

Queder, Fabian

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Competitive effects of cable networks on FTTx deployment

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Competitive effects of cable networks on FTTx deployment

Author:
Fabian Queder

WIK-Consult GmbH
Rhöndorfer Str. 68
53604 Bad Honnef
Germany

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WIK-Consult GmbH
Rhöndorfer Str. 68
53604 Bad Honnef
Germany
Phone: +49 2224 9225-0
Fax: +49 2224 9225-63
eMail: info@wik-consult.com
www.wik-consult.com

Person authorised to sign on behalf of the organisation

General Manager	Dr Iris Henseler-Unger
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1 Introduction

The European Union and its Member States have set themselves ambitious broadband targets. By 2025 the EU aims to provide access to at least 100 Mbps to all European citizens and gigabit connectivity for all main socio-economic drivers such as schools and hospitals (European Commission 2016). Germany even aims for nationwide gigabit-coverage by 2025 (Die Bundesregierung 2017). In the light of massive investments in NGA deployment that are necessary to reach these targets, it is intensively discussed which economic and market conditions foster telecommunications operators' investments in FTTP¹-infrastructures.

With the introduction of DOCSIS², which enabled cable networks to deliver broadband services, European policy makers considered cable networks a potential source for competition in fixed telecommunication markets. In the early 2000s, due to regulatory pressure, European incumbents divested their cable business and sold it to private companies enabling a substantial part of European households to choose between a cable network operator and the incumbent for broadband and telephony provisioning. Today's European telecommunications markets are therefore characterized by inter-platform competition between cable network operators, incumbents, and alternative operators that rolled-out their own infrastructure.³ In this regard, there is a vibrant debate (yet, barely covered by empirical studies) which effect the presence of cable networks have on the incumbent's as well as on alternative operators' investments in FTTx. On one hand, it is argued that higher cable coverage could increase investments as incumbents and alternative operators upgrade their networks in order to avoid losing market shares to competing cable networks. On the other hand, it is argued that the existence of cable networks hampers investments in FTTx-networks since operators investing in areas with existing coax-cable networks execute these investments against an existing infrastructure and an existing customer base. This *penetration risk* due to a lower (anticipated and actual) take-up, effectively reduces revenues and the ability to recover investment costs and consequently to invest without governmental subsidies.

The existing empirical literature on the impact of cable networks on incumbents' and alternative operators' investments in FTTx-networks is very limited and does not provide a conclusive answer. A study by Arthur D. Little (2016), commissioned by Cable Europe, compares incumbents' fixed investments per household between countries with 60% and more coverage with those with less than 60% and concludes: "*When cable is present, this pushes telco incumbents to deploy their own next generation technology such as VDSL (very high bit-rate subscriber lines) or FTTP (fibre to the premises)*". The

¹ Also referred to as FTTB/H.

² Data over Cable Service Interface Specification (DOCSIS) is the technology standard used to transmit data over cable networks.

³ Additionally, access obligations imposed on incumbents' copper networks led to the market entry of alternative operators and enabled intra-platform competition on the (legacy) copper infrastructure.

applied methodology, a simple comparison of means, is, however, not sufficient to allow for causal inference as it neglects all additional determinants such as cost of deploying a network, population density, purchasing power or any other relevant factors. A more recent study by Fourie and de Bijl (2018) resolves this drawback and explores the impact of various factors on FTTP-penetration among European households. The study draws on a dataset comprising data for 27 European countries from 2004 to 2015 and finds that FTTP-penetration is negatively affected by the cable market share in a country.

The present paper analyses the effect that cable networks have on investments in FTTx by drawing on a sample of 28 European countries and spanning the 2011-2017 period. In line with Fourie and de Bijl (2018), we find that there is a negative relationship between cable and investments in FTTx-networks. This restraining effect associated with cable networks contradicts the current regulatory regime which is primarily designed to enable effective competition against the incumbent on the copper- and fiber-based infrastructure. Therefore, our analysis is a crucial first step to design a sound regulatory and competitive framework to achieve the ambitious broadband targets set by the European Commission and national governments.

The remainder is structured as follows: Chapter 2 elaborates on the supply side competition between cable and FTTx-based networks. Chapter 3 presents the underlying dataset, our empirical approach and discusses the obtained results. Chapter 4 concludes.

