BI Norwegian Business School - campus Oslo

GRA 19502

Master Thesis

Component of continuous assessment: Thesis Master of Science

Does Internet Usage Impact Voter Turnout?

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Start:	02.03.2017 09.00
Finish:	01.09.2017 12.00

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Hand-in date:
31.08.2017

Programme:
Master of Science in Business with Major in Economics

CONTENT

Abstract

This master thesis explores the effect of internet usage on political participation and voters' political preferences, as measured by voter turnout and party vote shares. We conduct a two-stage least squares analysis within a fixed effects framework. The main results suggest a positive and significant effect of internet usage on voter turnout. The subsequent findings indicate a positive and significant effect of internet usage on vote shares of small parties and local list candidates, which do not belong to either left-wing or right-wing party blocs. However, placebo tests suggest that the identification strategy may not be the best fit for the voter turnout data. The results for political participation may be biased by the correlation between the instrument variable and underlying municipality-specific trends in the voter turnout. The bias does not appear to be present in the data for vote shares of small parties and local lists. A reasonable interpretation of these findings is that the internet roll-out programme of 2001 to 2008 was particularly beneficial in bringing attention to political parties of smaller size and individual politicians.

Acknowledgement

This thesis was written as a final project of our Master of Science in Business at BI Norwegian Business School. The thesis is written in cooperation with Jon Fiva, whom the authors would like to thank for his rewarding supervision and support. Thanks to Jo Saglie and Johannes Berg from the Institute for Social Research, Christopher Ongre Autzen at the Norwegian Social Science Data Service and Rune Sørensen for their assistance in collecting the survey data.

The authors would also like to show their sincerest gratitude to Manudeep Bhuller, Tarjei Havnes, Edwin Leuven and Magne Mogstad who took it upon themselves to provide new researchers with access to valuable internet data and sample codes.

Special thanks to Bendik Engebretsen and Carmen Cornejo, who have contributed with constructive feedback.

The authors would also like to express their thankfulness to their families, friends and colleges for support and understanding.

1 Introduction

Political participation in the electoral process is of great importance for the strength of democracy. The lack of participation from the population or its subgroups can have negative consequences for the legitimacy of the democracy (Regjeringen, 2015a). Potential drivers of political participation could be of great interest for policy makers. Numerous studies have uncovered that factors such as gender, age and ethnicity affect voter turnout (Wolfinger & Rosenstone, 1980). Other influencing factors include citizens' level of education, financial security and political interest (Wolfinger & Rosenstone, 1980; Rosenstone, Rosenstone & Hansen, 1993). One potential driver of voter turnout which has been recently discovered is the emergence of new media sources such as newspapers, radio, television and internet (Snyder & Strömberg, 2010; Strömberg, 2004; Gentzkow, 2006; Tolbert & McNeal, 2003). The primary objective of this thesis is to investigate whether internet usage could motivate citizens to vote during elections in Norway.

1.1 Motivation of The Study

There are several reasons that motivate us to investigate the effect of internet usage on voter turnout in Norway. First, we find the study of internet particularly interesting due to the complex nature of this communication technology. Internet affects society through a number of informational and communicational channels, making it difficult to distinguish the pure effect of internet on voter turnout. Secondly, there is no conclusive evidence on whether internet has a causal effect on political participation. Numerous international studies find either a positive, negative or non-significant effect of internet access on political participation. The ambiguity of the findings illustrates the research potential within this field of study. Thirdly, As the effect of internet on voter turnout remains largely unexplored within the Norwegian context, this thesis contributes to the body of existing literature with a Norwegian perspective.

Due to the Norwegian government's initiative of expanding the country's broadband network in 1999, Norway is particularly well-suited for the study of the effect of internet usage. The internet roll-out programme provided municipal authorities with additional funds for broadband investments which caused a rapid expansion of broadband internet across Norwegian municipalities. The establishment of DSL access nodes across the country was quickly followed by

citizens' adoption of internet. This is supported by our initial survey analysis, which shows that internet was increasingly used to obtain election-relevant information from 2003 to 2009.

1.2 Hypotheses and Empirical Evidence

Two hypotheses are assessed in the thesis. The first hypothesis states that internet usage has a causal effect on voter turnout. Empirical evidence on internet introduction suggests that the causal effect could be either positive or negative. On the one hand, Tolbert & McNeal (2003) find that internet access increases voter turnout during the U.S. presidential elections. Czernich (2012) also presents evidence that internet access has a positive effect on voter turnout in the German federal elections. Furthermore, Poy & Schüller (2016) identify a positive effect of internet access on political participation during the Italian national elections. On the other hand, Falck, Gold & Heblich (2014) find that broadband introduction in Germany has a significantly negative effect on voter turnout during the federal and state elections. Hence, the existing studies provide contradicting evidence on what effects internet should have on voter turnout.

The second hypothesis states that internet usage has a causal effect on vote shares of parties. DellaVigna & Kaplan (2007) are among the studies who find that there is an impact of new media introduction on vote shares of parties. The authors identify that the entry of the conservative channel *Fox News* into the cable TV market caused a gain in vote shares of the Republican party during the U.S. presidential and Senate elections. Furthermore, Falck et al. (2014) find a positive effect of internet introduction on vote shares of small parties. Poy & Schüller (2016) also identify that center-left parties together with far-right parties benefit from internet introduction, while center-right parties experience a decrease in their vote shares. Therefore, the existing literature gives no clear indication of what parties should gain the most from internet introduction.

1.3 Outline of The Study

The identification strategy of the thesis takes the two-stage least squares approach introduced by Bhuller, Havnes, Leuven & Mogstad (2013). We instrument internet usage with the internet coverage in order to retain only the variation in the internet user rate which is generated by the broadband roll-out programme. The model specifications include both time and entity-specific fixed effects.

For the first hypothesis, we find that an increase of 10 percentage points in the internet user rate results in an increase by half a percentage point in voter turnout. We argue that the positive effect follows from the exposure to political information online which increases voters' political knowledge and ability to participate in elections. For the second hypothesis, the results suggest that increased internet usage benefits other parties that cannot be classified as either left-wing or right-wing parties. The vote shares allocated to other parties increase by 2.49 percentage points if the user rate increases by 10 percentage points. We argue that internet usage increases the voters' exposure to small parties and local lists that would otherwise not receive similar coverage in traditional media.

The coefficient estimates are statistically significant and remain insensitive to both socioeconomic and service provision controls. The stability of the coefficients strengthens the credibility of our findings. However, placebo tests suggest that the identification strategy may not be the best fit for the voter turnout data. The results for political participation may be biased by the correlation between the instrument variable and underlying municipality-specific trends in the voter turnout. The bias does not appear to be present in the data for vote shares of small parties and local lists. A reasonable interpretation of these findings is that the internet roll-out programme of 2001 to 2008 was particularly beneficial in bringing attention to political parties of smaller size and individual politicians.

This thesis is organized as follows: section 2 presents the internet roll-out programme introduced in Norway, the institutional setting of the Norwegian election system, as well as some initial evidence of individuals' internet usage. Section 3 provides a review of related studies regarding the effect of new media introduction on political participation and voters' party preferences. Then, in section 4, we present the data foundation applied in this study and outline central variables for the following analyses. Section 5 describes the identification strategy employed in this thesis. In section 6, we discuss results and sensitivity checks. Finally, in section 7, we summarize our findings and conclude our study.

2 Institutional Setting

In this section, we introduce three elements that provide the foundation for our analysis of the impact of internet usage on voter turnout as well as voters' political preferences. Section 2.1 presents a policy initiative that mobilized the development of broadband infrastructure in Norway. We outline crucial features of the internet roll-out programme, in part by analysing the actual broadband data. Section 2.2 describes the institutional framework of national and local elections in Norway as well as political parties represented during the elections. In particular, we focus on the distribution of power and responsibilities between central and municipal authorities. In section 2.3, we investigate the Norwegian election surveys. The analysis gives some initial evidence of the covariation between internet usage and voter turnout, which we hypothesise is due to the informative channel provided through internet access.

2.1 The Introduction of Broadband Internet in Norway

A well-developed broadband infrastructure is argued to be of great importance for economic and social development, as it contributes to acceleration of economic growth, social development and innovation (Organisation for Economic Co-operation and Development, 2003). In 2004 the OECD Council put in place a set of recommendations to enforce policy principles that motivated expansion of broadband internet in the organisation's member states (OECD, 2004).

In Norway the same policy focus manifested itself through a National Broadband Policy initiative (St.meld.nr. 38, 1997-1998). The initiative was set out to develop a plan of actions securing the development of information technology (IT) competence across the country, since IT was seen as fundamental for the creation of new working opportunities. The government found that the IT-competence dominated in the central region of Oslo and Akershus, while it remained relatively scarce in decentralized areas such as the northern part of Norway (St.meld.nr. 38, 1997-1998). Therefore, one main target of the initiative was to ensure broadband access to every household and private enterprise at a reasonable and uniform price. At the same time, 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).

In order to achieve the goals of the National Broadband Policy initiative, the

government established a grant programme *Høyhastighetskommunikasjon (Høykom)* in 1999. The programme provided funding for public sector broadband projects and aimed to increase the national offering of broadband communication. *Høykom* also gave additional funding for regions where commercial investment had failed in developing broadband infrastructure. With help of the Høykom-distrikt programme, rural municipalities had an opportunity to quickly develop broadband internet access, which they otherwise would not be able to obtain. Since broadband internet was a relatively unknown term for most Norwegians in the late 1990s, the government had to persistently motivate municipalities to apply for the grants (Bothner, 2013). The grant programme was administered by the Norwegian research board *Norges Forskningsråd*, who received guidelines for the allocation of funds from the parliament, yet, without any clear criterion for the evaluation of grant applications (Finne, Ekeland & Stokke, 2004). The programme was so successful in motivating municipalities to apply for such investment grants, that there were more applications for the grant support than the available funding could cover (St.meld.nr. 49, 2002-2003).

The DSL-network access points were progressively installed by the Norwegian government, as can be seen by the gradual increase in the broadband coverage rate from 2001 to 2007 (Figure 1, left panel). The mean coverage rate grows with a relatively constant pace from 2001 to 2004 and doubles from 2004 to 2005, reaching 81 percent coverage in 2005. From 2005 to 2007 the growth rate remains low and relatively constant, resulting in the mean coverage rate of 93 percent in 2007. Due to the restricted funding and topographic features of the Norwegian landscape, municipalities received broadband access at different points in time. From 2000 to 2002 the central mass of the variation as well as whisker-to-whisker spread is zero (Figure 1, left panel). The median coverage rate goes from 0 percent in 2003 to 32 percent in 2004, before reaching 84 percent in 2005. The greatest variation in coverage rates across municipalities occurs in 2003 and 2004, as can be seen by the upper and lower quartiles of the boxes. Starting from 2005 the median coverage rate increases at a slower pace than in the previous period, and the variation in internet coverage gradually diminishes. DSL-technology remained dominant in the period 2000-2008 despite the emergence of new broadband technologies such as ADSL2+ and fiber-based connections (Post- og teletilsynet, 2011).

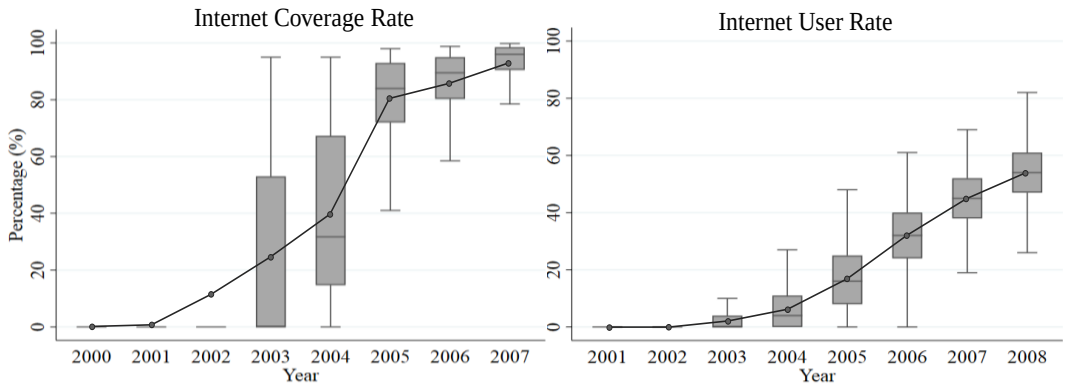

Figure 1. Box-and-whisker plot and yearly means of internet coverage rates (left panel) and internet user rates (right panel) across municipalities (2000-2008).

