels of investment in broadband infrastructure.

2.1.5. Declining revenues and investment

The relatively low price levels observed in many EU countries are consistent with our description of a region in which access policy has gradually led to the erosion of profit margins of incumbents, coupled with an uncertain investment climate. Not surprisingly, then, the decline in wholesale and retail prices has been accompanied by a steady fall in revenues and investment. Revenues of the telecommunications firms (Figure 7) increased substantially in the period 2001-2008 in the EU, but declined in subsequent years. In contrast, revenues in the OECD and the US have generally continued to increase over time.

Figure 7 – Telecommunications Revenues (2001-2011; 2005=100)

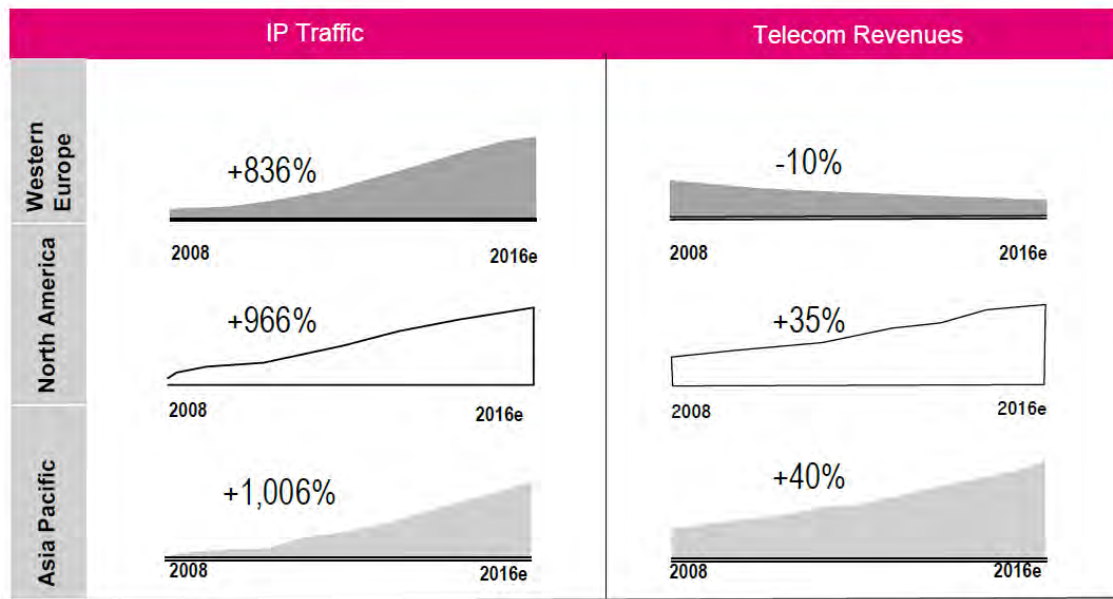


Source: OECD (2013). Note: EU20 for 2001-2004; EU21 for 2005-2011.

Prospects for revenue growth by EU companies are relatively poor in comparison with other regions. Figure 8, based on European Commission estimates, suggest that the EU revenues are expected to decline by 10% between 2008 and 2016, while revenues in North America and the Asia-Pacific region are expected to increase substantially, in the order of 35-40%. This as IP traffic is expected to increase dramatically in all three regions.

McKinsey (2013) reports that average revenues from fixed-line subscribers in Europe have fallen from the equivalent of USD51/month per subscriber in 2008 to USD46/month in 2011, a fall of 3 percent a year. Annual revenues have declined by approximately US\$15 billion for the fixed industry since 2008. In contrast, US fixed-line prices increased by 3 percent a year in the same period.

Figure 8 – Growth of IP Traffic and telecommunications Revenues (2008-2016)