2 Supply-side competition between cable and FTTx-networks

Our research is designed to investigate the impact of inter-platform competition exerted by cable, measured as the level of coverage, on investments in FTTx-networks. To do so, we first present the three distinct temporal waves of cable network roll-out that took place under varying market environments and different investment rationales. Second, we show why a difference in the competitive effect on FTTx-deployments of the different waves can be expected. Note that cable network expansion in this paper refers to additional households being reached rather than an upgrade to DOCSIS 3.0⁴, while FTTx-network roll-out can either be a geographic expansion or an upgrade from DSL to FTTC or FTTP.

⁴ The reason is that DOCSIS-upgrades are rather modular investments with limited CAPEX requirements. Thus, competitors can expect that household that are not updated to DOCSIS 3.0 yet, will be upgraded in the near future.

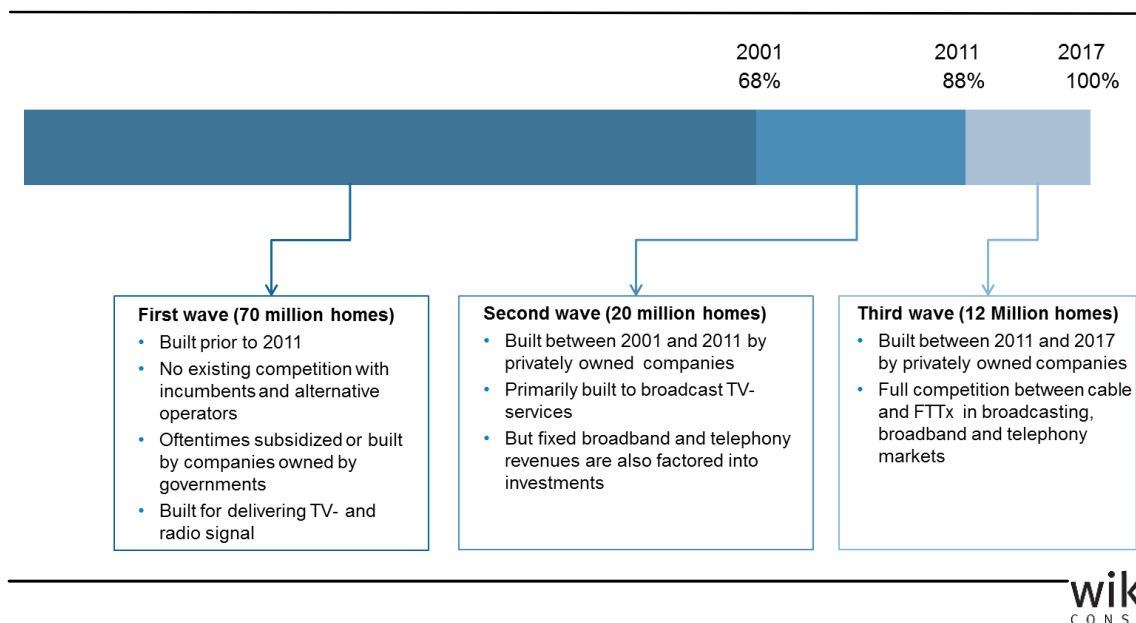
2.1 Three waves of cable network expansion

The majority of European cable access networks were built during the first wave of cable network expansion until 2001 mostly by (previously) state-owned incumbent operators. Cable networks at that time were designed to deliver TV- and radio-broadcasting services and roll-out decisions were mainly driven by media-political reasons. In general, during this first wave the political environments and overall market conditions were quite heterogeneous across Europe, e.g. in terms of media market liberalisation, TV-penetration, satellite market success, subsidies or governmental cable investment plans. Overall, cable networks that were built until 2001 account for 68% of all European households having access to a cable network today.

Between 2001 and 2011 cable network coverage continued to expand but, in contrast to the first wave of cable build-outs, these investments were made by private operators starting to compete against incumbents and alternative operators in the fixed broadband and telephony market. Nevertheless, during the 2001-2011 period cable network build-outs were still primarily driven by TV-market considerations as cable network operators generated the majority of their revenues with TV-services. The rather complementary role of coax-cable networks, used to provide TV-services, and FTTx-networks, offering telephony and broadband services, changed to a substitutable relationship with the introduction of DOCSIS 3.0 in 2010. DOCSIS 3.0 enabled cable networks to offer speeds by far superior to DSL and allowed cable operators to gain a steadily increasing broadband market share. In total, 20% of all cable networks present today were built during the second wave of cable expansion.