Note: The boxes illustrate the upper and lower quartiles (25 percent) of the data, with the median value given by the intersecting horizontal line. The whiskers illustrate the greatest and smallest values excluding the dotted outliers.

The internet user rate is measured as the percentage of households with broadband subscriptions. In contrast to the coverage rate, which was driven by the investment programme, the user rate captures the citizens' interest in broadband consumption. As seen by Figure 1 (right panel), internet usage increases with quite some delay after the internet coverage rate. In 2003 only 2 percent of Norwegian households have a broadband subscription, while in 2006 and 2008 the mean user rate equals to 32 percent and 54 percent, respectively. The mean internet usage has a constant growth pace without any substantial leaps from 2003 to 2008. Over the period the central mass of the variation in the user rate does not change considerably, and the median values of the internet usage correspond to its means.

2.2 The Norwegian Electoral System

The Norwegian government consists of a centralized national government and a local government with elections being held every second year, alternating between parliamentary elections and local elections (Regjeringen.no, 2017). The local government is characterized by a two-tier system, consisting of both municipal- (kommunestyret) and county-level authorities (fylkesvalget). The Norwegian parliament is elected according to the principle of proportional representation, where 169 parliament seats are allocated to reflect the vote share obtained by the candidates or their respective parties within the 19 election constituencies (counties) (Regjeringen.no, 2017).

Out of 169 representatives 150 are elected as representatives of their election

constituencies. The number of representatives from each constituency in parliament depends on the number of residents and the geographical size of the constituency. In order to ensure that rural citizens are fairly represented, rural areas are given more parliament seats per citizen than voters in more populated areas such as Oslo and Akershus (Regjeringen.no, 2017). The remaining 19 seats are allocated to contribute to a fair representation of small parties in the parliament. If parliament seats were allocated purely on the vote count of each election district, then the seat allocation would not accurately reflect the national vote count of parties (Stortinget.no, 2017).

Similarly to the parliamentary voting system, the county and municipal election systems also allocate seats according to the proportional representation (Regjeringen.no, 2017). During the local elections, representatives are elected for the municipal council and the county council, which are the highest orders of government at municipal and county levels, respectively. In most municipalities, the council elects an executive board (formannskapet) which has to consist of five council members and reflect the proportional composition of the municipal council (Nasjonal Digital Læringsarena, 2017).

The establishment of local government made counties and municipalities responsible for a broad range of welfare services, increasing their role in the everyday life of citizens. By European standards, the Norwegian municipalities carry a greater share of the responsibility for the welfare of its citizens compared to its European counterparts (NDLA, 2017). The municipality sector is responsible for administration of a large share of the country's economic resources. Municipalities' revenues made out 18 percent of mainland GDP in 2015, with every fifth employee working in the public sector (Regjeringen.no, 2015b). For the most part, municipalities' revenues consist of three main sources of funding: government grants, user charges and local tax revenues. Government grants that are not for predetermined allocation, as well as local tax revenues, constitute free revenues. The free revenue can be freely allocated towards the public service of the municipality's choice (Regjeringen.no, 2015b).

From 2002 to 2005 free revenue as a share of the total municipality revenue fell from 75 percent to 68 percent. Between 2006 and 2010 the percentage share of free revenue stabilized at approximately 67 percent of the total municipality revenue (Regjeringen.no, 2016). Still, the parliament practices considerable

influence on the municipal operations through its role as a financier. While the local authorities are responsible for the service provision within the respective regions, it is the parliament that determines grant policies, minimum requirements for public services and municipalities' opportunities to acquire funding through tax policy (Melbye, 2012).

As can be seen from Figure 2, between 1973 and 1989 national turnout is approximately 81 percent, while from 1993 to 2013 the level is approximately 76 percent. Between 1971 and 1983 the local turnout is equal to 73 percent on average. Starting from 1987, less and less citizens are participating in local elections. The lowest level of the local turnout is around 61 percent in 2003. From 2003 to 2013 there is an increase in number of people participating in local elections, with voter turnout increasing from 60 to 65 percent. Hence, voter turnout has consistently been higher for national elections than for local elections, suggesting that voters are more willing to participate in national elections than in local elections.

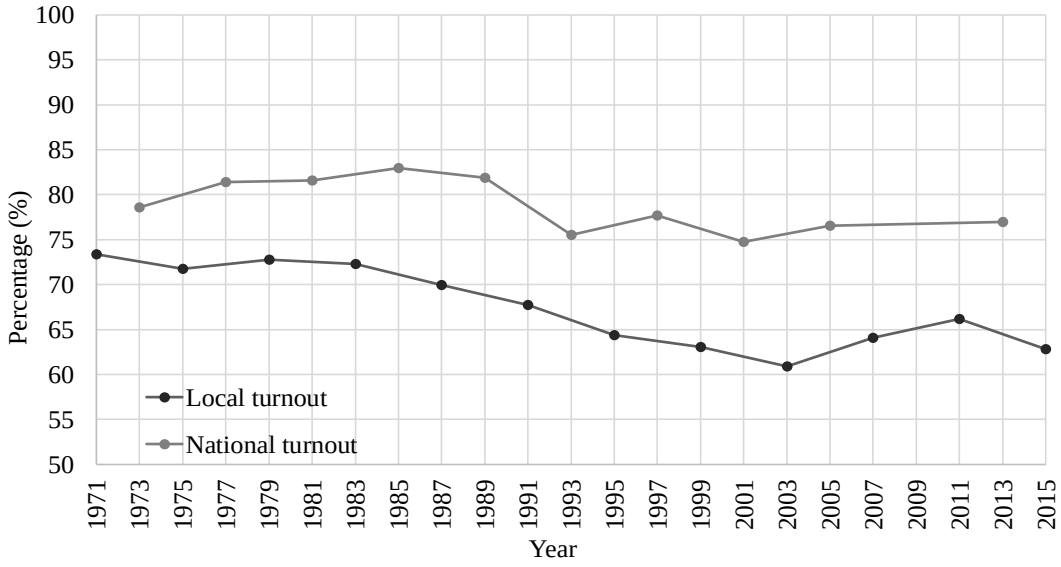

Figure 2. National voter turnout and local voter turnout (1971-2015).

The Norwegian political landscape consists of two major ideological blocs, a social democratic left-wing bloc and the more conservative right-wing bloc (Andersen, Fiva & Natvik, 2014). The blocs are equally dominant both during national and local elections. The emergence of national political parties in local politics has become increasingly apparent in Norway (Østerud, Engelstad, Selle & Makt- og demokratiutredningen, 2003). In addition to the two major blocs, several small parties participate in both national and local elections. For the most part, small parties represent interest of small groups of citizens and have narrower policy programmes than the traditional parties (Kvelland, 2015). Small parties typically

build their political agenda around one specific policy goal, which is the core pillar in all their political programmes. Among the small parties that participate at the national elections are *The Political Party (Det Politiske Parti), The Coast Party (Kystpartiet), The Retirment Party (Pensjonistpartiet), The Christian Union Party (Kristent Samlingsparti), The Workers Communist Party (Arbeidernes Kommunistparti), The Liberal Party (Det Liberale Folkepartiet), The Democrats (Demokratene)* and *the Green Party (Miljøartiet de Grønne)*. These parties campaign policy goals such as: reduction of international trade agreements, care for retiree and special needs citizens, protection of the Christian values in the society or promotion of environmental issues. Other small parties front even more niche interests such as the reduction of toll plazas, liberalization of alcohol tariffs or protection of native rights.

In addition to the two major policy blocs and small parties, voters can choose to elect local list candidates during the local elections. Local lists consist of political groups that address some specific local issues rather than the broad political programmes of the traditional parties. Local lists are largely non-partisan and are seen as the alternatives to the political parties that have emerged in local politics. Local list candidates receive a small but fairly stable share of votes in the local elections (Aars & Ringkjøb, 2005). The local list candidates are particularly favoured among municipalities with small population size. Skare (1996) finds that voters in small municipalities are more oriented towards individual candidates and less towards parties.

As can be seen from Figure 3, right-wing and left-wing parties receive the largest shares of votes during both national and local elections. Right-wing parties on average gain a larger share of votes than left-wing parties. Contrarily, other parties (which consist of local list candidates and small parties) gather significantly fewer votes than the traditional parties both during national and local elections.

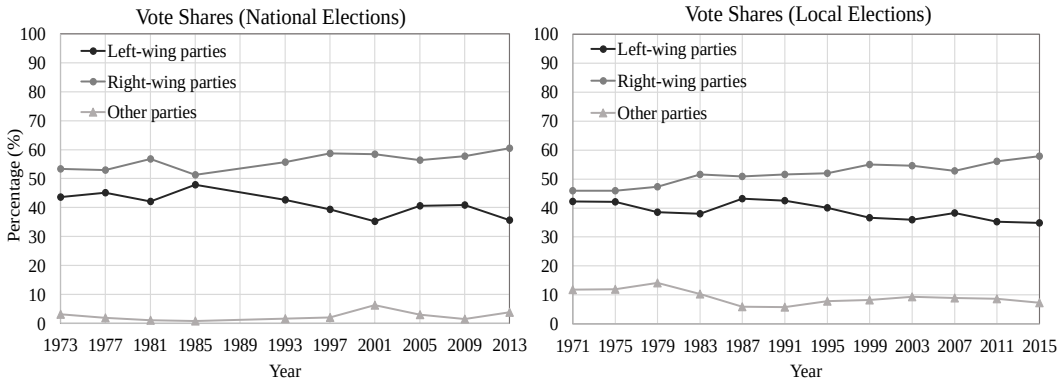

Figure 3. Vote shares during national (left panel) and local elections (right panel).

2.3 Election Survey

In this section, we explore characteristics of Norwegian citizens by analysing election surveys associated with national and local elections in Norway *(Valgundersøkelsen* and *Lokalvalgsundersøkelsen)* from 2003 to 2009. The surveys are conducted by *Statistics Norway (SSB)* on behalf of the institute of Social Science Research and outline the public's views of the electoral process and political matters. The surveys from 2003 to 2009 are of great value for our research, as they correspond to the period of the internet introduction and may provide useful insights into citizens' internet habits and political behaviour. We are particularly interested in analysing internet usage over time and across groups of respondents who did and did not participate (voters and non-voters) in the elections.

We conduct a pivot chart (or cross tabulation) analysis that allows us to evaluate the set of individual responses. A pivot chart is a two (or more) dimensional table that records the number of respondents that have specific characteristics described in the cells of the table (Qualtrics, 2011) The data is split into two groups of municipalities – small municipalities with population size equal or below 20,000 inhabitants and large municipalities with more than 20,000 inhabitants. A detailed overview of the data sorted by strata is displayed in Appendix B. The analysis gives an initial impression of possible linkages between internet usage and voter turnout. However, in order to distinguish a pure effect of the introduction of broadband access points on voter turnout, more advanced statistical techniques are required. These statistical techniques rely on actual voter turnout rather than self-reported political participation and take into account the selection bias caused by differences in factors such as socioeconomic features of municipalities. A more in-depth description of our identification strategy is presented in section 5.