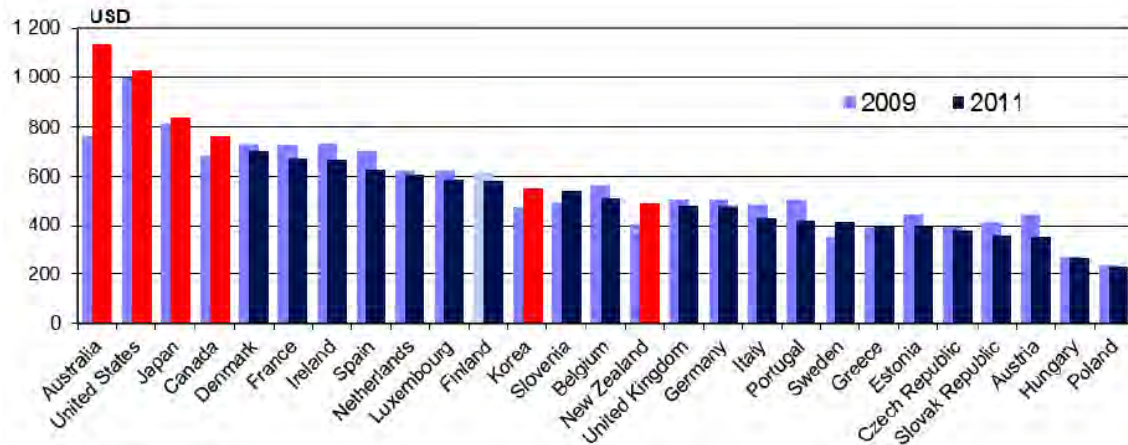
Source: European Commission.²⁸

The same trend emerges when examining revenues per “communications access path,” which typically corresponds to revenues per subscription or per fixed line²⁹. Figure 9 below – based on OECD data – shows that per capita revenues in Australia, the US, Canada and Japan, were above those in most EU markets in 2011.

²⁸ ‘Commission adopts regulatory proposals for a Connected Continent’, European Commission Press Release, MEMO/13/779, 11/09/2013, available at: http://europa.eu/rapid/press-release_MEMO-13-779_en.htm (last accessed on January, 2014).

²⁹ In OECD broadband statistics, access path include analogue + ISDN, DSL, cable modem, fiber and mobile subscriptions.

Figure 9 – Revenues per communication access path, 2011



Source: OECD (2013)

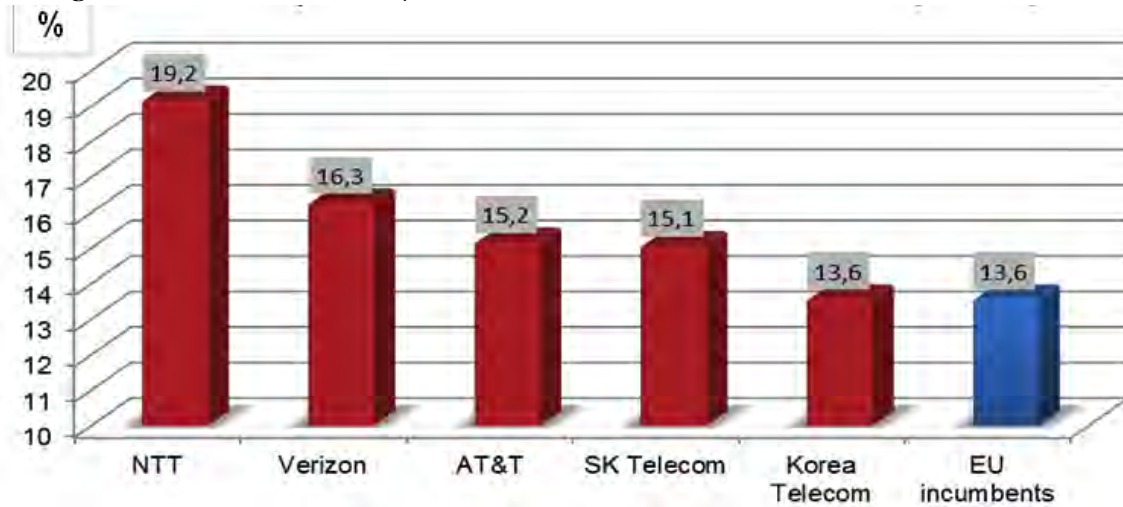
Comparatively low and declining revenues may make it more difficult to justify investment in next generation networks. If one assumes that the ratio of capital expenditures to revenues remains at its historic average of 10-15%, this could impose a constraint on investment in the EU.

McKinsey (2013) reports that the EBITDA (earnings before interest, taxes, depreciation, and amortization) margins of fixed-line operators in Europe fell by 4% a year between 2005 and 2011, which translates into 5 to 7 billion Euros of foregone profits a year. From 2005 to 2009, Europe invested, on average, US\$141 per head in telecommunications, while the United States and Canada, in contrast, invested US\$212 and US\$230 per head, respectively. This implies a telecommunications investment “gap” between Europe and the United States of around US\$100 billion over those five years.

Recent figures from IDATE (2013) suggest that the investment gap is widening: in the period 2011-2012 the overall sector’s CAPEX growth in the EU was negative (-0.2%), compared with strong growth in the US (+6.7%) and Japan (+7.5%). Yoo (2013) reports that in 2011 the estimated per capita investment in telecommunications was USD108 in Europe and USD211 in the US.