After 2011, the third wave of cable network roll-outs began. By that time, both technologies entered into fully-fledged competition on the broadband market, rather than serving complementary purposes. Roll-outs in the third wave account merely for 12% of all households having access to cable networks today.

Figure 1: Temporal waves of cable roll-outs



Source: WIK-Research

2.2 Distinct competition effects for each cable expansion wave

The different waves of cable network expansion had distinct competitive effects that only materialized during the third wave of cable expansion, which is the focus of this paper.

During the first wave, cable expansion had no immediate effect on incumbents and alternative operators' network planning since cable, exclusively delivering TV- and radio signals, was a complementary infrastructure to the copper- and fiber-based telephony and broadband network. The second wave of cable network expansion was different in the regard that cable operators became competitors in the broadband market. Given that the majority of households at that time, however, demanded bandwidth that were well in the range of speeds that could be delivered by DSL-networks, cable operators only gained limited, but a steadily increasing, broadband market share in the 2001-2011 period. With bandwidth demand on balance satisfied by the present DSL-network at that time, households lacked one important incentive to switch immediately after broadband over a cable became available. Hence, cable networks built in the first and second wave did not pose a significant competitive risk at the time of deployment.

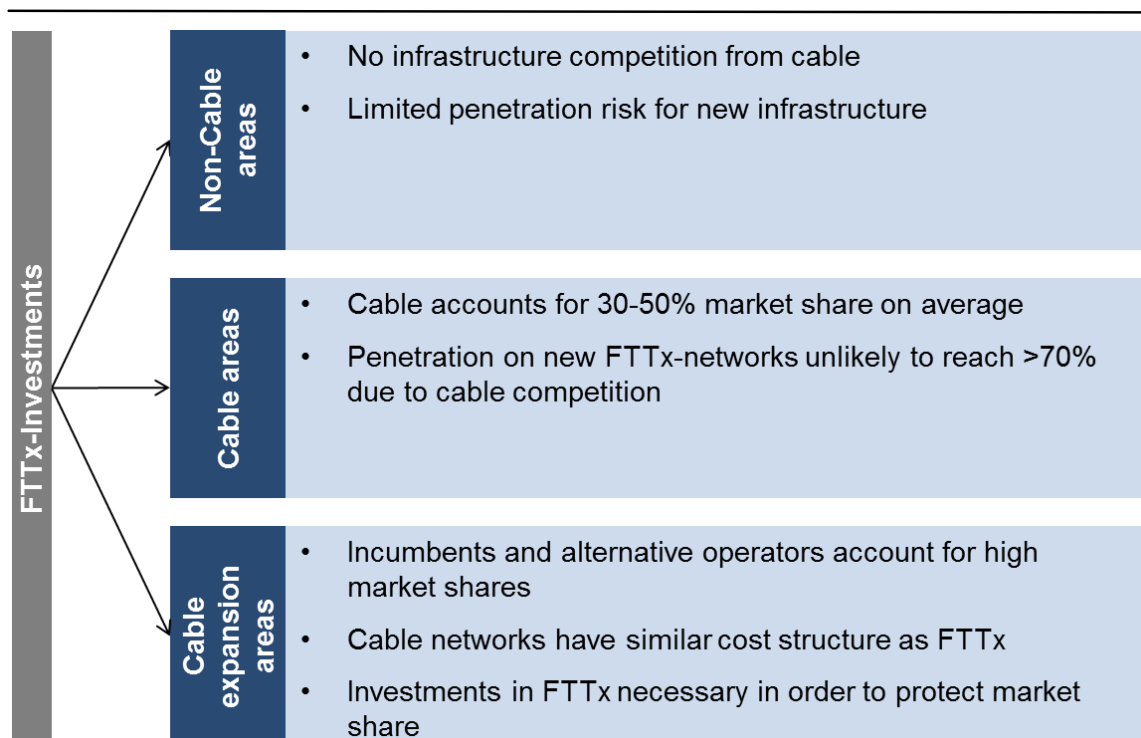
With a steadily rising bandwidth demand, cable penetration rose and eventually cable operators accounted for considerable market shares in cable regions built within the first and second wave. As a result, for copper- and fiber-based operators the addressable market became substantially smaller. Due to this *penetration risk*, operators that decide about (further) FTTx-investments face substantial decreases in the ability to recoup high

investment costs. Consequently, it can be expected that the degree of cable coverage has a significant negative effect on FTTx roll-outs in the analysed third expansion wave.

