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Introduction

Does internet usage impact government efficiency? And if so, in what way? This thesis aims to investigate the effect of broadband internet access on government efficiency at the municipal level in Norway. In particular, whether the supplementary information provided by internet access allows voters to more closely monitor the political performance of their political representatives - thus making it easier to hold politicians accountable.

Intuitively, internet access allows individuals to acquire political information at a significantly reduced cost, allowing them to increase their political knowledge and their ability to evaluate the performance of their representatives, thereby increasing the incentives of the politician to perform well. Conversely, one could argue that the abundance of online information can make political materials less accessible (or more easily substituted), lowering individual's political knowledge and their ability to monitor performance of their local politicians, thereby decreasing the incentives of the politician to perform. The above mentioned mechanisms will be the main interest of our thesis, and our research is well aligned with the recent debates and studies on the impact of internet access on political participation.

Our paper is related to growing economic literature on the effect of media. Such studies as Strömberg (1999), Tolbert & McNeal (2003), Czernich (2012), Falck et al. (2014), Gavazza et al. (2015), Prior (2015) and Poy & Schüller (2016) find support of an effect of media on voter turnout. However, the introduction of internet access has shown contrasting implications for voter turnout. Among these, Tolbert and McNeal (2003) identify that those with internet access are significantly more likely to report their participation in the following U.S presidential elections, finding support for increased voter turnout by expanded internet access. In contrast, Prior (2015) pinpoints that the introduction of the internet may have a negative impact on voting turnout for the U.S presidential election and political knowledge, as political information is substituted away by consumers with preferences for entertainment content rather than news. Depending on consumers' preferences for informative and entertainment contents, increased internet access may cause an increase or reduction in political information and thereby also voter turnout (Falck et al., 2014). The ambiguity of these international findings highlights the research potential within the field of mass media's impact on voter turnout. As this topic

remains unexplored within the Norwegian context, our work will contribute to this body of literature with a Norwegian perspective.

We will thereafter investigate the consequences of the broadband introduction for municipality level service provision. Possible inefficiencies in government service provision can be caused by the informational asymmetry between the electorate and the politician, as the politician possesses more information. This may also lead to increased budgetary slack in forms of overestimations of budgetary expenses and thereby government inefficiencies. Intuitively, if internet access does increase voters' political knowledge, then voters should be more inclined to vote and the cost for politicians from neglecting electorate's preferences should increase.

There exists literature analysing the impact of internet on local government efficiency, however, these studies are based on countries with a municipal service provision that differs greatly from the Norwegian welfare system. According to the decentralization theorem presented by Oates (1972), decentralized service provision increases the efficiency of allocation in service provision. In Norway and other Scandinavian countries, the decentralized structure of service provision is far greater than in countries such as the U.S, U.K, Germany or Italy - and therefore our study would highlight the impact of the internet on government efficiency in the case of great decentralization of service provision. This topic is highly relevant for policy makers, as voter turnout is the fundamental element of a well-functioning democracy.

We therefore suggest the following research question for the thesis: "Does internet usage impact government efficiency?"

The research design of our thesis is based on the methodology described in Gavazza et al. (2015), a study that investigates the implications of broadband internet for voter turnout and government efficiency in the U.K. In particular, we develop two regression analyses that reveal causal effects that constitute the main mechanism of our interest. Secondly, identification strategy is similar to those taken by Bhuller et al. (2013), a study about the effect of broadband introduction on sex crime in Norway. Accordingly, we employ a two-stage least squares estimation method that involves difference-in-difference analysis and instrument variable setup.

This paper is organized as follows: in the first section we present the background for our study. The second section provides a review of previous studies regarding the impact of the introduction of media and its relationship to voter turnout, government efficiency and political polarization. In the third section we present our research strategy and other methodologies we expect to use. Thereafter, in the fourth section, we introduce and discuss the dataset and variables considered in our study. Finally, the fifth section outlines the timeplan of our thesis.

Background

Johann Gutenberg's invention of the printing press laid the foundation for the subsequent printing revolution that led to the free flow of informational content. The emergence of the Internet has often been compared to the invention of the printing press, giving hopes to a new period of enlightenment.