Figure 10 below provides another perspective on why EU policy makers are concerned about investment. The figure shows that EU incumbents are not investing as much as operators in other countries per unit of sales for the period 2006-2012.

Figure 10 – Domestic CAPEX/Sales of EU incumbents vs. International (2006-2012)

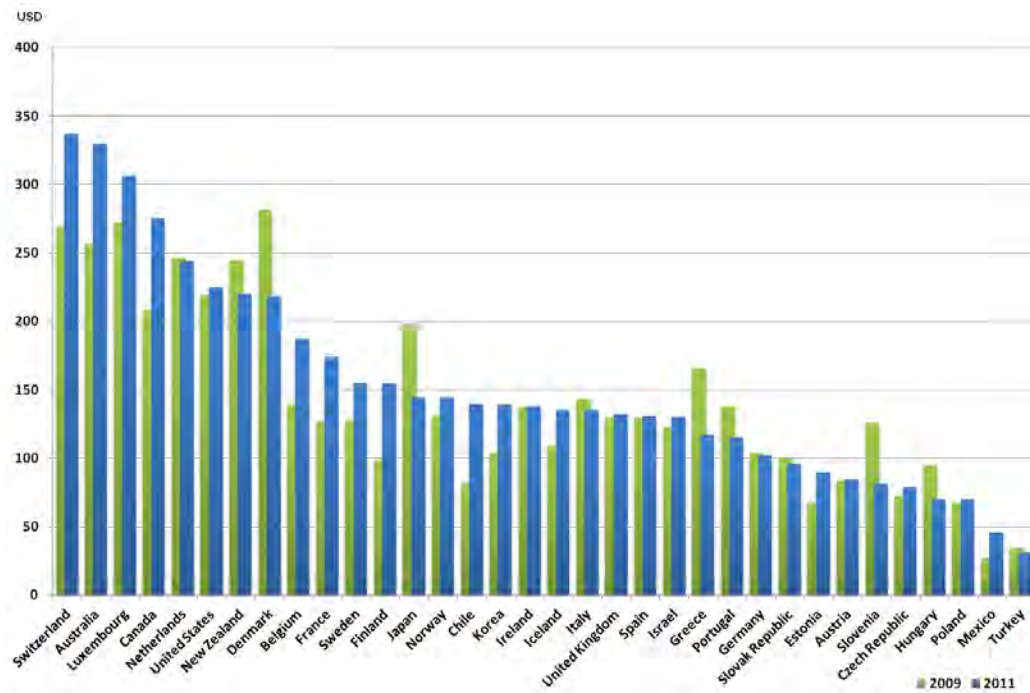


Source: HSBC

OECD (2013) reports country data on *per capita* investment in telecommunications infrastructure in 2009 and 2011 (figure 11 below). The figure shows that some EU countries such as Luxembourg (due to its very high population density and average income), Netherlands, Denmark and Belgium (the EU countries in which there is a strong presence of cable in addition to copper networks) investment levels match those of the US and Canada. In other EU countries, per capita investment is much lower³⁰.

³⁰ It must also be recalled that both US and Canada are much larger territories: comparing the Netherlands with the whole US is thus misleading. Rather, as observed in Renda (2013), it would make sense to compare, say, California or Massachusetts with Germany or the Netherlands.

Figure 11 - Public telecommunications investment per capita, USD



Source: OECD Communications Outlook 2013, Figure 3.10

2.2. The effect of regulation on investment: a literature review

A large empirical literature discusses the economic effects of telecommunications access regulation. Access regulation is typically measured by access to the local loop or some other point in the network. Two variables are typically examined to assess the economic impact of a regulation: network investment and broadband penetration. The economic literature, and especially the more recent literature, strongly supports the hypothesis that access regulation does not promote, and may hamper, telecommunications investment and broadband penetration.³¹

This section provides a general overview of the literature. We briefly review early scholarly papers that have attempted to measure the impact of regulatory regimes on the level of investment in the telecommunications sector. We then review a number of recent contributions to the literature.

³¹Broadband penetration is the most commonly used dependent variable for two reasons. A **theoretical reason is that access regulation by definition reduces new entrants' investment**, and it may do so by cutting inefficient duplicative investment, and compensates for it with **higher consumer's welfare (Crandall et al. 2013)**. A practical reason is that investment data series which are i) comparable across countries; and ii) specific for broadband infrastructure deployment are almost inexistent.

2.2.1. The early literature (2006-2010)

The lesson from the early literature is that wholesale access regulation, using different measures of *intra*-platform competition, does not clearly lead to higher levels of broadband penetration.