Cable networks built within the third wave, in contrast, may have a positive effect on FTTx-roll-outs. During the third expansion wave, bandwidth-intensive services, such as video streaming and other OTT services, became more and more popular thereby increasing households' bandwidth demand. The cable network expansions that occurred in the third wave was rather limited in its geographical scope but posed an immediate risk ('competitive shock') for incumbents and alternative operators in those new cable regions. Within a short period of time former DSL-only customers had the choice to switch to cable operators providing bandwidths satisfying their increased demand. Thus incumbents and alternative operators may reacted by investing in FTTx in these new cable regions in order to avoid customer migration and protecting their market position.

The following figure depicts the differences in investment considerations for FTTx-roll-outs between areas without cable (DSL-only), with long-standing cable coverage (first and second wave) and recent cable expansion areas (third wave):

Figure 2: FTTx-investments in different areas



In a nutshell, there are two distinct and independent effects of cable coverage on FTTx-networks. The initial cable roll-out waves had no immediate but a delayed negative effect on FTTx-network expansion, while the third wave may have an immediate but countervailing effect. Thus, incumbents and alternative operators have two options: either they choose not to invest in cable regions as the reduced target penetration effectively decreases the ability to recoup high investment costs (*penetration risk*), or they choose to invest in order to protect their existing customer base.

3 Empirical analysis

Our empirical analysis addresses the question whether cable network coverage reduces or increases investments in FTTx-infrastructures. To do so, we make use of coverage data instead of penetration data. Using coverage data allows us to assess the full effect of inter-platform competition accounting for all households having access to a cable network rather than being limited to only those who actually subscribe to broadband services over cable.⁵

3.1 Dataset description

Our analysis relies on a panel data set, including 28 European countries and covering the period from 2011 to 2017.⁶ Most of the data is drawn from the European Commission's "Broadband Access in Europe" study⁷ which regularly provides information on broadband coverage of different access technologies per country and year.⁸ Included technologies are DSL, FTTC, FTTP, WiMAX, Cable, DOCSIS 3.0, HSPA, LTE and Satellite. Due to different legacy infrastructures and business models, operators in some countries primarily choose to invest in FTTP while in other countries FTTC is the preferred technology. To account for these national differences throughout Europe, we aggregate the coverage data of both technologies in order to capture all

⁵ Most empirical literature dealing with regulatory issues in the telecommunications industry uses penetration as dependent and independent variables. However, using penetration data ignores the competitive effect stemming from households that can potentially connect to an alternative (cable) network. For instance, if an entrant builds a new network reaching 10,000 households that has immediate effects on all operators competing for these 10,000 households. Using penetration instead of coverage data would only take actual switching to the new network into account and not the full competitive effect by which the initial network operator is restrained. Hence if the new entrant achieves 20% take-up, penetration data would ignore the strong competitive effect of the remaining 8,000 households that can potentially switch to the new operator, too.

⁶ The included countries are Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Germany, Denmark, Greece, Spain, Finland, France, Croatia, Hungary, Ireland, Iceland, Italy, Lithuania, Latvia, Malta, Netherlands, Norway, Poland, Portugal, Romania, Sweden, Slovenia, Slovakia and United Kingdom.

⁷ See <https://ec.europa.eu/digital-single-market/en/news/study-broadband-coverage-europe-2017>

⁸ We exclude observations for Estonia due to unreasonably high variation over time that is most likely caused by measurement errors. In addition, Luxembourg is excluded as in this duopolistic market the incumbent is still state-owned and therefore underlays different investment considerations than all other privately-owned operators in our sample. Lastly, observations with a negative change in the aggregated FTTC- and FTTP- infrastructure were deleted due to implausibility ($\Delta \text{fttx_cov} < 0$).

investments of incumbents and alternative operators jointly. Table 1 presents the included variables and respective descriptive statistics in levels.