We begin with an analysis of surveys associated with the local elections of 2003 and 2007. The local surveys ask respondents how often they search for election-relevant information on internet in a given year. The respondents of the local surveys could describe the frequency of their internet searches as "never", "rarely" and "weekly". In this part of our study, we focus on the latter, "weekly", reply and regard it as "often searching on internet". Furthermore, the respondents are asked if they voted during the respective election, which helps us to identify groups of voters and non-voters. Figure 4 illustrates percentage shares of voters and non-voters who often search for election-relevant information on internet.

We note three specific observations from the local election surveys. First, citizens of small and large municipalities do not differ considerably in their frequencies of searching for election-relevant information on internet. Secondly, voters are more likely to self-report frequent searching for election-relevant information online than non-voters, which is well-aligned with the argument that internet introduction could motivate political participation. The pattern holds for both small and large municipalities. Finally, from 2003 to 2007 the data suggests the presence of an increasing trend in the reported frequency of searching for election-relevant information on internet. The tendency holds for both voters and non-voters that reside in municipalities of all sizes.

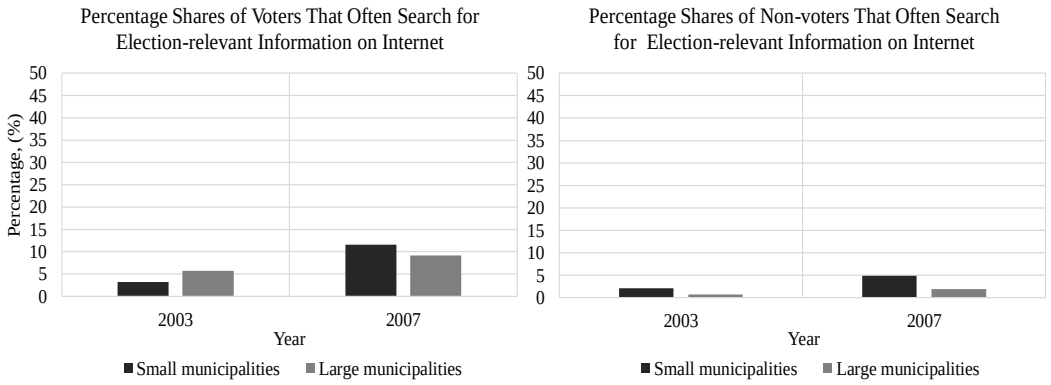

Figure 4. Percentage shares of voters (left panel) and non-voters (right panel) that often search for election-relevant information on internet during the local elections of 2003 and 2007.

Note: Small municipalities denote municipalities with population size equal or below 20,000 inhabitants. Large municipalities are defined as municipalities with more than 20,000 inhabitants.

We proceed with an analysis of surveys associated with the national elections of 2005 and 2009. The national surveys ask respondents how often they read election-relevant information on internet in a given year. The respondents of the surveys could describe the frequency of reading on internet as “never”, “rarely”, “weekly” and “often”. In this part of our study, we focus on the two latter replies and categorise them as “often reading on internet”. The question about voting during the respective national election is identical to that of the local surveys. Figure 5 illustrates percentage shares of voters and non-voters who often read election-relevant information on internet.

We note three specific observations from the national election surveys. Firstly, it appears that citizens of large municipalities read election-relevant

information on internet considerably more often than citizens of small municipalities. Secondly, the share of respondents stating that they often read election-relevant information online is consistently larger among voters than non-voters. The pattern holds for both small and large municipalities. Finally, from 2005 to 2009 the data suggests the presence of an increasing trend in the reported frequency of reading election-relevant information on internet. However, the tendency holds only for the group of voters that reside in either small or large municipalities.

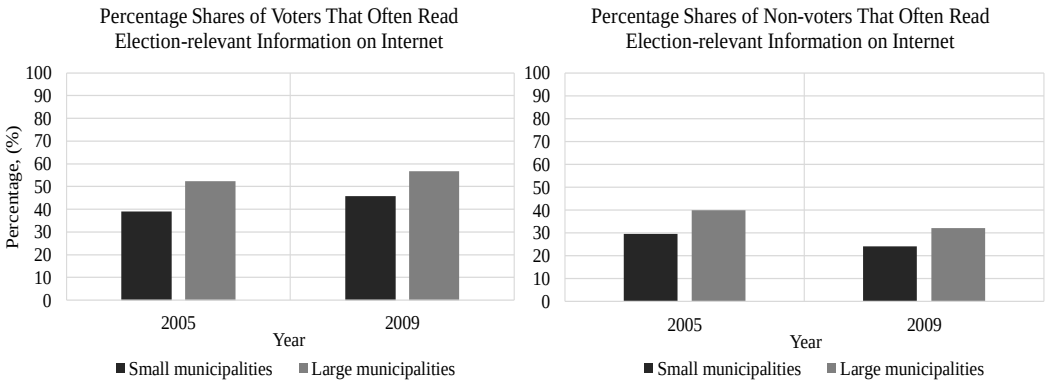

Figure 5. Percentage shares of voters (left panel) and non-voters (right panel) that often read election-relevant information on internet during the national elections of 2005 and 2009.

Note: Small municipalities denote municipalities with population size equal or below 20,000 inhabitants. Large municipalities are defined as municipalities with more than 20,000 inhabitants.

All in all, we find evidence of an increase in the number of respondents that use internet for obtaining election-relevant information that could validate the adoption of broadband internet in the period 2003-2009. However, the increasing trend in the data does not seem to be strong across all groups of the respondents. Furthermore, we find the differences in internet usage between local and national elections peculiar if one assumes that the internet questions of national and local surveys do not differ considerably. Citizens tend to read election-relevant content during national elections much more often than to search for election-relevant information during local elections.

3 Literature Review

Modern empirical research of mass media began during the 1930s (Prat & Strömberg, 2011). Since then, numerous studies have investigated effects of the introduction of new media sources such as newspapers, radio, TV and internet. In this section, we review a selection of studies on which effects the introduction of media has had on voter turnout and voters' political preferences.

3.1 The Informative Power of New Media

An important question for our study is whether media can provide citizens with more political information. Downs (1957) provides a theoretical model (the calcus of voting model) where voters are rational and participate in elections if the utility from participating in elections exceeds the cost of voting. In this voting model, voters gain utility from altering the election outcome according to their political preferences. With the introduction of internet, a citizen may have more available information which inflicts the voter lower effort cost, thereby increasing the citizen's incentive to participate in elections. If new media channels can provide even imperfect information about the policy outcomes or the nature of the policy maker, the argument made by Hölmstrom (1979) suggests that voters could improve the contract made with their political representatives.

Prat & Strömberg (2005) show that the liberalization of previously monopolized state TV did raise the political information received by citizens of Sweden. The study relies on election survey data consisting of interviews of Swedish voters before and after the Swedish general elections in 1988 and 1991. Prat & Strömberg (2005) find that citizens who watched more commercial TV news had a higher level of political knowledge than those who did not, with a sizable informative effect on those who would otherwise not obtain such political information.

A similar conclusion is drawn by Snyder & Strömberg (2010), who investigate whether citizens exposed to press coverage obtain more voter information. The authors analyse the American national election surveys from 1984 to 2004 and find that voters in areas where local newspapers had a higher coverage of House representatives were better informed about their representatives. Snyder & Strömberg (2010) use voters' abilities to accurately recall the names of congressional candidates and their ideological standings as a proxy for voters' political knowledge. The paper argues that the ability to recall politicians and their

ideologies is crucial for evaluating and monitoring performance of policy makers.

3.2 The Impact of New Media on Voter Turnout

Studies of the impact of new media on voter turnout show ambiguous effects of the new media introduction, often with sizable variations across the different types of media sources. In the case of newspapers, Snyder & Strömberg (2010) analyse the impact of press coverage of local congressmen, provided by newspapers, for voter turnout during U.S. congressional elections from 1984 to 1992 and from 1998 to 2004. The authors find that greater overlap between the political districts and the newspaper markets was associated with greater turnout during congressional elections. Similarly, Gentzkow, Shapiro & Sinkinson (2011) complement this finding by analysing entries and exits of local newspapers in the U.S. during the period 1869-1928. The authors identify that reading an additional newspaper increases voter turnout during the presidential and congressional elections by 0.3 percentage points. Gentzkow et al. (2011) indicate that the effect of newspaper consumption decreases in the number of available newspapers. Additionally, the study finds that the gain in turnout from reading newspapers is smaller subsequent to the introduction of radio and TV.

In the case of TV, Gentzkow (2006) finds that TV in the U.S. had a substantial negative effect on voter turnout during the 1950s. The author argues that the negative effect appeared as TV substituted other forms of media such as newspaper and radio that provided more political coverage. Sørensen (2016) presents a similar study to that of Gentzkow (2006) by taking an identification strategy that relies on the notion of exogenous variation in TV access. In contrast to the negative findings for U.S., Sørensen (2016) identifies a positive effect of the introduction of TV on political participation in Norway during elections from 1947 to 1987.

Over the past decade, the literature investigating new media introduction has shifted its focus from TV and newspapers towards the introduction of broadband internet. Tolbert & McNeal (2003) show that internet access did increase voter turnout by raising the political competence of voters during the U.S. presidential elections in 1996 and 2000. However, the same effect did not hold for the mid-term federal elections, which are often of less public interest. Czernich (2012) also presents evidence that internet access had a positive effect on voter turnout in the German federal election of 2005. However, the results are statistically

significant not in all specifications. Further support of the positive effect of internet access on political participation is found by Poy & Schüller (2016). The authors identify that the introduction of high-speed broadband in the Italian Province of Trento had a positive effect on voter turnout during the Italian national elections of 2008 and 2013.

In contrast to the positive findings, Falck et al. (2014) identify a small negative and statistically significant effect of internet access on political participation during the German federal and state elections from 2004 to 2008. The authors present a similar argument to that of Gentzkow (2006), explaining that the negative effect of broadband internet may be caused by a crowding-out of TV consumption. Furthermore, by analysing surveys associated with the U.S. national elections of 1996 and 2000, Prior (2002) finds that the effect of internet access on voter turnout is dependent on the online content preferences of consumers. For individuals with stronger preferences for entertainment content than for informational content, increased internet access would decrease their political knowledge and ability to participate in voting. This suggests that internet access may in fact lower the political competence of certain voters, and thereby also be detrimental to their participation in the election process.

3.3 The Impact of New Media on Political Preferences

A natural extension to studying voter turnout is to investigate whether new media has an impact on the political preferences of voters, as measured by party vote shares. For example, Gentzkow et al. (2011) study the effect of partisan newspapers on vote shares of the Republican and Democratic parties in the U.S. presidential elections during the period 1869-1928. The authors find no evidence of a significant effect of entries of Republican newspapers on vote shares of the Republican party. Contrasting evidence is presented for the case of cable TV by DellaVigna & Kaplan (2007). The authors find that the entry of the conservative channel *Fox News* into the cable TV market caused a gain in vote shares of the Republican party during the U.S. presidential and Senate elections from 1996 to 2000. The study indicates that the exposure to the Fox News TV channel motivated non-Republican viewers to vote for the Republican party.

Similar evidence to that of Gentzkow et al. (2011) is provided by Falck et al. (2014), who find the impact of broadband introduction on the distribution of cast party votes across the political spectrum during federal, state and local elections

from 2004 to 2008. The study indicates that vote shares of established parties, far-left parties and far-right parties remained unchanged after internet introduction. The authors argue that the lack of any favourable impact for the party groups could be caused by self-selection in online news consumption, in which partisan voters consume partisan information aligned with their political preferences. Furthermore, in some specifications, Falck et al. (2014) find a positive effect of internet introduction on vote shares of small parties. The authors argue that without internet small parties would receive less coverage in traditional media outlets.