Among the most important early papers, Distaso *et al.* (2006) find that inter-platform competition is a driver of broadband penetration, while intra-platform competition does not have a significant effect. Denni and Gruber (2007), along similar lines, observe that inter-platform competition is more important than intra-platform competition in explaining broadband penetration. At the same time, LLU has a significant and negative effect. Similar results are obtained by Hoeffler (2008). Friederiszick *et al.* (2008) use the investment on new fixed telecommunications lines as dependent variables, and find a negative correlation with LLU.

Wallsten (2006) shows more mixed effects: while LLU technical measures have a significant positive effect on broadband penetration, regulated LLU charges have the opposite effect. Wallsten and Hausladen (2009) study the relationship between LLU and bitstream and the rollout of fiber infrastructure. They find a negative and significant relationship between these two variables.

At least two papers find a positive correlation between LLU and broadband penetration: Garcia-Murillo (2005) and Gruber and Koutroumpis (2011). The latter estimate a positive correlation across 167 countries, hence the sample is not limited to the OECD peers; however, this effect plays a role only in the first years of broadband deployment. Earlier work by de Ridder (2006) finds a positive correlation between LLU and broadband penetration; however, a later refinement to the model by Boyle *et al.* (2008) yielded a negative correlation.

These early works suggest that inter-platform competition has more of an effect on penetration than intra-platform competition does.

2.2.2. Recent empirical work

More recent empirical work in the last two years does not alter the basic conclusions from earlier research. This work has explored other ways of studying the impact of access regulation, such as measuring the impacts of wholesale access regulation on NGN.

Bouckaert *et al.* (2010) distinguish between three modes of competition: i) inter-platform, ii) intra-platform facilities-based through full or shared ULL, and iii) intra-platform service-based through bitstream and resale. They find that inter-platform competition has a positive and significant effect on

broadband penetration, full and shared LLU have no significant effects, while service-based intra-platform competition has a negative and significant effect.

Cincera *et al.* (2012) published a working paper to refine Bouckaert *et al.*'s (2010) model using different proxies to measure the different modes of competition. They find that, unlike Bouckaert *et al.*, platform-based intra-service competition has a significant and positive effect to broadband penetration. It is, however, not possible to disentangle whether this different result is due to the different definitions of the independent variables, or to other technical differences of the model.

Briglauer *et al.* (2013) differs from previous study as they try to investigate the impact of access regulation on investment in NGN. Their results suggest that the number of wholesale lines in an incumbent's network has a significant and negative effect on the deployment of NGN; in contrast, inter-platform competition, measured as fixed-to-mobile substitution, availability of legacy technologies and cable penetration, have a positive and significant effect.

Grajek and Roeller (2012) perform an empirical analysis on a comprehensive data set covering 180 fixed-line and mobile operators in 25 European countries over 10 years using a new measure of regulatory intensity³². They explore the relationship between regulation and investment and find that wholesale access regulation reduces incentives for the regulated firm and for entrants to invest.

Finally, a very interesting paper was published by **Nardotto *et al.*** in 2012. It may shed new light on the relationship between access regulation and broadband penetration because it is based on a uniquely disaggregated dataset release by the British telecommunications regulator. The dataset includes **information on the incumbents' and entrants' lines at the local** exchange level, for four years across the entire United Kingdom. For each local exchange, the authors could observe the number of premises connected to the telephone network, the number of premises covered by the cable network, the number of actual subscribers to the incumbent, to the cable operator, and the number of subscribers served by each entrant through LLU. This dataset is complemented with information on the quality of broadband services, proxied by downlink and uplink speed, and with information on demographic characteristics. Nardotto and his coauthors find that the number of LLU lines has a significant negative impact on broadband penetration, but it increases average speed. LLU lines also

³² The regulatory intensity indicator for the fixed-line segment refers to the existence of regulated vertical separation and an accounting separation obligation, as well as the existence of regulation regarding the full unbundling, line sharing, bitstream access and subloop unbundling of the fixed-line incumbent's local loop.

have a negative and significant impact over other form of competition, such as bitstream and resale. These results remain consistent across different specifications.

Our review of the literature leads us to three conclusions: First, for legacy copper networks, access regulation seems to have produced mixed results; second, reliance on access regulation seems to have had a negative impact on investment in new broadband networks; and third, based on available data and the most recent empirical literature, it is reasonable to conclude that access policy has not sufficiently encouraged investments in alternative infrastructure in Europe.