A well-developed broadband infrastructure is often argued to be of great importance for the inhabitants of a country, its public services provision, and for the competitive abilities of the economy. It does not only play a critical role in the economy, but also provides additional benefits such as connecting consumers, businesses and government and motivating social interaction (OECD, Reynolds T, Wunsch-Vincent S, 2008). This view was shared by the OECD Council who, in February 2004, introduced "*The Recommendation of the Council on Broadband Development*", calling upon its member states to implement policies to facilitate the expansion of broadband markets and to encourage effective use of broadband services (OECD, Reynolds., T, Wunsch-Vincent, S., 2008). As can be read at OECD's webpage, among the focus points of the recommendation, member states were advised to implement policy that encouraged investments in technological infrastructure, new implementations of the technology, and access for all communities at competitive prices irrespectively of location in order to realize the full benefits of broadband internet. As a consequence, many OECD countries started to implement policies aimed to develop their information and communication technology.

The same policy focus manifested itself in Norway through a National Broadband Policy initiative (St.meld.nr. 38, 1997-1998) similar to those set out by the OECD Council. The initiative was set out to develop a plan of action securing the development of Norwegian IT-competence, as this was seen as fundamental for the creation of new working opportunities. The initiative found that the IT-competence dominated in the central region Oslo, Akershus, and remained relatively scarce in decentralized areas such as the northern part of Norway. Therefore, one main target of the initiative was to ensure broadband access to every household and private enterprise at a reasonable and uniform price in order to build IT-competence in all regions of the country. Furthermore, the public sector was to quickly adopt broadband internet since IT would increase the efficiency of public service provision (St.meld.nr. 38, 1997-1998). As can be read at SNL's webpage,

in order to achieve these goals a subsidy program was established by the Norwegian government named “*Høykom*” aiming at stimulating the development of broadband internet, later, especially in regions where commercial investors failed to provide broadband infrastructure (*Høykom-distrikt*). The program managed 250 million NOK for investments, forcing broadband to be progressively rolled out (St.meld.nr. 49, 2002-2003). This fact created exogenous variations in internet access that makes Norway well suited for a study of the introduction of broadband internet. We aim to exploit these exogenous variations in internet access to deal with common inference problems such as simultaneity and omitted variables, and expect this identification strategy to determine the impact of internet.

Today, 99.98% of Norwegian households could potentially get broadband access, meaning that less than 1000 households lack an offer of such internet access (NEXIA, Kvalbein, A. et al., 2016). Since the National Broadband Policy program was introduced in the late 1990s there has been a gradual uptake in internet coverage and usage, with substantial growth especially in the period 2003-2008. This becomes apparent when looking at the development in the number of broadband subscriptions and usage rates. The apparent relationship between broadband coverage and internet usage suggests that when internet access increased, so did the actual adoption among households (Figure 1). The DSL-technology remained the dominant technology from 2000 to 2008, even after the emergence of new technologies such as ADSL2+ and fiber based subscriptions. This validates the use of DSL-based subscriptions for our study centered around the introduction of broadband internet.

Although it seems that increased internet coverage resulted in increased internet usage, a crucial distinction needs to be made when it comes to media consumptions. Importantly, whether internet is used for non-informative or informative content. Prior (2015) shows that people's entertainment preferences will be of great importance for the informational effect of internet. SSB's “*Norsk Mediebarometer*” survey series from 1999 to 2015 illustrate the drastic changes in the media consumption habits of Norwegian individuals. From 2004 to 2015, time spent on the internet as a share of total mass media consumption per average day went from 8 percent to 31 percent, whilst newspaper consumption decreased from 8 percent of average daily media consumption to 3,9 percent (SSB, Vaage, O.F., 2004, 2015). At the same time the number of respondents stating that they read

news online increased significantly from 2002 until 2015, with $\frac{2}{3}$ stating reading online news daily (SSB, Vaage, O.F, 2002, 2015). Furthermore, the time spent on the internet on an average day increased drastically, with respondents spending 33 minutes online in 2004 in comparison to 87 minutes in the 2015 survey (SSB, Vaage, O.F, 2002, 2015). By 2015, internet had become the main source of media content in Norway, exceeding usage of both radio and cable TV (Medienorge, 2007).