In contrast to the studies finding no effect on party preferences, Poy & Schüller (2016) provide evidence of a shift in the share of cast votes of different political parties during the Italian national elections of 2008 and 2013. The shift in party vote shares is argued to be caused by the introduction of broadband internet in the Province of Trento. The authors identify that center-left parties together with far-right parties benefited from internet introduction, while center-right parties experienced a decrease in their vote shares.

4 Data

Our research is conducted by exploiting two sets of data. The first dataset consists of broadband internet statistics by Norwegian municipalities from 2001 to 2008. The second dataset is a local government dataset containing political statistics related to the local and national elections over the period from 1972 to 2017. The data allows us to estimate the impact of internet usage on voter turnout as well as on vote shares of political parties in the elections between 2001 and 2007. In this section, we present the variables applied in our study as well as descriptive statistics of our sample.

4.1 Data Description and Compilation

4.1.1 The Internet Data

The internet dataset contains household internet user rates, estimated internet coverage rates, in addition to socioeconomic variables of 422 Norwegian municipalities from 2001 to 2008. It covers the period with the most prominent internet expansion in Norway, making it particularly well-suited for our research. The same dataset is employed in Bhuller et al. (2013). The internet statistics is provided by the Norwegian Ministry of Government Administration, by the department responsible for monitoring the development in both coverage and usage of broadband internet. The internet data is collected by two Norwegian telecommunication consultancy firms Teleplan AS and Nexia AS (Bhuller et al., 2013).

4.1.2 The Election Data

The second dataset incorporated in our study is a local government dataset provided by Fiva, Halse & Natvik (2017). The data provides a broad set of statistics such as municipal expenditures for the provision of public services, municipal tax rates, parliamentary election and local election outcomes as well as statistics of socioeconomic characteristics of municipalities. For our thesis the election data is of the greatest interest, as it contains statistics such as voter turnout and vote shares of left-wing, right-wing and other parties. The local government dataset contains statistics from *Kommunedatabasen (NSD)* and *Statistikkbanken (SSB)*.

4.1.3 Data Compilation

In order to obtain a dataset consisting of internet and election statistics for

the period 1993-2007, we make some initial adjustments to the local government dataset. First, all observations outside the time span from 1993 to 2007 are excluded. Secondly, in the local government dataset, we drop municipalities such as Kvitsøy, Utsira, Modalen, Fedje and Storfjord that do not appear in the internet dataset. These adjustments leave us with municipalities that are not affected by structural changes such as boarder alternations and municipality merges from 2001 to 2007. Finally, we combine the internet dataset with the local government dataset, keeping only years in which national and local elections are held. Our main models are based on data in the years 2001, 2003, 2005 and 2007, while pre-expansion trends and placebo tests are based on data in the years 1993, 1995, 1997 and 1999. We combine the data by pooling national and local election data in order to base our analysis on more observations, increasing the precision of our regression estimates.

In addition, we extract two sets of controls from both datasets. Socioeconomic controls such as population size, unemployment rate, share of female residents and population age groups for the period 1993-2007 are collected from the local government dataset. We also add the following controls from the internet dataset: share of enrolled students, poverty rate, welfare recipients and share of urban residents from 2001 to 2007. The service provision controls from 2001 to 2007 are collected from the local government dataset. Ideally, we would like to exploit all controls starting from 1993. However, since socioeconomic controls from the internet dataset only cover the period 2001-2007, they cannot be used in placebo tests.

4.1.4 Data Quality

The internet data consists of the estimated coverage rates and internet user rates of Norwegian municipalities provided by Norwegian broadband internet operators. The data was specifically collected to provide the Norwegian Ministry of Government Administration with coverage rates that represented the current state of internet coverage for each municipality. The same data was used by the government to monitor the roll-out programme, which gives some reassurance that the data accurately represents the internet coverage for Norway from 2001 to 2008. The local government dataset consists of election data from all election districts in Norway, which has been also recently updated. Since both voter turnout and vote shares are based on actual recorded vote counts during the election periods, the data

serves as an accurate representation for political engagement of the Norwegian population.

4.2 Descriptive Statistics

The compiled dataset consists of data on 422 municipalities over 4 years, which gives a total of 1688 observations. Table 1 presents descriptive statistics for the dependent variables (voter turnout and vote shares) and the independent variables (internet coverage rate and internet user rate). Table 2 provides descriptive statistics for socioeconomic and service provision controls. The tables show means, standard deviations, minimum and maximum values of the variables.

4.2.1 Dependent Variable 1: Voter Turnout

Voter turnout is defined as the ratio of cast party votes to eligible voters during the national and local elections (Fiva et al., 2017). The mean for voter turnout is 69.53, while the minimum and maximum values are 43.25 and 87.25. The minimum and maximum values correspond to the local election of 1995 and the national election of 1993, respectively. The standard deviation of voter turnout is 8.18. When comparing the standard deviations of voter turnout to that of other dependent variables, it becomes clear that voter turnout is somewhat less volatile than vote shares. Citizens across municipalities tend to differ more in their party preferences rather than in their level of participation. An interpretation of this could be how some citizens who are disconnected with their elected representatives would allocate votes differently in the next election. Nonetheless, they would still take part in the election, rather than not.

4.2.2 Dependent Variable 2: Vote Share

The dataset contains three dependent variables that measure vote shares of the following party groups: left-wing parties, right-wing parties and other parties. The vote share of left-wing parties is defined as the joint share of votes received by *Rød Valgallianse*, *Sosialistisk Venstreparti* and *Det Norske Arbeiderpartiet*. Similarly, the vote share of right-wing parties is defined as the joint share of votes received by *Venstre*, *Senterpartiet*, *Kristelig Folkeparti*, *Høyre* and *Fremskrittspartiet*. Lastly, the vote share of other parties is defined as the joint vote share of votes received by election list that is not classified as left-wing or right-wing (Fiva et al., 2017). As outlined in section 2.2, the group of other parties includes small parties during the national elections and both small parties and local

list candidates during the local elections.

From the descriptive statistics of vote shares, we see that the vote share of other parties has significantly lower mean than both the left and right blocs. At the same time, right-wing parties have higher vote shares than left-wing parties on average. The standard deviation of other parties is considerably lower than that of left- and right-wing parties, indicating that citizens' preferences of other parties are probably more consistent across municipalities. The standard deviation of left-wing and right-wing vote shares are quite similar, suggesting that the difference in the loyalty of left-wing and right-wing voters is only minor.

Table 1. Descriptive statistics of election and internet data (2001-2007).

Variable	Mean	Standard Deviation	Min	Max
Dependent variables				
Turnout	69.529	8.177	43.249	87.253
Vote Share Left-wing	38.245	12.560	0.000	100.000
Vote Share Right-wing	56.130	14.604	0.000	94.100
Vote Share Other	5.624	10.689	0.000	100.000
Internet variables				
User Rate	16.028	19.522	0.000	86.000
Coverage Rate	34.292	38.647	0.000	98.800

Note: The dependent variables are created by pooling national and local election data.

4.2.3 Independent Variables: Internet Coverage and User Rates

In the internet dataset broadband is defined as internet with download speed at or greater than 256 kilobits per second. The internet coverage rate is defined as the fraction of households residing in a given municipality who have access to broadband internet. The internet user rate is defined as the fraction of households with a subscription to broadband internet (Bhuller et al., 2013).

Bhuller et al. (2013) find that the coverage rate in the previous year is correlated with the user rate in the current year. Intuitively, internet usage is closely related to internet coverage, as internet coverage is a prerequisite for internet usage. As can be seen from Figure 1 in section 2.1, the user rate follows the coverage rate with an approximately one-year lag. The correlation between the internet coverage rate in the preceding year and the internet user rate in the current year is important for the 2SLS approach presented in section 5 (Bhuller et al., 2013).

The maximum values of the internet variables do not differ much. However, the mean of the coverage rate (34.29) is more than twice as large as the mean of the user rate (16.03). The difference may appear due to the delay in the uptake of the internet user rate. As shown in section 2.1, half of the municipalities have an internet coverage rate above 97 percent in 2007, while in 2008, half of municipalities has an internet user rate below 51 percent. The standard deviation of the coverage rate is 38.65. The high variation provides evidence of the sequential timing of the roll-out programme. The standard deviation of the user rate (19.52) is lower than that of the coverage rate, suggesting lower variation in acquiring broadband subscriptions.

4.2.4 Control Variables 1: Socioeconomic Controls

Our socioeconomic controls consist of the following variables: educational attainment, share of students, after-tax income, unemployment rate, poverty rate, share of welfare recipients, share of population living in urban areas, gender composition and age composition.

Population is the total number of inhabitants in a given municipality, measured in thousands (Fiva et al., 2017). *Education* is measured as average years of schooling for citizens that are 16-59 years old. *Student* refers to the percentage share of registered students in the population 16 years or older. *Income* is given by the average after-tax disposable income earned by citizens aged 16-59, discounted by the consumer price index to the base year 1998 and measured in thousand NOK. *Unemployment* is measured by the percentage share of population registered as fully unemployed (within the age group 16-59). *Poverty* is the percentage share of citizens with income below half of the median equivalent after-tax income calculated using the OECD equivalence scale. *Welfare* denotes the percentage share of the population registered as recipients of social economic assistance (within the age group 16-59). *Urban* refers to the percentage share of citizens residing in densely populated areas (Bhuller et al., 2013). *Female* is given by the percentage share of women in the total population. *Age* corresponds to shares of population within a given age group (Fiva et al., 2017).

Table 2. Descriptive statistics of control variables (2001-2007).

Variable	Mean	Standard Deviation	Min	Max
Socioeconomic controls				
Population	10.500	29.978	0.444	548.617
Student	11.293	1.624	5.276	18.241
Income	157.632	24.846	111.939	442.629
Education	2.558	0.447	1.055	4.712
Unemployment	2.605	1.335	0.309	10.080
Poverty	4.113	1.136	0.882	10.412
Welfare	1.547	0.761	0.000	7.706
Urban	49.749	27.678	0.000	99.532
Female	49.736	1.018	45.070	53.571
Age 16-25	13.075	1.657	7.850	19.493
Age 26-35	12.815	1.968	6.175	21.302
Age 36-45	13.728	1.269	8.237	18.606
Age 46-55	12.963	1.039	5.337	17.723
Age 56-65	9.932	1.876	4.737	19.439
Age 66-75	8.782	2.054	3.295	18.583
Age over 76	8.036	1.796	3.612	16.918
Service provision controls				
Childcare	3.644	1.735	0.386	32.049
Educational	12.699	3.862	5.444	47.197
Elderly Care	14.345	6.066	0.643	61.971
Health & Social	5.827	2.899	1.879	38.399
Culture	2.691	2.312	0.552	41.337
Transportation	1.557	1.613	0.000	25.517
Administration	5.009	3.032	0.260	25.206

Note: Income, Childcare, Educational, Elderly Care, Health & Social, Culture, Transportation and Administration are all noted in 1000 NOK. Population is noted in 1000 inhabitants.

The chosen socioeconomic controls have frequently been used as control variables in the existing literature. Multiple papers demonstrate the importance of population size, urbanity, education, unemployment, income and age for political participation (Geys, 2006; Putnam, 2000; Rosenstone, 1982; Rosenstone et al., 1993; Lyons & Alexander, 2000; Wolfinger & Rosenstone, 1980). In addition, voter turnout is affected by race, age, ethnicity and gender as well as individual attitudes such as political interest and partisanship (Abramson, 1983; Campell, Converse, Miller & Stokes, 1960). However, the obtained datasets do not include race, ethnicity or political interest measures.

4.2.5 Control Variables 2: Service Provision Controls

The group of service provision controls consists of municipality level expenditures on the following services: childcare, education, elderly care, health and social work, transport and central administration. The service provision controls are measured as the sum of gross current expenditures *(Driftsregnskapet)* and gross investment *(Investeringsregnskapet)* in a given public service area (Fiva et al., 2017).