3. THE INVESTMENT SHORTFALL IN THE EU: A REVIEW OF PROPOSED REMEDIES

Access policy has been a key feature of EU telecoms policy since 1998. There are strong signs, however, that the regulatory environment in the EU will likely change. Key decision makers and institutions are calling for a wide range of regulatory reforms, many of which are aimed at stimulating investment in high-speed Internet. Here, we review some of the evidence that change may occur and some of the proposed policy changes. These policy changes could include subsidies for high-speed broadband, actions aimed at cutting red tape for operators wishing to operate across Member States, slight amendments to the regulatory framework, and also a new proposal on net neutrality that leaves **room for “specialized services” (i.e., Internet services with guaranteed quality of service)**.

In 2013, the European Commission acknowledged that the regulatory framework in place needs to be changed if Europe is to achieve a significant level of broadband investment in the future. Commenting on the general state of European broadband investment, a memo issued by the European Commission on August 30, 2013, stated:

“...Europe is losing the global race to build fast fixed broadband connections. Concretely: telecoms companies are under-performing, other businesses are losing competitiveness and frustrated consumers are stuck in the internet slow lane...Given the long pay-back times for investment in fast broadband (20-30 years) the Commission believes more predictable revenue streams for network owners and predictable prices for access seekers will spur investments in further high-speed networks. Such incentives are necessary if the EU is to reach its targets to get fast broadband to all citizens and business by 2020”.³³

In another recent speech, the Vice-President of the European Commission, Neelie Kroes has gone so far as to admit that “We've gone from leader to follower in mobile and we've got a broadband investment problem”³⁴.

Two weeks later, in presenting the new “Connected Continent” package on September 11, 2013, Kroes observed that

³³ European Commission Memo, Regulatory mess hurting broadband investment: consumers and business stuck in the slow lane, 30 August 2013.

³⁴ See *Kroes prepares push to revive telecoms reform*; European Voice, 13 June 2013.

“If you combine Japan, South Korea and the USA it is the same population as Europe. But they have over 8 times more fixed fibre broadband, and almost 15 times more 4G. And the gap is growing. ... Current trends are unsustainable for the sector, and unsustainable for our whole economy. Without the infrastructure to compete, we aren't going anywhere – in any sector. We hurt consumers, we hurt the economy, we hurt our strategic future if we do not act”³⁵.

The European Commission has analyzed the current state of the EU telecoms sector as follows:

“There has been massive growth in demand (especially data), however, since last reform of EU telecoms rules, ... this growth has not been monetized. Revenue is declining in real terms (-2.2% in 2011 and -1.1% in 2012) and relative to US & Asian & other markets. Market capitalization is down 22% since 2011. Moreover, Europe's former telecoms monopolies have a net investment rate of virtually zero, lagging behind competitors (source: HSBC). Wireless investment is half the rate of US/Canada since 2002.”³⁶

This sense of urgency has led the European Commission and some Member States to propose a number of reforms of the existing regulatory framework, which are aimed at encouraging investment in fixed and mobile broadband infrastructure. For example, in 2010 the Commission proposed to increase **wholesale access prices in order to account for a “risk premium”** associated with investment in NGNs³⁷. In the UK, the regulator Ofcom decided not to impose upon the incumbent the obligation to offer virtual access at cost oriented prices, provided that prices are fair and non-discriminatory³⁸. This has reportedly led to good outcomes in terms of accelerating fiber deployment in the UK³⁹.

More recently, the European Commission presented a proposed reform of the **regulatory framework (the “Connected Continent” proposal)** that places more emphasis on stimulating investments in high-speed broadband infrastructure.

³⁵ See Neelie Kroes, *We must act now – time for a Connected Continent*, SPEECH/13/693 12/09/2013.

³⁶ http://europa.eu/rapid/press-release_MEMO-13-779_en.htm.

³⁷ Commission Recommendation on regulated access to Next Generation Access Networks (NGA), 2010/572/EU, 20.9.2010.

³⁸ See *i.a.* Ofcom's review of the wholesale broadband access market, http://stakeholders.ofcom.org.uk/binaries/consultations/review-wba-markets/summary/WBA_July_2013.pdf

³⁹ See Plum (2013).

Measures include rules aimed at reducing permitting costs, harmonizing conditions for wholesale access, and a new proposal that could allow network providers to charge for offering customers a better quality of service. At the same time, the Commission adopted a new Recommendation on costing methodologies and non-discrimination obligations, which advocates the removal of wholesale access price regulation for fiber networks, subject to non-discrimination requirements and provided that there is sufficient competitive pressure from legacy networks or at least one alternative infrastructure-with comparable reach⁴⁰.

These recent documents also show that the European Commission is increasingly aware that, absent a change of direction in the approach to wholesale access regulation, it is unlikely that Europe will be able to catch up with its international competitors in terms of ultra-fast broadband availability⁴¹. However, we believe that it may be difficult to implement significant regulatory changes to the existing framework because of vested interests that benefit from it. The national regulators have **already criticized the Commission's** "presumption that two networks represent sufficient competition"⁴².