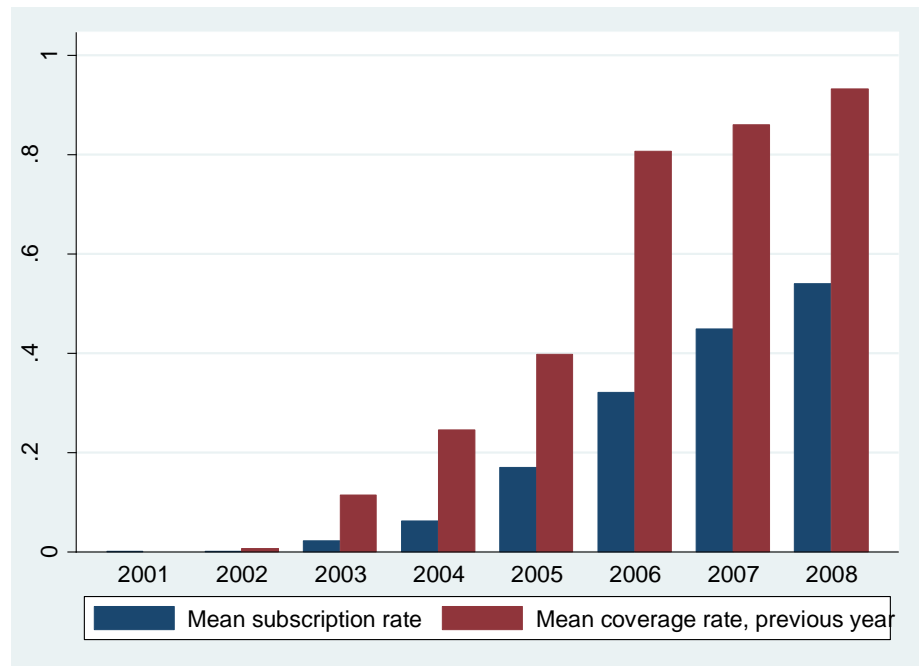


Figure 1. Internet subscription and coverage rates in Norway.

Demographically, internet has shown varying consumption preferences and usage between the different age segments. The age segments 16-24-years-old and 25-44-years-old were the most active users of the internet from 1997 to 2015, while the age group 67-79-years-old consistently lagged behind the younger segments (SSB, Vaage, O.F., 2015). Another finding is how the young adults prefer to read online newspapers - more so than the segment of older age. Interestingly, SSB's report "Kulturvaner 1991-2015" reveals little variation in consumers' choice of news channels: individuals with either higher or lower levels of education choose online newspapers as their main source of news content.

The emergence of social platforms such as MySpace and Facebook had a great impact on the Norwegian consumption pattern of internet usage, with 47 percent stating that they used internet for online communities in 2010 in contrast to only 13 percent in 2007 (SSB, Vaage, O.F., 2007, 2010). In 2014, 46 percent of the respondents stated they visited Facebook daily (Medienorge, Bjørnstad, N., Tornes,

K.A., 2014). Although online newspapers remain the most important provider of news for internet users, Facebook has become an increasingly important channel for news content, with 22 percent stating Facebook was the most important media for their news consumption (Medienorge, Bjørnstad, N., Tornes, K.A., 2014). This may suggest that, although the internet contributes to the consumption of entertainment and social media, it may still have an informative effect as a by-product of the social media.

Literature review

Numerous studies have investigated the implications of the introduction of new media sources such as newspapers, radio, TV and internet and their subsequent effect on voting turnout and policy efficiency. The effect of new media access is most easily measured by analysing the effects of the introduction, rather than the later phases. This has resulted in a large body of literature focused on the introduction phase of new media. In this section, we provide a literature review of related studies of the informational effects of media introduction on voters and subsequently policy makers.

Impact on voter turnout

Strömberg (1999) is the first study that identified the impact of media on voter turnout and policy making by exploiting regional differences in consumption of news. In particular, the author investigates the effects of the introduction of radio at a county level in the United States. A research question of the paper is whether the extensive radio distribution affected the dissemination of funds for a New Deal unemployment relief program that was implemented between 1933 and 1935. During that period, the share of households with a radio receiver ranged from 1 to 90 percent, creating necessary variation for identifying informational effects on the government spending. Strömberg (1999) finds that access to radio in fact increased the federal funding in the New Deal programs and voter turnout. The author finds that an increase in county radio penetration of 10 percent boosts voter turnout by 1.2 percent, with the increase in voter turnout particularly strong in rural areas where the lack of political information was present. The estimated effect on relief spending also increases with higher radio penetration, mainly that a one standard-deviation increase in the share of households with radio in a given county would cause the governor to increase relief spending by 9 percent per capita.