Table 1: Dataset description

Variable	Description (measured in)	Mean	Min	Max	Std. Var.	N	Source
<i>FTTC_cov</i>	VDSL coverage (in %)	0,37	0	0,94	0,28	194	European Commission
<i>fttp_cov</i>	FTTP coverage (in %)	0,30	0	0,95	0,26	193	European Commission
<i>fttx_cov</i>	Aggregate of <i>fttc_cov</i> and <i>fttp_cov</i> (in %)	0,68	0,02	1,58	0,30	193	European Commission
<i>delta_fttx_cov</i>	Additional FTTC and FTTP coverage per year (in %)	0,09	0	0,4892	0,08	155	European Commission
<i>cb_cov</i>	Cable coverage (in %)	0,47	0	1	0,26	194	European Commission
<i>dcs_cov</i>	DOCSIS 3.0 coverage (in %)	0,45	0	1	0,26	193	European Commission
<i>Pop_dens</i>	Population density (Inhabitants per km ²)	162,01	3,1	1375	248	196	World Bank
<i>Labour_costs_constr_ppp</i>	Labour costs index for the construction industry (PPP; 0-100)	16,44	1,06	58,94	13,94	162	Eurostat
<i>Gdp_per_cap</i>	GDP per capita (in US-dollars PPP)	36464	15676	75648	11780	196	World Bank
<i>tv_ms_dtt_sat</i>	TV market share of DTT and Satellite (in %)	0,56	0,057	0,99	0,24	160	EC's Financial indicators studies ⁹
<i>d2_2014</i>	Dummy variable for year 2014 (0;1) ¹⁰						

⁹ See most recent study: <https://ec.europa.eu/digital-single-market/en/news/broadband-data-files-digital-scoreboard-2017>.

¹⁰ We include a dummy variable in the regression analysis to account for changes in the survey's methodology.

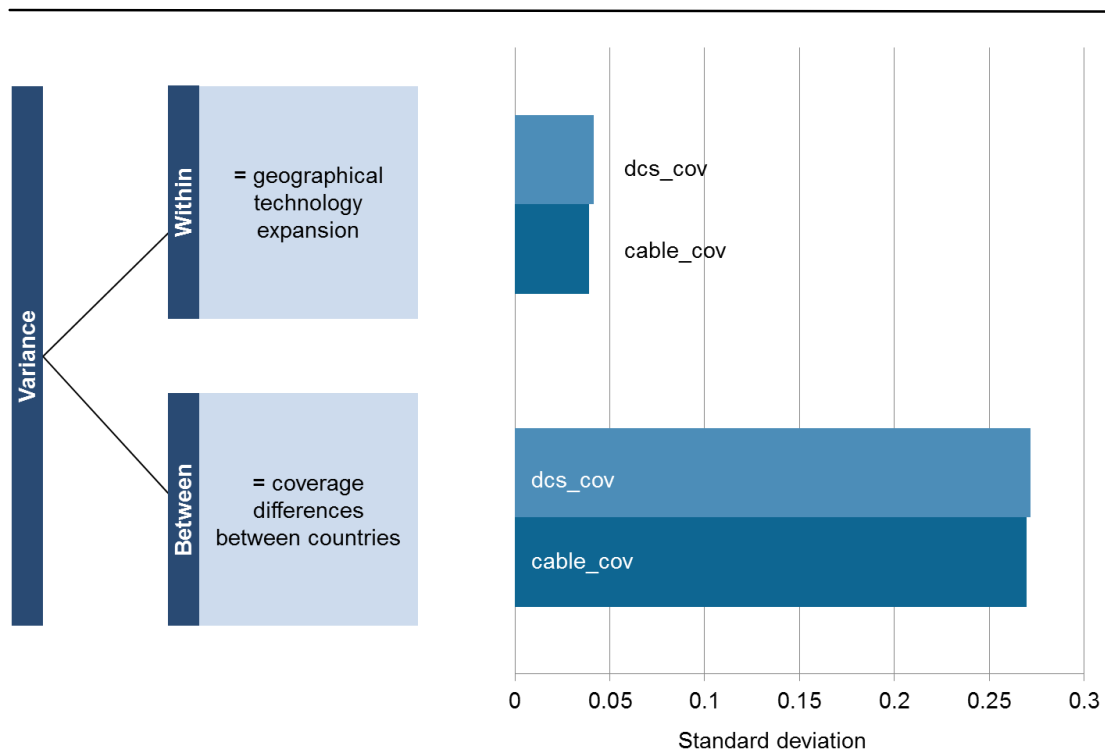
Variables *fttc_cov* and *fttp_cov* represent the national FTTC- and FTTP-coverage, respectively. Our dependent variable, *delta_fttx_cov*, states the annual percentage change of households that are additionally covered by either a FTTC- or FTTP-network. The national cable and DOCSIS-coverage, measured in percentages, are denoted by *cb_cov* and *dcs_cov*. Given that we test the impact of cable and DOCSIS-network coverage on FTTx-deployments, *cb_cov* and *dcs_cov* are the main explanatory variables of interest. In addition, we account for different relevant supply and demand variables. The cost of deploying and operating telecommunications networks depend on different factors such as the underlying technology, cost of construction, population density and other geographic conditions. Lower costs of construction allow for cheaper network roll-outs and a higher population density, going hand in hand with more urban and less rural areas, allows operators to exploit economics of scale as more (potential) customers can be connected to the infrastructure once it is deployed. Hence, the network roll-out in densely populated areas is considerably less costly and broadband supply in general should be promoted. Increases in GDP, as an indication for purchasing power on the demand side, are expected to influence FTTx-deployments positively.