As outlined in section 2.1, local governments could apply for receiving funding to proceed with infrastructure investments. The Høykom funding programme did however require municipalities to contribute own funds to such investment projects. For that reason, the introduction of broadband internet across the Norwegian municipalities could be driven by the service provision of a given municipality. Although our identification strategy relies on a fixed effects model that accounts for time-invariant municipality-specific expenditure levels, we nevertheless control our results for municipality service provision that vary over time. The need for such service provision controls is discussed in section 5.1.

5 Identification Strategy

The empirical strategy of the thesis addresses two hypotheses. The first hypothesis is whether internet usage has a significant impact on voter turnout at municipal level in Norway. The second hypothesis is whether internet usage affects voters' political preferences. The preferences are measured by vote shares of left-wing parties, right-wing parties, and other parties that do not classify as neither left-wing nor right-wing. The causal relationship between the introduction of broadband and the dependent variables, voter turnout and political preferences, is either positive, negative or insignificant.

The identification strategy of the thesis deals with the main endogeneity concerns described in previous studies on new media introduction: the problem of omitted variables and simultaneity. The omitted variable bias is a bias in the estimated coefficient that arises when the regressor is correlated with an omitted variable (Stock & Watson, 2015). Simultaneity refers to the case in which at least one of the explanatory variables is determined simultaneously with the dependent variable (Wooldridge, 2010). As seen in the previous studies, one widely-adopted identification strategy is to use an instrument variable (IV) to eliminate causal effect of the dependent variable on a regressor (Appendix A). The strategy involves using a two-stage least squares (2SLS) framework, which is presented in section 5.1 of the thesis. Since the models used in the study include fixed time and municipality effects, section 5.2 explains intuition behind the fixed effects model. The last part of the identification strategy section describes a set of sensitivity tests helping to check robustness of our results.

5.1 The Two-stage Least Squares Model

In order to identify the isolated effect of internet usage, we would ideally conduct an experiment, in which internet subscriptions would have been allocated randomly. However, since we cannot allocate subscriptions to people, nor prevent them from using internet, our best option is to simulate the ideal experiment by employing a quasi-experimental variation generated by the broadband roll-out (Angrist & Pischke, 2008). Bhuller et al. (2013) investigate the impact of broadband usage on sex crimes in Norway by exploiting exogenous variations in broadband access. The exogenous variation followed from the lack of public investment funds, sparsity of population and challenging geographical features in Norway such as mountains and fjords. Similar features led to exogenous variations in internet access

in other countries, which are exploited in a number of studies such as Strömberg (2004), Czernich (2012), Falck et al. (2014) and Gavazza, Nardotto, & Valletti (2015).

The identification strategy of the thesis takes the two-stage least squares approach introduced by Bhuller et al. (2013). We instrument internet usage with the internet coverage rate in the preceding year in order to extract the exogenous component of variation in the internet user rate in the current year. The 2SLS approach retains only the variation in the internet user rate which is generated by the broadband roll-out programme (Angrist & Pischke, 2008). The first stage is given by the regression of the internet user rate u on the instrument variable – the internet coverage rate *z*, equation (2). Parameter φ captures the effect of the coverage rate in the preceding year on the user rate in the current year.

The second stage is presented in equation (1), in which the internet user rate is replaced with its fitted values from the first stage. Parameter δ is a key coefficient of interest, which captures the effect of the instrumented user rate on voter turnout as well as vote shares. For the first hypothesis, the second stage gives the relationship between the predicted values of the internet user rate u and the voter turnout. For the second hypothesis, the second stage gives the relationship between the predicted values of the user rate and vote shares of the party groups (left-wing, right-wing and other parties). The regressions also include a vector of exogenous time-varying covariates x' to improve precision of the estimates, and subscripts *m* and *t* that denote municipality and year, respectively. The fixed time and municipality effects in the model correspond to α and γ, τ and θ, accordingly. Parameters ε and η denote error terms.

$$g_{mt} = \delta u_{mt} + x'_{mt}\beta + \alpha_m + \tau_t + \varepsilon_{mt} \quad (1)$$

$$u_{mt} = \varphi z_{mt-1} + x'_{mt}\lambda + \gamma_m + \theta_t + \eta_{mt} \quad (2)$$

Note: g denotes voter turnout in the model that tests the first hypothesis and party vote shares in the models that test the second hypothesis. Source: Bhuller et al. (2013).

While the 2SLS estimator is consistent, it is biased (Angrist & Pischke, 2008). As a sample size goes to infinity, a consistent estimator would have variance that tends to zero, while a biased estimator would not converge to its true value (Gujarati & Porter, 2009). Nevertheless, the issue of bias is limited in large samples. To increase the sample size in our analysis, we investigate the effect of internet

usage on voter turnout and party choice for combined national and local elections.

The 2SLS estimates must be considered as a local average treatment effect of broadband usage on voter turnout for the sub-population of compliers and may not be valid in an external setting. The complier group refers to individuals who take treatment when it is randomly assigned to them (Angrist & Pischke, 2015). Bhuller et al. (2013) investigate a survey data on individuals' broadband use to gain insight into the characteristics of the complier group. The authors find that the complier group is overrepresented by young males. According to Lyons & Alexander (2000), young individuals tend to participation in elections at lower rates than older citizens. For that reason, we expect that the actual effect of internet usage on voter turnout of the whole population would be higher than the effect estimated by the 2SLS approach.

A valid instrument variable (in our case the internet coverage rate) must satisfy two key assumptions as outlined by Angrist & Pischke (2015). Firstly, the IV must meet the relevance condition, so that the instrument has a causal effect on the independent endogenous variables, resulting in the statistically significant first stage. Secondly, the instrument must satisfy the exclusion restriction, so that the instrument does not affect the outcome variables in any other way as through the first-stage channel. Only the former of the two conditions for a valid instrument can be statistically tested.

We test whether the instrument variable employed in the thesis satisfies the relevance condition by checking the correlation between the internet coverage rate and the internet user rate. As discussed in section 4, we use the coverage rate in the preceding year and the user rate in the current year. There is a clear correlation between the two internet measures, proving that the level of broadband subscriptions may be driven by the installation of DSL-network access nodes in the previous year. The correlation coefficient between the user rate and the coverage rate in the preceding year is on average 0.76 from 2003 to 2005 and 0.57 from 2006 to 2008.

The exclusion restriction requires that the internet coverage rate does not affect the voter turnout and the vote shares in any other way than through the internet user rate. This restriction cannot be validated by statistical testing, since investigating the possible correlation between the instrument against all other determinants of turnout is infeasible. One such factor that may be affected by

internet coverage and influence voter turnout is the level of education. Yet, it seems reasonable to maintain our assumption that there are few, if any, other determinants of voter turnout that can be affected by internet coverage.

Bhuller et al. (2013) employ a set of controls that account for potential drivers of the roll-out programme. They identify supply and demand factors that could correlate with timing of the broadband expansion and therefore bias the estimated results. Ideally, municipalities who receive government support at any point in time should not significantly differ from those who are still waiting for funds (Angrist & Pischke, 2015). The supply-side determinants are related to geographical and infrastructural characteristics of the municipalities. The demand-side factors include municipality features such as expenditures on public services, industry composition, levels of income, education, urbanization and population density (Bhuller et al., 2013).

Our 2SLS models include two sets of controls introduced in section 4. First, we provide a baseline estimates that do not take into account any controls. Secondly, we include socioeconomic controls. Finally, we add the service provision controls. The service provision controls as well as some socioeconomic controls are identified to be demand factors that could potentially drive the roll-out programme (Bhuller et al., 2013). However, we do not expect the demand factors to affect regression estimates considerably, since Bhuller et al. (2013) find that the broadband expansion is correlated with education, population size and urbanization only before 2003.

5.2 The Fixed Effects Model

Our analysis consists of fixed effects models that include both time and entity-specific fixed effects. For the fixed effects model, a crucial assumption is that potential unobserved factors are constant over time and within each cross-sectional unit (Wooldridge, 2010). By unobserved factors, we refer to specific features of a cross-sectional unit that are not observed (Wooldridge, 2010). Examples of such unobservable factors at the individual level could be citizens' cognitive ability, motivation, political interest and cultural capital. In our case, a cross-sectional unit refers to one specific municipality and the unobserved factors then refer to the individual unobserved features aggregated at municipal level.

It is reasonable to assume that the previously mentioned unobservables

would stay constant over time, as it seems unlikely that municipalities will experience changes in their population composition that would lead to changes in such unobservables. For that reason, our model specification takes a fixed effects approach rather than a random effect approach (in which the unobservable factors are more likely to be variant over time) (Wooldridge, 2010). The fixed effects model minimizes the likelihood of the omitted variable bias by accounting for the influence of unobservables that do not vary over time. However, it does have a significant drawback. When relying on both time and municipal fixed effects, the model eliminates a lot of variation in variables of interest, which could result in low statistical precision (Wooldridge, 2010). Furthermore, the fixed effects model does not address time- and municipality-varying unobservables. For that reason, we add controls to our fixed effects models to reduce the influence of observable factors that do vary over time and within each entity.

As shown in section 2.2, there is a persistent difference in levels of political participation during the national and local elections. When estimating national and local turnout jointly, the absence of time dummies would lead to imprecise estimates. However, estimates of the fixed effects model do not suffer from the same issue, since the time fixed effects take into account differences in voter turnout (as well as in all other variables) across years.

5.3 Sensitivity Checks

In order to check robustness of the identification strategy and the baseline findings, we perform two sensitivity tests that are presented in Bhuller et al. (2013). Firstly, we include pre-existing time trends into the baseline model with socioeconomic controls. Secondly, we conduct placebo tests.

5.3.1 Inclusion of Pre-existing Time Trends

The sensitivity test involves extrapolating pre-existing time trends in the outcome variables (voter turnout in the model that tests the first hypothesis and vote shares in the models that test the second hypothesis). The outlined approach captures any variation in the instrument variable that is correlated with pre-existing time trends in the outcome variables (Bhuller et al., 2013). We estimate municipality-specific trends by regressing the outcome variables on linear and quadratic time trends from the period prior to the internet expansion (Bhuller et al., 2013). In particular, time trends are based on years 1993, 1995, 1997 and 1999.

5.3.2 Placebo Tests

The second sensitivity check is a placebo test which helps us to identify whether internet access has an effect on voter turnout prior to the internet expansion. Intuitively, there should be no causal effect of broadband internet on voter turnout in this setup, as internet broadband has not yet been introduced. The significant placebo tests would suggest that the instrument is correlated with one or more underlying municipality-specific trends in the outcome variables (Bhuller et al., 2013). In order to conduct the placebo test, we replace current voter turnout with data from years 1993, 1997 for national elections and years 1995, 1999 for local elections. The placebo test is performed on the reduced-form specifications in order to evaluate the effect of the internet coverage rate on the prior-to-expansion turnout. The same checks are also applied for models with voters' political preferences.

6 Results and Discussion

In this section, we present results of the regression analysis and provide a discussion of the main findings. We support our results with empirical evidence from previous studies. The impact of internet coverage rate on internet usage is investigated in section 6.1. The estimated effect of broadband usage on voter turnout is presented in section 6.2. Subsequently, section 6.3 provides findings for the effect of internet usage on vote shares of left-, right-wing and other parties. Finally, we proceed by evaluating robustness of the main results by including pre-expansion trends and conducting placebo tests in section 6.4.

6.1 The Effect of Internet Coverage Rate on Internet Usage

Table 3 displays results from the first stage of the 2SLS approach outlined by equation (2) in section 5.1. The table presents results from regressing the internet user rate on the instrument variable – the internet coverage rate. Column 1 of the table displays findings of the baseline model, which includes municipal fixed effects, time dummies and heteroskedasticity-robust standard errors clustered at the municipality level. Column 2 adds the set of socioeconomic controls, while column 3 reports the estimates when including also the service provision controls.