The research design introduced by Strömberg (1999) has been applied to numerous studies on the effects of new media sources initiation on voting turnout. An overview of the papers is presented in Table 1.

Poy & Schüller (2016) exploit a government funded internet roll-out and investigate the impact of high-speed broadband expansion (ADSL2+) on electoral turnout and political polarization in the Province of Trento - a region in Italy that already had full low-speed coverage (up to 2 Mbps) in 2010. The lack of guidelines provided by the local government made the timing of the treatment exogeneous of

regional differences such as socioeconomic characteristics, isolating the role of demand and supply factors in the targeted municipalities. Using the number of days of exposure to the high-speed internet as a treatment variable, the study finds a positive effect of ADSL2+ technology on voter turnout. This results suggest an increase in voter turnout by about 0.2 percentage points when the roll-out is introduced 90 days before the election. In the case when municipalities are exposed to the new technology for longer than 18 months, the positive effect of the internet access reveals a 3.3 percentage point higher increase in voter turnout.

In regards to our study, these results suggest we may expect to find a positive but delayed effect on voter turnout given by the introduction of broadband internet.

Similarly, Czernich (2012) investigates the introduction of DSL based broadband in Germany in 2005 and its impact on political participation in the German Federal Election (Bundestagswahl). The author finds support for a positive impact on voter turnout during the German Federal Election by an increase in the DSL rate for all OLS specifications, even when controlled for population, surface area, county level economic variables, and voter participation in the previous federal election. The study suggests that an increase in the DSL rate by 10 percentage points is associated with an increase of voter participation by 0.15 percentage points. Furthermore, due to the endogeneity concerns, Czernich (2012) takes an instrument variable approach, using the distance between the nearest distributional main frame as an instrument for DSL availability. However, the Durbin-Wu-Hausman test suggests that the OLS estimates are more efficient than the instrumental-variable ones.

Although the instrument-variable econometric specification was not chosen as the most efficient for Germany, this article shows that spatial differences in the media network can create an exogenous source of internet access variation. In relation to our study, the results from Czernich (2012) suggest we may find an increase in voter turnout by the introduction of broadband internet.

Table 1. Media impact on voter turnout: overview of studies.

Study (authors and year of publishing)	NewsSource (newspaper, radio, internet)	Election (county, election type, year)	Identification Strategy (specification and IVs)	Findings (sign of effect and significance)
Strömberg (1999)	Radio (access)	U.S. County election for office of governor, 1920-1930.	OLS, IVs: <i>Ground conductivity and Share of woodland</i>	Positive & significant
Poy & Schüller (2016)	Broadband Internet (ADSL2+ access)	Italian national elections for Chamber of Deputies, 2008-2013.	DiD, with pre-treatment placebo estimations.	Positive & significant
Czernich (2012)	Broadband Internet (DSL availability)	German federal election, 2005.	OLS, IVs: <i>Distance between municipality and mdf.</i>	Positive & significant
Tolbert & McNeal (2003)	Broadband Internet (access)	American presidential elections, 1996, 1998 and 2000.	LRM	Positive & significant for Presidential elections
Falck et al. (2014)	Broadband Internet (DSL availability)	German federal, state and local elections, 2004-2008.	OLS, with pre-treatment placebo estimations, IVs: <i>Distance between municipality and mdf.</i>	Negative & significant
Gavazza et al. (2015)	Broadband Internet (access)	UK local elections, 2006-2010	OLS IVs: <i>Rain and Relative Elevation.</i>	Negative & significant
Prior (2015)	Broadband Internet and cable TV (access)	American presidential and house elections, 1996 and 2000	OLS	Negative & significant for those with entertainment preferences

* Instrument variables are denoted by (IV), control variables are denoted (CV), OLS refers to Ordinary Least Squares regressions and LRM refers to Logistic Regression Model.