That said, we believe some reform could occur, and some if it could promote long-term consumer welfare. The draft Recommendation on relevant markets adopted on January 24, 2013 places greater emphasis on issues related to dynamic efficiency (i.e., getting the investment incentives right) and less of a focus on static efficiency. Also, it encourages national regulators to consider all sources of competitive pressure in defining the relevant market and in assessing whether a given fixed-line operator could be said to have Significant Market Power. The draft recommendation also includes an explicit statement on the negative effects that over-regulation may exert on investment⁴³. If some of these recommendations are adopted, the EU approach to regulation could stimulate greater investment in NGNs.

⁴⁰ Commission Recommendation on consistent non-discrimination obligations and costing methodologies to promote competition and enhance the broadband investment environment, C(2013) 5761, 11.9.2013. See also the Impact Assessment document attached to the recommendation, SWD(2013) 329.

⁴¹ See the Impact Assessment of the recommendation on costing methodology and non-discrimination obligations, SWD(2013) 329, Section 2.3, pages 15-17.

⁴² See **BEREC's views on the proposal for a Regulation "laying down measures to complete the European single market for electronic communications and to achieve a Connected Continent"**, BoR (13) 142.

⁴³ See <http://ec.europa.eu/digital-agenda/en/news/draft-revised-recommendation-relevant-markets> and the related explanatory note, at <http://ec.europa.eu/digital-agenda/en/news/draft-revised-recommendation-relevant-markets>.

4. CONCLUSION

This paper examines the EU approach to broadband regulation over the past decade and the impact this regulation has had on the evolution of the EU telecommunications market. Our main findings can be summarized as follows:

- **Wholesale access regulation has been a key feature of EU telecommunications policy** since the 1990s, and in particular after 2002, when the “ladder of investment” became the reference model for the promotion of entry in the EU telecommunications market. This model tried to reconcile the need to promote entry and service-based competition in the short-term with the goal of achieving facilities-based competition in the long term.
- **For legacy copper networks, the results of access regulation are disappointing from the perspective of promoting long-term consumer welfare.** On the positive side, the general regulatory approach adopted in the EU has likely led to an increase in the number of operators (estimates vary from several hundreds to two thousand). This has spurred competition at the retail level, and may have led to a reduction in prices. However, this regulatory framework also likely led to relatively low investment in broadband infrastructure. The relatively low investment levels are likely to reduce consumer welfare over the longer term. Accordingly, many academics have questioned the viability of this approach to regulation.
- **Reliance on access regulation seems to have had a negative impact on investment in new high-speed broadband networks.** Although the transition to NGNs is too recent to allow for definitive statistical analyses, the first attempts to measure the impact of wholesale access regulation on ultra-fast broadband deployment suggest this regulation has adversely affected investment and consumer welfare. Europe lags behind the US, Canada and Japan in terms of investment, speed, and penetration of fast and ultra-fast broadband.
- **The European Commission has begun to acknowledge that the lack of investment in broadband is a serious problem.** During the past year, the Commission has proposed a variety of measures that include reliance on public subsidies, actions aimed at cutting red tape for operators wishing to operate in more than one Member State, slight amendments to the regulatory framework, and also a new proposal on net neutrality that could afford pricing flexibility for better quality of service. In addition, the European Commission has proposed removing direct regulation of prices for wholesale access to NGNs where one alternative infrastructure of comparable reach is in place. Some of these proposals could encourage

investment in faster broadband networks, but much work remains if the objective is to improve the long-term welfare of consumers.

REFERENCES

Bouckaert, J., van Dijk, T. and F. Verboven (2010), 'Access regulation, competition, and broadband penetration: An international study', *Telecommunications Policy*, Vol. 34, No. 11, pp. 661-671.

Bourreau, M., Doğan, P. and M. Manant (2010), 'A critical review of the "ladder of investment" approach', *Telecommunications Policy*, Volume 34, No. 11, 683-696.

Boyle, G., Howell, B. and W. Zhang (2008), 'Catching up in broadband regressions: does local loop unbundling really lead to material increases in OECD broadband uptake?'. Paper presented at the 19th European Regional Conference of the International Telecommunication Society, September 18-20, Rome.

Briglaier, W., Ecker, G. and K. Gugler (2013), 'The impact of infrastructure and service-based competition on the deployment of next generation access networks: Recent evidence from the European member states', *Information Economics and Policy*, Vol. 25, No. 3, pp. 142-153.