3.2 Estimation strategy

As explained in Chapter 2.2, we suspect that the effect of cable coverage between 2011 and 2017 on FTTx-deployments may be twofold: On the one hand, cable expansion in the first and second wave, that account for nearly 90% of the cable coverage today, hampers FTTx-network build-outs as it increases the penetration risk for new infrastructures. On the other hand, cable roll-out in the third wave may have a countervailing effect as incumbents and alternative operators may invest to protect their market position.

In order to account for these two effects, we make use of different panel estimators. First, a between estimator, which only draws on variation between countries, is used to compare the effect of the average degree of cable and DOCSIS-roll-out in different countries and its effect on FTTx-investments. Second, we use a fixed effects estimator, which only uses within (time) variation for each country, to isolate the effect of additional households that gained access to a cable network during the third wave of cable expansion. Third, to combine both approaches, we estimate our model using the random effects estimator, which equals a matrix-weighted average of both the fixed and the between effects. Given little within but high between variation for cable and DOCSIS-coverage (see Figure 3), we expect the random effects estimation to be determined by the between effect.

Figure 3: Between and within variance in main variables



Generally, the random effects estimator is more efficient than the between estimator and most empirical studies consequently only consider the random and fixed effects estimators. To decide between the two, the so-called Hausman test is usually applied.¹¹ This test, however, relies on the assumption that the between effect equals the within effect. While this is a valid assumption for most research questions, it is not in our case. As outlined in Chapter 2.2, there are reasonable arguments to expect that both effects may differ. Consequently, we use the between estimator to quantify the average impact that an additional percentage of cable coverage between countries has, and separately apply the fixed effects estimator to answer the question which impact an additional percentage of cable coverage, that was rolled-out during the third wave of cable expansion, had on FTTx-investments.

Our baseline model (Model A) is specified as follows:

¹¹ The Hausman test basically compares the coefficients estimated by the random effects estimator with those obtained by the fixed effects estimator (for detailed derivation of the test statistics see <https://www.stata.com/support/faqs/statistics/between-estimator/>).

$$\begin{aligned}
 & \text{delta_fttx_cov}_{it} \\
 &= \beta_0 + \beta_1 X_{cov_{it}} + \beta_2 \log_gdp_per_cap_{it} + \beta_3 \log_pop_dens_{it} \\
 &+ \beta_4 \log_labour_costs_constr_{it} + \beta_5 \lambda_t + \alpha_i + \varepsilon_{it},
 \end{aligned} \tag{1}$$

where $X = \{cb, dcs\}$ denotes cable and DOCSIS-coverage, respectively. Equation (1) also contains period effects, λ_t , country-specific effects, α_i , to control for unobserved heterogeneity across countries and periods, plus an unobservable error term, ε_{it} .¹²

In Model B, we additionally control for the deployment potential of FTTx-networks in each country (*depl_pot*). Including the deployment potential accounts for the fact that the lower the current FTTP- and FTTC-coverage is, the larger is the share of households that can still be covered and potentially connected to a FTTx-network.¹³

The estimation equation of Model B reads:

$$\begin{aligned}
 & \text{delta_fttx_cov}_{it} \\
 &= \beta_0 + \beta_1 X_{cov_{it}} + \beta_2 \log_gdp_per_cap_{it} + \beta_3 \log_pop_dens_{it} \\
 &+ \beta_4 \log_labour_costs_constr_{it} + \beta_5 \text{depl_pot}_{it-1} + \beta_6 \lambda_t + \alpha_i + \varepsilon_{it},
 \end{aligned} \tag{2}$$

where $X = \{cb, dcs\}$ again denotes cable and DOCSIS-coverage. The first lag of the deployment potential variable is employed to remedy any endogeneity concerns as an increase in FTTx-coverage decreases the deployment potential for the same year.