Using data from the 1996, 1998 and 2000 American National Election Studies, Tolbert & McNeal (2003) examine the impact of internet usage and access to political information on voter turnout. The authors find that internet access and election news online increased the probability of voting by an average of 12 and 7.5 percent for the years 1996 and 2000, respectively. The positive result for presidential elections suggests that internet connection may provide individuals with greater access to political information, which in turn stimulates increased turnout. The findings are supported by empirical observations: respondents who state that they view election information online are found to be more likely to report voting. For the 2000 elections, the coefficients for both viewing online news and internet access are positive and significant, and almost twice those of 1996, which the authors argue is due to the growing size of the population with internet access. However, for the 1998 midterm election the Internet News variable is not found to significantly explain the voting, suggesting that internet access has limited impact on elections of lower interests.

This result suggests that we should find a stronger impact on national level voter turnout than for municipality level elections.

The impact of internet access is, however, ambiguous. A study by Falck et al. (2014) provides a contrasting result to the aforementioned papers. This study finds that increased internet availability may in fact have a negative impact on voter turnout. Falck et al. (2014) explores the impact of broadband internet on voting behaviour in Germany within the period 1995-1999, for three levels of government. Firstly, for the national election (*Bundestagswahlen*), secondly, for the state elections (*Landtagswahlen*), and finally, for municipality level election (*Kommunalwahlen*). Comparing the pooled voter turnout in this period with the pre-internet election cycle 1990-1994, the authors find a small and statistically significant negative effect of internet access on voter turnout. However, only for national elections.

Falck et al. (2014) suggest that different implications of broadband internet for local and non-local elections can be explained by a crowding-out effect of other informative media. They find that this crowding-out effect appears during national elections, but not during local elections. In order to test these hypotheses, the authors regress the respondents' intensity of TV consumption on their intensity of the internet consumption and find a positive and significant relation. In contrast,

while regressing newspaper consumption on online news, the Falck et al. (2014) finds that in municipalities with high DSL-availability, national newspaper consumption declines at higher pace than the consumption of local newspapers. This suggests that the introduction of broadband in Norway could give a dual result for national and local elections, where voter turnout at the national level could decrease, and remain unaffected for municipal elections.

Prior (2015) investigates whether access to new media can have negative impact on knowledge and voter turnout for individuals who prefer entertainment content rather than news and positive impact on those with preferences for news. Using the 1996 and 2000 American National Election Studies and the Media Consumption Surveys for 1996, 1998 and 2000, Prior develops measures of people's relative preferences for entertainment over news along with respondents' political knowledge as the ability to recognize election candidates. The study found evidence that having cable TV access or connection to both cable TV and the internet lowered individuals' political knowledge for respondents with entertainment preferences.

This result implies that the informational effects on voters caused by increased internet depend on the content preferences of individuals and information of their preferences is therefore necessary in order to determine the resulting effects on voter turnout. An important question related to our study therefore become how people in Norway use internet. In order to account for the heterogeneity of consumption among different demographic groups, we distinguish the impact of broadband internet by investigating the implications for different age groups and socioeconomic factors.

Impact on government efficiency

Bruns & Himmler (2012) investigate the role of newspaper circulation on municipality level efficiency in Norway, where efficiency is measured by a public sector efficiency index provided by Borge et al. (2008). The study finds evidence in support of that higher circulation of local newspaper in a municipality is associated with more efficient service provision and that this connection is larger for small and non-central municipalities. The data suggests that a one standard deviation increase in newspaper circulation increases efficiency by 0.8-2.9 percentage points. Although this study investigates the introduction of newspapers,

it highlights the potential efficiency gains of media introduction, and a positive impact for government efficiency as a result of broadband introduction.

Snyder & Strömberg (2010) study whether newspapers' coverage of politics impacted voter turnout and policy efficiency of U.S. Congress. The paper stands among similar studies as it aims to identify a causal relationship throughout the sequential impact of newspapers on policy efficiency. In particular, whether congruence increases newspapers' coverage of politics, makes voters better informed and thereby encourages house representatives to produce better policy for their constituencies. The authors distinguish between increased general newspaper coverage and coverage of congressional politics by measuring the congruence between the media markets and political districts. They argue that in the case of the U.S, a better match between the media markets and political districts increased the coverage of congressional politics. These findings related to federal policy efficiency and voter turnout are of particular interest for our thesis. Snyder & Strömberg (2010) use the Consolidated Federal Funds Report which contains federal expenditure allocation information across counties and measured the policy efficiency by the representatives' ability to obtain more federal funds for their district. The authors find that a one standard deviation increase in congruence raises the number of articles written about the House representative by 50 additional items, increases voters' ability to correctly name the candidates for House by 10 percent, and finally, enlarges federal spending per capita by 3 percent. Although these resulting coefficients are not large, they support the role of an active press for the monitoring ability of voters.