Cambini, C. and Y. Jiang (2009), 'Broadband investment and competition. A literature review', *Telecommunications Policy*, Vol. 33, No. 10-11, pp. 559-574.

Cave, M. (2006), 'Encouraging infrastructure competition via the ladder of investment', *Telecommunications Policy*, Vol. 30, No. 3-4, pp. 223-237.

Cave, M. (2007), Applying the Ladder of Investment in Australia, Report for Telstra, available at: <http://www.telstra.com.au/abouttelstra/download/document/schedule-a-annex-1-martin-cave-report.pdf>

Cave, M. (2010), 'Snakes and ladders. Unbundling in a next generation world', *Telecommunications Policy*, Vol. 34, Issues 1-2, pp. 80-85

Cincera, M., Dewulf, L. And A. Estache (2012), 'On the (In)Effectiveness of Policies to Promoted Broadband Diffusion in Europe (2003-2010): An Econometric Assessment', ECARES Working Paper 2012-032

Crandall R.W., Eisenach J.A. and A.T. Ingraham (2013), 'The long-run effects of copper-loop unbundling and the implications for fiber', *Telecommunications Policy*, Vol. 37, No. 4-5, pp. 262-281.

CRTC – Canadian Radio-television and Telecommunications Commission (2013), Communications Monitoring Report, September 2013, available at:

<http://www.crtc.gc.ca/eng/publications/reports/PolicyMonitoring/2013/cmr2013.pdf>

De Ridder, J. (2007), 'Catching-up in broadband – What will it take?', *OECD Digital Economy Papers*, No. 133, OECD Publishing.

Denni, M. and H. Gruber (2007), 'The Diffusion of Broadband Telecommunications in the U.S. - The Role of Different Forms of Competition', *Communications & Strategies*, Vol. 68, p. 139.

Distaso, W., Lupi, P. and F.M. Manenti (2006) 'Platform competition and broadband uptake: Theory and empirical evidence from the European Union', *Information Economics and Policy*, Vol. 18, No. 1, pp. 87-106.

Distaso, W., P. Lupi, and F. Manenti (2009), 'Static and dynamic efficiency in the European telecommunications market: The role of regulation on the incentives to invest and the ladder of investment', in Lee I., (ed.), *Handbook of research on telecommunications planning and management*. USA: IGI Global.

ECORYS (2013) Future electronic communications markets subject to ex-ante regulation, Report for DG CONNECT of the European Commission, available at: http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=3148.

ERG - European Regulators Group (2005), Broadband Market Competition Report, ERG(05)23 available at http://www.erg.eu/streaming/erg_05_23_broadbd_mrkt_comp_report_p.pdf?contentId=543108&field=ATTACHED_FILE.

European Commission (2013) Market Functioning in Network Industries – Electronic Communications, Energy and Transport, European Economy Occasional Papers no. 129, February.

Farrell, J. (1997), Prospects for Deregulation in Telecommunications, Mildly Revised Version, May 30, 1997, Speech, May 9, available at: <http://www.fcc.gov/Bureaus/OPP/Speeches/jf050997.txt>

Friederiszick, H., Grajek, M. and L.H. Roeller (2008), 'Analyzing the relationship between regulation and investment in the telecommunications sector'. ESMT White Paper no. WP-108-01.

Garcia-Murillo, M. (2005), 'International broadband deployment: The impact of unbundling', *Communications & Strategies*, Vol. 57, pp. 83-105.

Grajek, M. and L.-H. Roeller (2012), 'Regulation and Investment in Network Industries: Evidence from European Telecoms', *Journal of Law and Economics*, Vol. 55, No. 1, pp. 189-216.

Hausman, J. and J. Sidak (2005). 'Did mandatory unbundling achieve its purpose? Empirical evidence from five countries', *Journal of Competition Law and Economics*, Vol. 1, No. 1, pp. 173–245.

Höffler, F. (2007), 'Cost and benefits from infrastructure competition. Estimating welfare effects from broadband access competition', *Telecommunications Policy*, Vol. 31, No. 6-7, pp. 401-418.

ITRE – Industry, Research and Energy Committee of the European Parliament (2013), 'Entertainment x.o to Boost Broadband Deployment', Study prepared by WIK-Consult and TNO.

Jorde, T.M., Sidak, J. and D.J. Teece (2000), 'Innovation, Investments, and Unbundling', *Yale Journal of Regulation*, Vol. 17, pp. 1-37.

Katz, R.L. (2013), 'Investment, infrastructure and competition in European telecom', *Intermediai*, Vol. 41, No. 2, pp. 20-27.