To check the robustness of our results, we additionally employ an IV (instrument variable) estimator to re-estimate Equations (1) and (2). We use the market share of Digital Terrestrial Television (DTT) and satellite in TV-broadcasting as an instrument for cable and DOCSIS-coverage. Both variables are negatively correlated because higher cable coverage leads to more competition on the TV-broadcasting market which in turn may reduce the market share of DTT and satellite technologies. At the same time, the market share of DTT and satellite technologies is (i) likely uncorrelated to the error term as dynamics in the TV-broadcasting market are unrelated to the broadband market and (ii) unrelated to the dependent variable given that FTTx-investment decisions do not factor in TV market technology shares or vice versa.

3.3 Results

The following tables presents the estimation results of Model A and Model B using the between (BE), random effects (RE), instrumental variable (IV) and country fixed effects (FE) estimators. Table 2 presents the results using cable and Table 3 using DOCSIS-

¹² The between and random effects estimator are both based on the assumption that the unobserved effects are uncorrelated to the independent variables.

¹³ Precisely, the variable deployment potential is defined as the sum of FTTC- and FTTP-deployment potential for each year, thus it is given by $\text{depl_pot}_{it} = (1 - \text{fttc_pot}_{it}) + (1 - \text{fttp_cov}_{it})$.

coverage as the main explanatory variable. Columns 1-4 state the results of Model A and columns 5-8 those of Model B.

Table 2: Estimation results for cable as explanatory variable

	Model A				Model B			
	BE	RE	IV	FE	BE	RE	IV	FE
<i>cb_cov</i>	-0.09*** (0.031)	-0.092*** (0.028)	-0.18*** (0.044)	0.032 (0.123)	-0.084** (0.034)	-0.064** (0.031)	-0.104 (0.049)	0.081 (0.119)
<i>log_gdp_ per_cap</i>	0.11* (0.062)	0.11** (0.044)	0.14** (0.058)	-0.69 (0.086)	0.12* (0.063)	0.13*** (0.046)	0.15*** (0.055)	0.22 (0.132)
<i>log_pop_dens</i>	0.003 (0.007)	0.006 (0.007)	0.02*** (0.008)	0.68*** (0.228)	0.0 (0.008)	0.0 (0.009)	0.014* (0.008)	0.77*** (0.066)
<i>log_labour_ costs_costr</i>	-0.02 (0.018)	-0.021 (0.014)	-0.03 (0.017)	-0.14 (0.084)	-0.023 (0.019)	-0.022 (0.015)	-0.025 (0.017)	-0.14** (0.066)
<i>depl_pot</i>					0.015 (0.033)	0.072*** (0.02)	0.097*** (0.032)	0.158** (0.064)
N	150	150	119	150	150	150	119	150
p-value	0.01347	0.00012	0.0001	0.00817	0.02623	0.00000	0.00000	0.00328
R ²	0.377	0.137	0.059	0.111	0.352	0.169	0.168	0.167

Heteroscedasticity and autocorrelation robust standard errors in parentheses.

Significance levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

All regressions include a constant as well as a linear time trend which are not reported for brevity.

Table 3: Estimation results with DOCSIS as the explanatory variable

	Model A				Model B			
	BE	RE	IV	FE	BE	RE	IV	FE
<i>dcs_cov</i>	-0.92*** (0.031)	-0.087** (0.028)	-0.18*** (0.045)	0.16 (0.153)	-0,087** (0.034)	-0.059* (0.032)	-0.108** (0.05)	0.225 (0.164)
<i>log_gdp_ per_cap</i>	0.118** (0.061)	0.102** (0.044)	0,134** (0.057)	-0.105 (0.084)	0.119* (0.062)	0.119*** (0.045)	0.141*** (0.054)	0.189 (0.118)
<i>log_pop_dens</i>	0.004 (0.007)	0.004 (0.007)	0.024*** (0.009)	0.76*** (0.216)	0.003 (0.008)	-0.002 (0.009)	0.0013 (0.009)	0.831*** (0.238)
<i>log_labour_ costs_costr</i>	-0.02 (0.018)	-0.024 (0.015)	-0.026 (0.017)	-0.141* (0.078)	-0.023 (0.019)	-0.021 (0.015)	-0.024 (0.017)	-0.14*** (0.062)
<i>depl_pot</i>					0.013 (0.034)	0.068*** (0.022)	0.089*** (0.032)	0.166** (0.064)
N	151	151	120	151	151	151	120	151
p-value	0.01818	0.00025	0.00016	0.00014	0,03523	0,00000	0,00000	0,0001
R ²	0.355	0.127	0.042	0.143	0.326	0.155	0,138	0.204

Heteroscedasticity and autocorrelation robust standard errors in parentheses.