Impact on political polarization

As a complementary part of our study we evaluate the impact of internet as a new source of information for political polarization. Lelkes et al. (2015) investigates the effect of access to broadband internet for polarization and finds support of broadband availability increasing partisan hostility. The authors argue that the underlying mechanism behind this polarization effect of internet access follows from increased exposure to partisan information. Using microdata from 2004 containing browsing data of individuals in the U.S. and a browsing list of 400 popular news websites the authors find support the argued mechanism, finding that democrats were far less probable of choosing a conservative media source, and vice versa.

Research design and methodology

The thesis aims to study whether internet access has a significant impact on voter turnout and thereby government efficiency at municipal level in Norway. The first causal effect of broadband introduction is either an increase or decrease in voter turnout during elections. The second causal effect of internet access is either an increase or decrease in government spending on medical, educational and social services. We argue that these two causal effects of interest can be explained by the relative amount of news and entertainment that become available online for potential voters. For that reason, an ideal experiment for our study would involve a random assignment of broadband internet subscription (Angrist and Pischke, 2008). However, since we cannot allocate subscriptions to people, nor prevent them in obtaining internet access, our best option is to mimic the ideal experiment by employing a quasi-experiment.

Bhuller et al. (2013) investigate an impact of internet introduction on sex crimes in Norway by exploiting exogenous variation in broadband access. Among features of the Norwegian internet provision program that contributed to the high deviations in broadband access across the municipalities were lack of public investments, low population density and the requirement to ensure internet connection for public institutions. In particular, the authors argue that broadband coverage rates were most likely to represent outcomes of the requirement to provide internet to public institutions. Despite this observation, Bhuller et al. (2013) look at a variety of supply and demand factors that can drive the roll-out program, undermining the assumption of randomness. The supply-side determinants are related to the internet network and infrastructure of the municipalities. These variables are also used for extracting exogenous internet variation in studies such as Strömberg (1999), Czernich (2012), Falck et al. (2014) and Gavazza et al. (2015). The demand-side factors include measures that identify the level of regions' development and public expenditures on administrative, educational and medical needs.

The identification strategy of this thesis is aimed to deal with the main endogeneity concerns described in the previous studies: omitted variable problem and simultaneity. Difference-in-difference (DiD) analysis and instrument variable (IV) setup are among the most widely-used methods in the reviewed literature. The former helps to utilize differences in treatment effect across regions, the latter

provides an instrument to eliminate causal effect of the dependent variable on a regressor. The main mechanism of our interest is split into two parts as in the research design suggested by Gavazza et al. (2015). The first model addresses the effect of internet access on voter turnout which can be interpreted as a proxy variable that represents to what extent people are interested in the local elections participation. The second model investigates the effect of internet access on the local government efficiency and therefore provides the main results of our paper (Figure 2). We expect that the introduced setup is the most suitable for our research question since it provides the most accurate implications for government efficiency given by internet access. Links between these models bring additional information about the degree to which people consider voting during the elections as a tool to influence government efficiency.

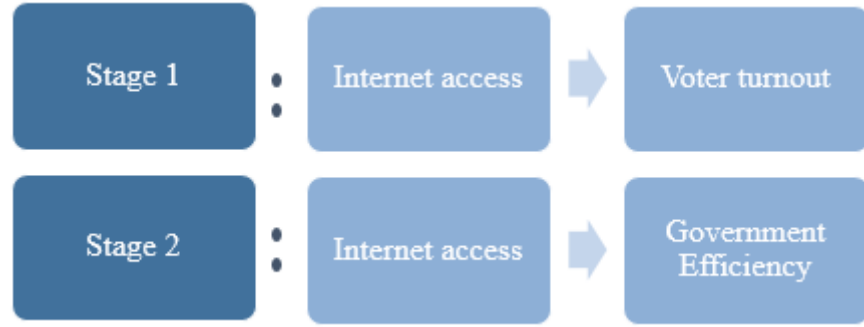


Figure 2. Research design overview.