In the baseline model, the first-stage coefficient is positive and significant. The coefficient value of 0.16 implies that a 10 percentage point increase in the internet coverage rate in the previous year results in 1.63 percentage point increase in internet usage in the current year. Table 3 also provides the first-stage F-statistic which measures the information content contained in the instrument (Stock & Watson, 2015). The F-statistic for the baseline model equals 362. Our identification strategy follows the same approach as that of Bhuller et al. (2013), and we therefore compare our first stage against theirs. The authors find a positive and significant first stage with a coefficient value of 0.13. Even though our study is based on only four years of the sample used in Bhuller et al. (2013), we still obtain a coefficient of 0.16. It seems that our sample is sufficient to capture the necessary variation in the internet data. Moreover, Bhuller et al. (2013) report the strong first stage with corresponding F-statistic equal to 323, which is relatively close to the F-statistics in our test. We conclude that the internet coverage rate seems to be a strong predictor of the user rate.

The estimated first-stage coefficient remains significant and constant when controlling for socioeconomic factors, indicating a 1.60 percentage point increase

in internet usage if coverage rate raises by 10 percentage points. Among the statistically significant controls, population size, after-tax income and the percentage share of urban population have a positive effect on voter turnout, while the age group 56-65 has a negative effect. Furthermore, the inclusion of the service provision controls does not considerably affect the initial estimates, although only expenditures on culture and transport appear to be nonsignificant. All in all, the first-stage coefficient remains insensitive to both socioeconomic and service provision controls. Therefore, the results do not seem to be driven by neither time-varying socioeconomic features nor by service provision controls that may affect the internet roll-out. The stability of the first stage provides support for our chosen identification strategy.

Table 3. The first-stage estimates for all models.

Variables	(1) Baseline	(2) Socioeconomic	(3) Service provision
Coverage	0.163***	0.160***	0.158***
	(0.009)	(0.009)	(0.009)
Population		1.186**	1.034**
		(0.598)	(0.520)
Education		-2.928	-2.097
		(4.537)	(4.225)
Student		-0.119	0.0575
		(0.230)	(0.229)
Income		0.046***	0.041***
		(0.016)	(0.014)
Unemployment		0.033	-0.005
		(0.334)	(0.334)
Poverty		0.224	0.293
		(0.258)	(0.245)
Welfare		0.397	0.318
		(0.351)	(0.339)
Urban		0.201***	0.156**
		(0.063)	(0.062)
Female		0.052	-0.078
		(0.737)	(0.749)
Age Groups	✓	✓	✓
Service provision			✓
F-value	362.310	342.450	347.260
Obs.	1,688	1,687	1,680

Note: The dependent variable is the internet user rate. The ticker symbols show what groups of control variables are included in the specification. The regressions are based on 422 municipalities over 4 years, all including municipal fixed effects, time dummies and heteroscedasticity-robust standard errors clustered at the municipality level. The latter is shown in parentheses below the coefficient estimates. Significance levels are shown by

*** p<0.01, ** p<0.05, * p<0.1.

6.2 The Effect of Internet Usage on Voter Turnout

The second stage of the 2SLS approach outlined in equation (1) is presented in Table 4. The second stage gives a positive coefficient of 0.05, which is also statistically significant at the five percent level. The coefficient indicates that an increase of 10 percentage points in the internet user rate would result in an increase by half a percentage point in voter turnout. We argue that the positive effect follows from the exposure to political information online which increases voters' political knowledge and ability to participate in elections. The 2SLS approach provides estimates for the complier group, suggesting an increase in political participation for those citizens who subscribe for internet due to the instalment of broadband access nodes in their municipalities in the previous year.

The positive effect of internet introduction on voter turnout is well-aligned with the previously discussed findings of Tolbert & McNeal (2003), Czernich (2012) and Poy & Schüller (2016). Tolbert & McNeal (2003) find that individuals with internet access were on average 12.5 percent more likely to participate in the U.S. presidential election of 2000. Czernich (2012) identifies that an increase of the DSL rate by 10 percentage points led to an increase of voter participation in the German federal election of 2005 by 0.15 percentage points. Poy & Schüller (2016) argue that exposure to ADSL2+ for roughly three months increased voter turnout during the Italian national elections of 2008 and 2013 by about 0.2 percentage points.

Column 2 of table 4 provides the second-stage results after controlling for socioeconomic factors. The estimated effect on political participation increases to 0.07. The coefficient is significant at the one percent level, making the causal effect of internet usage on voter turnout more precise than in the model without socioeconomic factors. Among the statistically significant controls, the age group 46-75 has a positive effect on voter turnout, while the age group 16-25 and the unemployment rate have a negative effect. The age group 16-25 captures voting behaviour of the youngest eligible voters, those from 18 to 25 years old. The negative effect of the youngest age group on voter turnout is consistent with findings of Lyons & Alexander (2000). The authors argue that young individuals tend to have lower level of participation rates than older citizens.

The literature presented in section 4.2.4 suggests that several of our

socioeconomic controls should have a significant effect on political participation. While most socioeconomic factors show similar signs to those found in the existing literature, other socioeconomic controls show the opposite effects. The discrepancy between the estimated coefficients for control variables and relations found in the previous studies most likely appear due to the fixed effects approach which eliminates variation across municipalities and years. Nevertheless, we find it useful to discuss our socioeconomic controls in light of the existing literature.

Table 4. The second-stage estimates for voter turnout.

	(1) Baseline	(2) Socioeconomic	(3) Service provision
User Rate	0.050**	0.067***	0.071***
	(0.023)	(0.025)	(0.026)
Population		-0.267	-0.226
		(0.164)	(0.142)
Education		2.903	2.403
		(2.137)	(2.146)
Student		0.0814	0.0123
		(0.124)	(0.124)
Income		-0.013	-0.014
		(0.009)	(0.009)
Unemployment		-0.408*	-0.348*
		(0.210)	(0.208)
Poverty		0.195	0.212
		(0.161)	(0.156)
Welfare		-0.285	-0.280
		(0.236)	(0.239)
Urban		-0.004	-0.011
		(0.033)	(0.034)
Female		-0.433	-0.353
		(0.313)	(0.312)
Age Groups	✓	✓	✓
Service provision			✓
Obs.	1,688	1,687	1,679

*Note: The dependent variable is voter turnout. The ticker symbols show what group of control variables are included in the specification. The regressions are based on 422 municipalities over 4 years municipal fixed effects, time dummies and heteroscedasticity-robust standard errors clustered at the municipality level. The latter is shown in parentheses below the coefficient estimates. Significance levels are shown by *** p<0.01, ** p<0.05, * p<0.1.*

The signs of most socioeconomic controls are similar to those found in the previous studies. The positive relationship between education and voter turnout follows from the argument that education provides citizens with more information which increases their ability to participate in elections (Wolfinger & Rosenstone,

1980). The likelihood that voters cast the determining vote of an election decreases in the number of citizens in an electoral district (Geys, 2006). In line with this argument, greater population size in an electoral constituency has a negative effect on voter turnout in our model. Furthermore, Putnam (2000) and Nevitte et al. (2009) find that citizens living in rural areas are more likely to vote during elections since small communities provide citizens with an incentive to engage in civic activities. The argument could explain the negative effect of our urban control variable. Moreover, the negative effect of the unemployment rate on voter turnout corresponds to a withdrawal effect suggested by the existing literature. The withdrawal effect implies that citizens who are hurt by low economic status allocate less resources towards penalizing their political representatives (Rosentsone, 1982).

However, we find it peculiar that income, poverty rate and the share of female population show opposite effects to that of existing empirical evidence. Rosenstone, Steven & Hansen (1993) suggest that poorer citizens participate in elections at lower rates since they often lack the leisure time and resources to do so. This argument would suggest that a higher poverty rate should have a negative effect on voter turnout in our model, while a higher income – a positive effect. As can be seen from SSB (2017), disparities between shares of male and female that participate in elections start to vanish from 1961. From 1993 to 2013 the share of females during elections is at the same level or higher than the share of males. The pattern would suggest that shares of female population should not have a negative impact on voter turnout in our model.

Column 3 of table 4 provides estimates after adding the service provision controls. The second-stage coefficient is 0.07. The marginal increase indicates that the baseline results are not driven by the service provision controls. Among statistically significant controls, expenditures on education have a positive effect on voter turnout, while expenditures on childcare have a negative effect. Furthermore, variables that control for expenditures on transport and central administration have a positive and significant effect on voter turnout. Andersen et al. (2014) find that transport and administration services are among targeted spending programmes that may motivate participation in the local elections. In contrast to the primary welfare services that are regulated by the national government (i.e. schooling and elderly care), transport and central administration may benefit specific groups in the population. All in all, the second-stage coefficient remains insensitive to both socioeconomic and service provision controls. The stability of the coefficient would

suggest a causal effect of internet usage on voter turnout.

6.3 The Effect of Internet Usage on Political Preferences

A natural extension of our main topic is to study to which extent internet usage has effect on voters' political preferences. In this part of the thesis, we present our results for the effect of internet on vote shares. Table 5 reports our findings, with columns 1-3 showing the second-stage estimates for the left-wing parties and columns 4-6 representing the estimates for other parties. Right-wing parties are considered as a reference group and therefore not presented in the table.

Table 5. The second-stage estimates for vote shares.

	Left-wing parties			Other parties		
	(1) Baseline	(2) Socio-econ	(3) Service prov.	(4) Baseline	(5) Socio-econ	(6) Service prov.
User Rate	-0.141***	-0.149***	-0.140***	0.249***	0.249***	0.245***
	(0.046)	(0.048)	(0.048)	(0.055)	(0.057)	(0.057)
Pop.		0.187*	0.201**		-0.404*	-0.343*
		(0.097)	(0.094)		(0.221)	(0.187)
Education		-2.575	-3.750		-5.954	-6.150
		(5.347)	(5.427)		(8.325)	(8.138)
Student		0.203	0.191		0.133	-0.085
		(0.235)	(0.237)		(0.319)	(0.326)
Income		-0.008	-0.012		-0.004	-0.004
		(0.010)	(0.010)		(0.016)	(0.017)
Unempl.		0.273	0.077		0.047	0.291
		(0.589)	(0.587)		(0.806)	(0.773)
Poverty		-0.077	-0.129		-0.027	0.075
		(0.340)	(0.319)		(0.570)	(0.507)
Welfare		-0.214	-0.263		0.541	0.580
		(0.540)	(0.546)		(0.811)	(0.819)
Urban		-0.002	0.021		0.037	-0.024
		(0.064)	(0.066)		(0.069)	(0.059)
Female		-0.350	-0.464		-0.760	-0.310
		(0.752)	(0.758)		(1.205)	(1.197)
Age Group	✓	✓	✓	✓	✓	✓
Service			✓			✓
Obs.	1,688	1,687	1,679	1,688	1,687	1,679

*Note: The ticker symbols show what group of control variables are included in the specification. The regressions are based on 422 municipalities over 4 years. All regressions include municipal fixed effects, time dummies and heteroscedasticity-robust standard errors clustered at the municipality level. The latter is shown in parentheses below the coefficient estimates. Significance levels are shown by *** p<0.01, ** p<0.05, * p<0.1.*

Starting with the effect of internet usage on vote shares of left-wing parties, the second-stage coefficient shows a significant effect of -0.14. The estimate implies that if the internet user rate increases by 10 percentage points, the percentage of the joint votes allocated towards left-wing parties decreases by 1.41 percentage points. When controlling for socioeconomic factors, the estimated second stage is -0.15 and still significant. Population size and the age group over 76 years old has a positive effect on vote shares of left-wing parties. After adding the service provision controls, the estimated coefficient returns to the initial value of -0.14, which is also significant. The expenditures on education has a positive effect on the voters' preferences of the left-wing parties.