Significance levels: * p < 0.10, ** p < 0.05, *** p < 0.01.

All regressions include a constant as well as a linear time trend which are not reported for brevity.

All coefficients have the expected signs when using the BE, RE and IV estimator. The coefficient of GDP per capita is positive and statistically significant in all model specifications. If significant, population density has a positive effect on FTTx-deployments as well, while higher labour costs are associated with less investments in FTTx. The relationship between deployment potential and actual FTTx-deployments is positive and statistically significant in most specifications. This shows that market players expand their FTTx-networks faster the larger the potentially addressable market.

Consistent with our hypothesis, the BE and RE estimators yield a negative and statistically significant coefficient for cable and DOCSIS-coverage in each specification. Unsurprisingly, the random effect coefficient is slightly smaller than the between coefficient as the random effects estimator does also take the within variation into account. Given that variation in the data is predominantly between and not within countries, these results are our results of interest. The IV estimation supports this result, which is another indication that the estimated negative relationship is robust.

These results allow to draw conclusions on how cable networks effect FTTx-investments given the current market structure: Incumbents and alternative operators facing competition from a broadly rolled-out cable network are only able to expand their FTTx-footprint significantly slower than those operating in markets with limited cable coverage. This effect is explained by the penetration risk that operators face when investing in existing cable regions. The larger the present cable footprint, the larger is the probability that cable networks, being able to deliver speeds of up to 1 Gbit/s, account for a significant market share – even if an alternative operator invests in FTTx. The market share that operators anticipate to gain in a cable region is apparently not sufficient to recoup the immense investment costs. Our results thus imply that cable network coverage effectively limits incumbents and alternative operators in their ability to choose a FTTP- instead of FTTC-typology because the high costs associated with FTTP-investments seem to be too high to be recovered in cable network regions.

The results for the fixed effects estimation are partly different, but again in line with our expectations. As described earlier, the between and within estimators are measuring different effects: The latter measures the effect of increased cable household access during the third wave of cable expansion that aimed to extent the addressable market to households which cable companies were previously unable to access. Thus these investments are no different from those of operators deploying FTTP. And therefore the FE estimator does not answer the questions which overall competitive effect cable networks have, but rather indicate that operators react to market entry of a new competitor when faced with the immediate risk of losing market share. Given that cable network expansions since 2011 were rather limited, the fixed effects estimations are imprecise and insignificant for the variables of interest, the national level of cable and DOCSIS-coverage. The unique competition effect that cable networks have on the broadband market can therefore not be explored using country fixed effects estimations.

4 Conclusion

This paper is the first to analyse the impact of cable and DOCSIS-coverage on FTTx-investments. We use a sample of 28 European countries from 2011 to 2017 and apply panel data techniques while carefully accounting for possible endogeneity problems.

We document a considerably restraining effect of cable and DOCSIS-coverage on annually FTTx-roll-out. Hence, a broader coverage of a competing cable infrastructure, or put differently more inter-platform competition, hampers the deployment of fiber-based networks. Our results especially imply that higher costs associated with FTTP-investments would in many instances be too high to be recovered in cable network regions. Cable network coverage effectively limits incumbents and alternative operators in their ability to choose FTTP as their preferred typology instead of FTTC due to the considerable penetration risk that operators face when investing in existing cable regions. Cable coverage is thus rather a hampering factor than a driver for investments in FTTx-infrastructures.

DOCSIS 3.1 will further expand bandwidths that can be delivered over cable and incurs rather small incremental investments to upgrade the network. In contrast, the upgrade from FTTC to FTTP requires significant investments. Following from the penetration risk imposed by cable networks already today the extent of future FTTP-roll-outs remains unclear. This result demands in some way a paradigm shift from the existing regulatory regime which is designed to enable competition against the significant market power of incumbents throughout Europe. Our results show it is not self-evident that all cable regions will see infrastructure competition between cable and FTTP-networks in the future. Especially, public policy makers need to factor that into decisions affecting wholesale markets. Wholesale obligations on cable networks intending to enable service competition could unintentionally prevent inter-platform competition. Therefore we recommend policy makers to factor in this potentially different role of cable providers in the competitive landscape in broadband markets.

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