Since the internet data is similar to those used in Bhuller et al. (2013), we employ the two-stage least squared (2SLS) estimation method as suggested by the authors. The first stage is given by the regression of internet subscription rates on the instrument variable - internet coverage rate in (2), the second stage - by the standard DiD regression with the predicted values of internet subscription rates (1). Internet coverage rate in the previous year z is our instrument variable that helps to extract exogenous component of the variation of internet subscription rates i . The model also includes a vector of time-varying covariates x' , which control for other factors that can impact voter turnout or local government efficiency, and subscripts k and t that denote municipality and year, respectively.

$$g_{kt}^* = \delta i_{kt} + x'_{kt} \beta + \alpha_k + \tau_t + \varepsilon_{kt} \quad (1)$$

$$i_{kt} = \varphi z_{kt-1} + x'_{kt} \lambda + \gamma_k + \theta_t + \eta_{kt} \quad (2)$$

* g denotes local government efficiency in the second model and voter turnout in the first model of the research design.

One can also argue the importance of including fixed time and state effects (α and γ , τ and θ , accordingly) into the model. The former effects appear due to the differences in the timing in broadband internet roll-out and therefore absence of a common post-treatment period. The latter effects are needed since many municipalities are involved in causal comparison (Angrist & Pischke, 2015). Therefore, the time effects help to control for general trends in Norway while the state effects - for fixed differences between the municipalities, ensuring minimization of the omitted variable bias (Woodridge, 2013).

Research design implemented in this thesis exploits the differences in internet user rates across Norwegian municipalities instrumented with internet coverage rates. An important requirement behind this type of econometric analysis is a common trends assumption. This condition implies that pre-treatment trends of the outcome in the treatment and control groups are parallel, referring to municipalities with internet access and without. However, since our sample includes a lot of observations, it is plausible to relax the common trends assumption. In particular, if there is no evidence of the parallel pre-trends across municipalities before the internet roll-out, state-specific parameters can be added to the model. Nevertheless, since the broadband technology was gradually implemented, it can be hard to capture the treatment effect if there are different pre-trends in the sample (Angrist & Pischke, 2015).

As previously mentioned, an ideal experiment would apply a randomized sample. To best mimic such an experiment, the empirical approach is based on an IV setup. The IV represented by internet coverage rate should satisfy three assumptions revealed in Angrist & Pischke (2015): to have causal effect on the internet subscription rates, to be as good as randomly assigned, and to meet an exclusion restriction. To control for these requirements, we plan to check if impact of the IV is significant during the first stage of the 2SLS estimation method, if supply and demand covariates do not correlate with internet roll-out, and if internet coverage rates do not impact the dependent variables in other ways than through the subscription rates. In addition, we plan to perform a number of sensitivity checks. Some of them can validate exogeneity of the chosen IV by estimating the level of a selection bias created by the Norwegian government during the internet roll-out. Ideally, municipalities who receive government support at any point of time should not significantly differ from those who are still waiting for funds

(Angrist & Pischke, 2015). Bhuller et al. (2013) find several deviations in the data from this assumption: broadband expansion is correlated with variables such as education, population size and density, however, only at the beginning of the governmental internet program, before 2003.

Data

The data we employ in our analysis consists of three sets of information. First of all, internet database features internet subscription rates and internet coverage rates used in Bhuller et al. (2013), as well as socioeconomic characteristics. The former internet statistics is gathered by the Norwegian Ministry of Government Administration, the latter - by the state-owned enterprise Telenor, which is the main internet provider in Norway. Secondly, local and national government turnout estimates come from a local government dataset (Fiva, Halse, and Natvik 2015), which also contains different socioeconomic indicators. Thirdly, a government efficiency measure is represented by the production index introduced by Borge et al. (2008) and provided by the author. All data is collected at yearly basis over the period from 2001 to 2008, excluding Norwegian municipalities that were reformed.

As previously described, the research design of our thesis explains two causal effects that are subsequently represented by two econometric models. Our research is based on two panel datasets that differ in size, and we therefore provide summary statistics for both samples, as presented in Table 2 and 3. The first sample includes data for local voter turnout estimates, the second one - for the production index. One weakness of the second dataset is that there are a lot of missing values of the production index that measures local government efficiency (only 2,894 out of 3,376 observations contained in the first model). For that reason, we decided to reduce the second sample by cutting those municipalities that lack values for 4 years or more. All in all, the first dataset includes 422 municipalities over 8 years which gives a total of 3,376 observations, while the second dataset includes 394 municipalities and comprises a total of 3,152 observations.