The resulting effect of internet usage on vote share of other parties is positive and statistically significant. The second stage coefficient is approximately 0.25 for all specifications. The stability of the estimated effect strengthens the credibility of our findings. The vote shares allocated to other parties increase by 2.49 percentage points if the user rate increases by 10 percentage points. In the specification with socioeconomic controls, the effect of population size is significant at the ten percent level. In contrast to the positive impact of population size on the vote shares of left-wing parties, the effect on the other parties is negative. The results suggest that left-wing parties receive more votes in large municipalities, while other parties – in small municipalities. The pattern may occur due to the differences in political programmes of the parties. Both left-wing and right-wing parties put forward broader political programmes with greater mass appeal. Contrarily, other parties typically represent narrower political programmes than the traditional party blocs. Column 3 of table 5 provides results when including the service provision controls. Among significant controls, transport expenditures have a positive effect on vote share of other parties, while childcare and education expenditures have a negative effect.

As shown in section 2.2, other parties consist of small parties during national elections and both small parties and local lists during local elections. The results suggest that with internet introduction small parties and local list candidates receive more votes than the traditional parties. A similar finding is made by Falck et al. (2014). The authors identify that small parties experience an increase in their vote shares caused by the introduction of internet. The authors refer to a previous study of Gentzkow & Shapiro (2011) for an explanation of the findings. Gentzkow & Shapiro (2011) argue that consumers of online news obtain information from

several online sources and therefore increase their exposure to content about small parties. The exposure to information about small parties could thus impact voters' voting decisions and cause voters to abandon their previous parties in favour of the small parties (Gentzkow & Shapiro, 2011).

By using browsing history from Google for the period 2001-2007, we identify that several small parties indeed were presenting their political programmes and updates online. For example, in 2001 every citizen with an internet subscription would be able to access official party webpages of *The Green Party*, *The Political Party*, *The Retirement Party*, *The Workers Communist* and *The Christian Union Party*. By 2002, several other parties had established their online presence, and among these are *The Coast Party*, *The Liberal Party* and *The Democrats*. In addition, the small parties were also frequently addressed in online newspapers. There may be several reasons why citizens choose to leave the left-wing or right-wing blocs in favour of small parties. One reason may be that small parties have narrower programmes that better suit the preferences of voters. Alternatively, citizens might be interested in a specific policy goal that is prioritized by a small party, but neglected by left- or right-wing parties.

Local list candidates were present on internet to a lesser extent, most of them may not have had own webpages with political programmes. However, online newspapers such as *Østlendingen, Drammens Tidene, Dagbladet and NRK* were publishing articles about local lists and their representatives. The news contained information about local list candidates running for municipal or county councils and interviews with candidates on specific issues. Moreover, citizens might have been able to find a local list candidate by searching for a particular local issue which was of the main focus of the candidate. Strand (2005) finds that those who choose to support local list candidates either consciously choose to turn away from the political parties or simply more or less randomly choose to do so. The voters point to three main reasons for their preferences for local lists. First, interest in one specific policy issue. Secondly, dismay with the political culture among the incumbent representatives in the municipality council. And finally, irrelevance of political parties in local politics (Strand, 2005).

6.4 Sensitivity Checks

This section provides results of two types of sensitivity checks: inclusion of pre-existing time trends and placebo test.

6.4.1 Inclusion of Pre-existing Time Trends

Table 6 displays results of the sensitivity check that involves the extrapolation of pre-existing time trends (from 1993 to1999) in the outcome variable. We provide the following model specifications for each dependent variable: a baseline model with socioeconomic controls, a model that includes linear pre-existing trends in the outcome variable and a model with quadratic pre-existing trends in the outcome variable. The first three columns present estimates for voter turnout, while the subsequent columns contain results for vote shares.

The first-stage estimates of all specifications that include both linear and quadratic pre-existing time trends in outcome variables do not differ considerably from the baseline cases. The second-stage coefficient for voter turnout increases by half when we assume linear pre-existing trend in the turnout data. In contrast to linear trend, the inclusion of quadratic pre-existing trend into the baseline model affects the regression results only marginally.

The coefficient estimates do not differ considerably when we assume linear or quadratic pre-existing time trends in vote share of left-wing parties. The baseline results for vote share of left-wing parties do not seem to be driven by either liner or quadratic pre-existing time trends. However, the results for vote shares of right-wing and other parties are not consistent with the baseline specifications. When including linear and quadratic pre-existing trends, the estimated effect increases for right-wing parties, yet decreases for other parties. The sensitivity check suggests that the internet coverage rate may be correlated with pre-existing time trends in voter turnout, vote shares of right-wing and other parties. Therefore, the baseline estimates for voter turnout, vote shares of right-wing and other parties that do not include possible pre-existing time trends may be biased.

6.4.2 Placebo Tests

Table 7 presents reduced-form specifications that estimate the direct effect of the internet coverage rate on voter turnout as well as on vote shares. Baseline model estimates are provided in the even columns and corresponding placebo estimates are shown in the odd columns. The placebo test evaluates the effect of the internet coverage rate on prior-to-expansion outcome variables (from 1993 to 1999). All specifications include a set of socioeconomic variables that consists of population size, unemployment rate, percentage of females in population and age groups.

Table 6. Sensitivity check 1: inclusion of pre-existing time trends.

	Voter turnout			Vote share left-wing parties			Vote share right-wing parties			Vote share other parties		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
User Rate	0.067***	0.101***	0.069***	-0.149***	-0.151***	-0.151***	-0.100*	-0.141**	-0.135**	0.249***	0.302***	0.283***
	(0.025)	(0.028)	(0.026)	(0.048)	(0.048)	(0.048)	(0.057)	(0.061)	(0.062)	(0.057)	(0.063)	(0.062)
First Stage	0.160***	0.149***	0.159***	0.160***	0.160***	0.159***	0.160***	0.155***	0.154***	0.160***	0.156***	0.156***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Socioeconomic	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Age Groups	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Trend	No	Linear	Quadratic	No	Linea	Quadratic	No	Linear	Quadratic	No	Linear	Quadratic
Obs.	1,687	1,683	1,683	1,687	1,683	1,683	1,687	1,683	1,683	1,687	1,683	1,683

*Note: The variable Pre-trend 1 denotes the linear pre-trend of the corresponding outcome variable, while the variable Pre-trend 2 refers to the quadratic pre-trend of the corresponding outcome variable. Heteroskedasticity-robust standard errors are clustered at the municipality level and shown in parentheses below the coefficient estimates. Significance levels are shown by *** p<0.01, ** p<0.05, * p<0.1.*

The reduced-form results are well-aligned with findings from the 2SLS approach, both in terms of significance and signs of the coefficient estimates. The internet coverage in the previous year indeed has a positive and significant effect (at the five percent level) on voter turnout, with the coefficient value of 0.01. The reduced-form effect of internet introduction is indeed negative and significant for vote shares of right-wing and left-wing parties (at the five percent level), yet positive and significant for other parties.

Table 7. Sensitivity check: placebo test

	Voter turnout		Vote share left-wing parties		Vote share right-wing parties		Vote share other parties	
	(1) Baseline	(2) Placebo	(3) Baseline	(4) Placebo	(5) Baseline	(6) Placebo	(7) Baseline	(8) Placebo
Coverage	0.010** (0.004)	0.014*** (0.004)	-0.023*** (0.008)	-0.023*** (0.007)	-0.018** (0.009)	0.015* (0.009)	0.041*** (0.009)	0.007 (0.010)
Socioeconomic	√	√	√	√	√	√	√	√
Obs.	1,684	1,684	1,684	1,684	1,684	1,684	1,684	1,684

*Note: Column 1 shows the reduced form effect, while column 2 shows the placebo estimate of internet coverage on voter turnout from 1993-1999. Heteroskedasticity-robust standard errors are clustered at the municipality level and shown in parentheses below the coefficient estimates. Significance levels are shown by *** $p<0.01$, ** $p<0.05$, * $p<0.1$.*

The placebo effect for vote share of other parties is not significant. The non-significant placebo test suggests that the baseline estimates for vote share of other parties are unlikely to be biased by the association between the internet coverage rate and underlying trends in the outcome variable. However, estimates from the placebo test are statistically significant for voter turnout, vote shares of left-wing parties and right-wing parties (at the ten percent level). For voter turnout, the

placebo effect is higher and more significant than the causal effect estimated in the baseline model. For vote share of left-wing parties, the placebo effect is equal to that of the baseline specification. For vote share of right-wing parties, the placebo test results in the opposite effect of internet introduction to that of the baseline model.

The significant placebo tests provide evidence of the association between internet access and voter turnout, as well as vote shares of left-wing and right-wing parties, during the period prior to the broadband introduction. The significant placebo tests suggest that the internet coverage rate may be correlated with one or more underlying municipality-specific trends in voter turnout, as well as in vote shares of left-wing and right-wing parties. In this case, the instrument variable may not satisfy the exclusion restriction, implying that our identification strategy may not be the best fit for the actual data of voter turnout, vote shares of left-wing and right-wing parties. Therefore, the baseline estimates for voter turnout, vote shares of left-wing and right-wing parties should be interpreted with some caution.

7 Conclusions

In this thesis, we test two hypotheses. The first hypothesis is whether internet usage impacts voter turnout. The second hypothesis is whether internet usage impacts the political preferences of voters as measured by the vote shares allocated towards party blocs. Our study is based on Norwegian election data and internet statistics of 422 municipalities over four election years within the period from 2001-2007. We employ a two-stage least squares analysis within a fixed effects framework. The first-stage estimates indicate that the internet coverage rate is a strong predictor of the internet user rate, implying that the broadband roll-out programme was indeed followed by actual internet usage.

In assessing the first hypothesis, we find that an increase of 10 percentage points in the internet user rate results in an increase by half a percentage point in voter turnout. The second-stage coefficient is statistically significant and remains insensitive to both socioeconomic and service provision controls. The stability of the coefficient would suggest a causal effect of internet usage on voter turnout. We argue that the positive effect follows from the exposure to political information online which increases voters' political knowledge and ability to participate in elections. The positive effect on the complier group suggests an increase in political participation for those citizens who subscribe for internet due to the instalment of broadband access nodes in their municipalities in the previous year. The positive effect of internet introduction on voter turnout is well-aligned with the findings of Tolbert & McNeal (2003), Czernich (2012) and Poy & Schüller (2016).

In assessing the second hypothesis, the results suggest that increased internet usage benefits other parties that cannot be classified as either left-wing or right-wing parties. The increase in vote share of other parties comes at the expense of both left-wing and right-wing parties. The vote shares allocated to other parties increase by 2.49 percentage points if the user rate increases by 10 percentage points. The stability of the estimated effect when including both socioeconomic and service provision controls strengthens the credibility of our findings. We argue that internet usage increases the voters' exposure to small parties and local lists that would otherwise not receive similar coverage in traditional media. We find evidence of the emergence of both small parties and local lists online from 2001 to 2008. In particular, small parties established official webpages presenting their political agendas and updates, while information about local list candidates was covered in online news.

However, our findings should be interpreted with some caution. The first sensitivity check suggests that the internet coverage rate may be correlated with pre-existing time trends in voter turnout, vote shares of right-wing and other parties. Therefore, the baseline estimates for voter turnout, vote shares of right-wing and other parties that do not include possible pre-existing time trends may be biased. Furthermore, the second sensitivity check suggests that the identification strategy employed in this thesis may not be the best fit for the voter turnout data. The significance of the placebo test indicates that the internet coverage rate may be correlated with one or more underlying municipality-specific trends in voter turnout. Therefore, in assessing the first hypothesis, our study is inconclusive. The placebo tests also indicate that estimates for vote shares of left-wing and right-wing parties may suffer from the same bias as voter turnout. However, the bias does not appear to be present in the data for vote shares of small parties and local lists. A reasonable interpretation of these findings is that the internet roll-out programme of 2001 to 2008 was particularly beneficial in bringing attention to political parties of smaller size and individual politicians. As such, the second hypothesis stating that internet usage has a causal effect on vote shares of parties is only partly supported by our study.