McKinsey (2013) 'Re-Establishing the European Union's Competitiveness with the Next Wave of Investment in Telecommunications', in World Economic Forum (ed.), *The Global Information Technology Report 2013*.

Nardotto, M., Valletti, T. and F. Verboven (2012), 'Unbundling the incumbent: Evidence from UK broadband', CEPR Discussion Papers No. 9194.

OECD (2013), *OECD Communications Outlook 2013*, OECD Publishing.

Oldale A. and J. Padilla (2004) 'From state monopoly to the "investment ladder": competition policy and the NRF', Swedish Competition Authority Series: The Pros and Cons of Antitrust in Deregulated Markets.

Pelkmans J. and G. Luchetta (2012) *Enjoying a Single Market for Network Industries*, Paris: Notre Europe.

Pindyck, R.S. (2007), 'Mandatory Unbundling and Irreversible Investment in Telecom Networks', *Review of Network Economics*, Vol. 6, pp. 274-298.

Plum consulting (2013), Future evolution of fibre regulation, Report for British Telecom, available at http://www.plumconsulting.co.uk/pdfs/Plum_Sept2013_Future_evolution_of_fibre_regulation.pdf

Renda A. (2010), ‘**Competition-regulation Interface in Telecommunications. What’s left of the Essential Facilities Doctrine**’, *Telecommunications Policy*, Vol. 34, No. 1-2, pp. 23-35.

Renda A. (2013), Net Neutrality and Mandatory Network-Sharing: How to disconnect the continent, CEPS Policy Brief No. 309, 18 December.

Renda A., Luchetta, G. and F. Simonelli (2013) ‘**The Italian Decline in Telecommunication Services**’, Working Paper.

Valletti, T. (2003), ‘**The theory of access pricing and its linkage with investment incentives**’, *Telecommunications Policy*, Vol. 27, No. 10-11, pp. 659–675.

Wallsten, S. (2006), ‘**Broadband and unbundling regulations in OECD countries**’, Working Paper 06-16, AEI-Brookings Joint Center for Regulatory Studies.

Wallsten, S. and S. Hausladen (2009), ‘**Net Neutrality, Unbundling, and their Effects on International Investment in Next-Generation Networks**’, *Review of Network Economics*; Vol. 8, pp. 90-112.

Yoo, C.S. (2013), Comparing US and European Broadband Coverage, Presentation at the University of Pennsylvania Law School, December 13.

OFFICIAL DOCUMENTS

BEREC – Bureau of European Regulators for Electronic Communications, **BEREC views on the proposal for a Regulation “laying down measures to complete the European single market for electronic communications and to achieve a Connected Continent”, 17.10.2013.**

17 October 2013 Communication from the Commission, Guidance on its enforcement priorities in applying Article 82 of the EC Treaty to abusive exclusionary conduct by dominant undertakings. OJ C 45/7, 24.2.2009.

Commission Recommendation on regulated access to Next Generation Access Networks (NGA), 2010/572/EU, 20.9.2010.

Commission Recommendation on consistent non-discrimination obligations and costing methodologies to promote competition and enhance the broadband investment environment, C(2013) 5761, 11.9.2013.

Commission Staff Working Document, Impact Assessment Accompanying the document Commission Recommendation on consistent non-discrimination

obligations and costing methodologies to promote competition and enhance the broadband investment environment, SWD(2013) 329, 11.9.2013.

Directive 2009/136/EC of the European Parliament and of the Council **amending Directive 2002/22/EC on universal service and users' rights relating** to electronic communications networks and services, Directive 2002/58/EC concerning the processing of personal data and the protection of privacy in the electronic communications sector and Regulation (EC) No 2006/2004 on cooperation between national authorities responsible for the enforcement of consumer protection laws, OJ L 337/11, 18.12.2009.

Directive 2009/140/EC of the European Parliament and of the Council amending Directives 2002/21/EC on a common regulatory framework for electronic communications networks and services, 2002/19/EC on access to, and interconnection of, electronic communications networks and associated facilities, and 2002/20/EC on the authorisation of electronic communications networks and services, OJ L 337/37, 18.12.2009.

Proposal for a Regulation of the European Parliament and of the Council laying down measures concerning the European single market for electronic communications and to achieve a Connected Continent, and amending Directives 2002/20/EC, 2002/21/EC and 2002/22/EC and Regulations (EC) No 1211/2009 and (EU) No 531/2012, COM(2013)627, 11.9.2013.

Regulation (EC) No 1211/2009 of the European Parliament and of the Council establishing the Body of European Regulators for Electronic Communications (BEREC) and the Office, OJ L 337/37, 18.12.2009.

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