As shown in the tables with the summary statistics, internet coverage rate has higher standard deviation than internet user (subscription) rate, proving that the broadband roll-out in Norway was implemented gradually. Voter turnout in the first model varies much less than the production index in the second model, standard deviation is 0.057 and 15.615, respectively. In addition to the main variables of interest, a set of municipal level socioeconomic characteristics is included. Among them are the total number of inhabitants in a municipality, their average age of education (beyond 9 years of compulsory schooling), average household after-tax income, unemployment rate for population aged 16-59, poverty rate and population share in urban residence as a centrality indicator. In addition, a set of controls

related to the political polarization are included. Variables such as share of votes and seats received by left- and right-wing parties can take into account changes in policy programs that may impact local government efficiency as well as voters' preferences during the elections.

Table 2. Summary statistics for stage 1 of the study.

Stage 1: Impact on voter turnout (N=3,376)	Mean	Std. Dev.	Min	Max
Internet user rate (per capita, at the start of year t)	0.196	0.217	0.000	0.880
Internet coverage rate (per capita, at the start of year t-1)	0.420	0.413	0.000	0.998
Voter turnout (local elections)	0.620	0.057	0.453	0.824
Population	10815.000	31283.330	444.000	560484.000
Education	2.595	0.452	1.055	4.793
After-tax income	160302.9	24188.900	-7016.893	442629.100
Unemployment rate	0.013	0.007	0.001	0.0625
Poverty rate	0.039	0.012	0.009	0.184
Centrality indicator	0.500	0.277	0.000	0.996
Share of votes received by left-wing parties	0.375	0.140	0.000	1.000
Share of votes received by right-wing parties	0.543	0.176	0.000	0.941
Share of seats won in the last election by left-wing parties	0.377	0.144	0.000	1.000
Share of seats won in the last election by right-wing parties	0.543	0.179	0.000	0.947

Table 3. Summary statistics for stage 2 of the study.

Stage 2: Impact on govern. efficiency (N=3,152)	Mean	Std. Dev.	Min	Max
Internet user rate (per capita, at the start of year t)	0.199	0.218	0.000	0.880
Internet coverage rate (per capita, at the start of year t-1)	0.425	0.413	0.000	0.998
Production index (N=2,894)	109.579	15.615	12.300	182.000
Population	11411.280	32268.470	499.000	560484.000
Education	2.613	0.444	1.525	4.793
After-tax income	160687.400	24261.800	-7016.893	442629.100
Unemployment rate	0.013	0.007	0.002	0.063
Poverty rate	0.039	0.012	0.009	0.184
Centrality indicator	0.515	0.271	0.000	0.996
Share of votes received by left-wing parties	0.377	0.139	0.000	1.000
Share of votes received by right-wing parties	0.549	0.167	0.000	0.941
Share of seats won in the last election by left-wing parties	0.379	0.143	0.000	1.000
Share of seats won in the last election by right-wing parties	0.548	0.171	0.000	0.947

Plan of the research completion

After delivery and presentation of our preliminary master thesis, we will initiate the first econometric analysis and hope to have our first basic models constructed by the end of February. These models are the same as those sketched out in the research design section above. We expect this period to be highly instructive in terms of the econometric approaches of DiD and IVs. Additionally, by the end of February, we aim to have completed our search for data, added possible useful control variables and potential (demand and supply driven) covariates of internet access.

In April, we expect to finalize our initial econometric analysis and run the supplementing sensitivity tests discussed previously. By this time, we aim to have produced a first complete draft of our thesis which we intend to handover to our supervisor for review and feedback. This feedback will be central for our subsequent work in late June and early July.

The month of June will mostly be used to expand on our existing preliminary thesis and supplement it with the results of our analysis. These results will be related to the following causal effects: firstly, impact of broadband internet introduction on voter turnout, and, secondly, impact of broadband internet introduction on local government efficiency. Once we obtain empirical results, we proceed by comparing them to the similar empirical models and findings for other countries. This should prove fruitful for future studies, making the thesis a dissent contribution to the field of study. We expect to extend some of this work into the beginning of July.

By mid-July, we plan to have completed a final first draft of our master thesis, using the remaining part of July for text editing and necessary corrections suggested by our supervisor.

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