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Appendices

Appendix A – Literature Overview

Table 8. Studies that consider the impact of new media on voter turnout.

Study *(authors and year of publishing)*	New Media *(newspaper, radio, internet)*	Election *(county, election type, year)*	Identification Strategy *(specification and IVs)*	Findings *(sign of effect and significance)*
Strömberg (2004)	Radio (access)	U.S. County election for office of governor, 1920-1930.	OLS, IVs: *Ground conductivity and Share of woodland*	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: *Distance between municipality.*	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: *Distance between municipality.*	Negative & significant
Gavazza et al. (2015)	Broadband Internet (access)	UK local elections, 2006-2010	OLS IVs: *Rain and Relative Elevation.*	Negative & significant
Prior (2002)	Broadband Internet and cable TV (access)	American presidential and house elections, 1996 and 2000	OLS	Negative for those with entertainment preferences

Note: 2SLS approach with an instrument variable setup is denoted by (IV), control variables are denoted (CV), OLS refers to Ordinary Least Squares regressions and LRM refers to Logistic Regression Model.

Appendix B – Survey Analysis

The data is examined across strata in order to account for differences in characteristics related to the population size of municipalities. Since national and local surveys define strata based on population size of municipalities, our analysis is restricted to evaluating the two surveys separately.

The data suggests the presence of an increasing trend in the reported frequency of internet usage from 2003 to 2007 (Table 9). The increase in the number of respondents that use internet for retrieving political information validates the adoption of broadband internet in the period. The rise in the number of individuals that use internet at least once per week varies between 1.7 and 9.5 percentage points across strata. At the same time, the percentage of individuals that never use internet drops, and the decrease ranges from -11.1 to -20.2 percentage points across strata.

Table 9. Internet usage for searching for election-relevant information during the local elections of 2003 and 2007.

Survey		2003			2007		
Strata	Internet usage	Voters	Non-voters	Average	Voters	Non-voters	Average
0-2,500	Often	3.980	2.564	3.750	11.111	4.762	10.040
	Rarely	20.398	10.256	18.750	29.469	14.286	26.908
	Never	75.622	87.179	77.500	59.420	80.952	63.052
2,501-5,000	Often	4.072	1.449	3.448	11.650	2.326	10.040
	Rarely	22.624	15.942	21.034	29.612	25.581	28.916
	Never	73.303	82.609	75.517	58.738	72.093	61.044
5,001-10,000	Often	1.515	1.471	1.504	11.739	7.843	11.032
	Rarely	20.707	16.176	19.549	28.261	19.608	26.690
	Never	77.778	82.353	78.947	60.000	72.549	62.278
10,001-20,000	Often	3.000	3.333	3.077	11.538	4.286	9.712
	Rarely	23.000	10.000	20.000	25.962	20.000	24.460
	Never	74.000	86.667	76.923	62.500	75.714	65.827
20,001-60,000	Often	5.085	1.250	3.891	7.035	0.000	5.556
	Rarely	16.949	8.750	14.397	36.181	20.755	32.937
	Never	77.966	90.000	81.712	56.784	79.245	61.508
Over 60,000	Often	6.161	0.000	4.869	11.111	3.774	9.665
	Rarely	21.801	10.714	19.476	32.407	15.094	28.996
	Never	72.038	89.286	75.655	56.481	81.132	61.338

Note: The table shows the cross-tabulation of the survey questions 22 and 3. Question 22: "Hvor ofte søkte du etter lokalt valgstoff på internett i forbindelse med kommunevalget i år?" (How often did you search for local election information online in relation to this year municipal election?). Question 3: "Stemte du ved kommunevalget i år?" (Did you

vote during this year municipal election?)

When we distinguish between voters and non-voters, a general trend is that the respondents reporting participation in the local elections of 2003 and 2007 use internet for obtaining political information more frequently. The percentage of individuals who use internet at least once per week is higher among voters than among non-voters across all strata, except the stratum with municipality size of 10,001-20,000 citizens. In contrast to the frequent internet searchers of political information, the share of respondents stating that they never use internet is consistently larger among non-voters. The finding suggests that voters are more likely to self-report frequent usage of internet for obtaining election-relevant information than non-voters, which is well-aligned with the argument that internet introduction could motivate political participation.

Turning to the national surveys of 2005 and 2009, we find similar patterns to those found in the local surveys (Table 10). However, the results do not always hold for all strata in 2005. Across all strata the percentage of respondents reporting using internet at least once per week increases from 2005 to 2009, and the rise varies between 5.2 and 14.0 percentage points. The only exception from the increasing trend is a percentage change of -0.2 for the stratum with municipality size between 20,000 and 99,999 residents. At the same time, the share of individuals that never use internet decreases from 2005 to 2009. The decline holds for all strata and ranges from -1.5 to -7.8 percentage points. When considering groups of voters and non-voters in 2005 and 2009, we find trends similar to those in the local dataset, except for the smallest and the largest strata in 2005. Share of respondents that use internet for obtaining political information at least once per week is higher among the group of voters, while those who do not use internet make out a larger share of non-voters.

Table 10. Internet usage for reading election-relevant information during the national elections of 2005 and 2009.

Survey		2005			2009		
Strata	Internet usage	Voters	Non-voters	Average	Voters	Non-voters	Average
0-199	Often	31.959	37.500	32.381	42.547	19.149	39.566
	Rarely	27.835	25.000	27.619	24.845	27.660	25.203
	Never	40.206	37.500	40.000	32.609	53.191	35.230
200-1,999	Often	38.095	25.000	36.957	54.483	22.222	50.920
	Rarely	28.571	25.000	28.261	17.241	44.444	20.245
	Never	33.333	50.000	34.783	28.276	33.333	28.834
2,000-19,999	Often	46.809	26.667	44.037	44.884	18.182	51.471
	Rarely	27.660	13.333	25.688	23.432	45.455	25.000
	Never	25.532	60.000	30.275	31.683	36.364	23.529
20,000-99,999	Often	54.286	20.000	52.000	53.680	33.333	51.765
	Rarely	20.000	0.000	18.667	18.615	37.500	20.392
	Never	25.714	80.000	29.333	27.706	29.167	27.843
Over 100,000	Often	51.462	50.000	51.381	58.266	31.250	56.629
	Rarely	17.544	30.000	18.232	19.556	40.625	20.833
	Never	30.994	20.000	30.387	22.177	28.125	22.538

Note: The table shows the cross tabulation of the survey questions 51 and 82. Question 51: "Hvor ofte leste du om valget på internett i forbindelse med valgkampen?" (How often did you read about the election about the election campaign online). Question 82: "Stemte du ved valget i høst?" (Did you vote the election this fall?).

Appendix C – First Stage (Extended Table)

Table 11. The first-stage estimates for all models.

	(1) Baseline	(2) Socioeconomic	(3) Service provision
Coverage	0.163***	0.160***	0.158***
	(0.009)	(0.009)	(0.009)
Age 16-25		-0.296	-0.256
		(0.425)	(0.396)
Age 26-35		-0.776	-0.943*
		(0.590)	(0.547)
Age 36-45		-0.202	-0.191
		(0.645)	(0.575)
Age 46-55		-0.353	0.047
		(0.565)	(0.529)
Age 56-65		-1.435**	-1.101**
		(0.569)	(0.539)
Age 667-5		-0.395	-0.190
		(0.624)	(0.606)
Age 76-00		-0.574	-0.249
		(0.675)	(0.673)
Childcare			1.036***
			(0.351)
Education			-0.142**
			(0.063)
Elderly Care			-0.066*
			(0.040)
H&S			-0.181**
			(0.078)
Culture			-0.026
			(0.108)
Transport			-0.028
			(0.152)
Admin			-0.344**
			(0.141)
Socioeconomic		✓	✓
Obs.	1,688	1,687	1,680

*Note: The dependent variable is the internet user rate. The ticker symbols show what groups of control variables are included in the specification. The regressions are based on 422 municipalities over 4 years, all including municipal fixed effects, time dummies and heteroscedasticity-robust standard errors clustered at the municipality level. The latter is shown in parentheses below the coefficient estimates. Significance levels are shown by *** p<0.01, ** p<0.05, * p<0.1.*

Appendix D – Second Stage for Voter Turnout (Extended Table)

Table 12. The second-stage estimates for voter turnout.

	(1) Baseline	(2) Socioeconomic	(3) Service provision
User Rate	0.050**	0.067***	0.071***
	(0.023)	(0.025)	(0.026)
Age16-25		-0.472**	-0.529***
		(0.203)	(0.200)
Age 26-35		0.083	0.051
		(0.273)	(0.274)
Age 36-45		0.368	0.280
		(0.313)	(0.309)
Age 46-55		1.108***	0.947***
		(0.267)	(0.265)
Age 56-65		0.827***	0.691***
		(0.255)	(0.249)
Age 66-75		1.164***	1.063***
		(0.242)	(0.238)
Age over 76		0.221	0.167
		(0.300)	(0.295)
Childcare			-0.189**
			(0.089)
Education			0.074**
			(0.030)
Elderly Care			-0.018
			(0.022
H&S			-0.035
			(0.045)
Culture			0.069
			(0.056)
Transport			0.202**
			(0.082)
Admin			0.165**
			(0.083)
Socioeconomic		✓	✓
Obs.	1,688	1,687	1,679

*Note: The dependent variable is voter turnout. The ticker symbols show what group of control variables are included in the specification. The regressions are based on 422 municipalities over 4 years municipal fixed effects, time dummies and heteroscedasticity-robust standard errors clustered at the municipality level. The latter is shown in parentheses below the coefficient estimates. Significance levels are shown by *** p<0.01, ** p<0.05, * p<0.1.*

Appendix E – Second Stage for Vote Shares (Extended Table)

Table 13. The second-stage estimates for vote shares.

	Left-wing parties			Other parties		
	(1) Baseline	(2) Socio-economic	(3) Service provision	(4) Baseline	(5) Socio-economic	(6) Service provision
User Rate	-0.141***	-0.149***	-0.140***	0.249***	0.249***	0.245***
	(0.046)	(0.048)	(0.048)	(0.055)	(0.057)	(0.057)
Age 16-25		0.275	0.392		-0.244	-0.544
		(0.396)	(0.389)		(0.598)	(0.595)
Age 26-35		0.197	0.222		0.836	0.523
		(0.532)	(0.559)		(0.792)	(0.809)
Age 36-45		0.115	0.0762		0.637	0.310
		(0.591)	(0.609)		(0.935)	(0.925)
Age 46-55		-0.378	-0.326		0.740	0.193
		(0.435)	(0.458)		(0.659)	(0.641)
Age 56-65		0.175	0.143		0.120	-0.248
		(0.445)	(0.464)		(0.717)	(0.724)
Age 66-75		0.814	0.786		0.675	0.326
		(0.581)	(0.607)		(0.979)	(0.972)
Over 76		1.520***	1.329**		-0.005	-0.184
		(0.557)	(0.603)		(1.108)	(1.106)
Childcare			0.075			-0.377**
			(0.146)			(0.179)
Education			0.181**			-0.185*
			(0.077)			(0.098)
Elderly			0.067			-0.034
Care			(0.047)			(0.080)
H&S			0.053			0.088
			(0.080)			(0.115)
Culture			-0.017			0.139
			(0.140)			(0.288)
Transport			-0.074			0.701**
			(0.199)			(0.275)
Admin			0.151			0.226
			(0.182)			(0.227)
Socioecon.		✓	✓		✓	✓
Obs.	1,688	1,687	1,679	1,688	1,687	1,679

*Note: The ticker symbols show what group of control variables are included in the specification. The regressions are based on 422 municipalities over 4 years. All regressions include municipal fixed effects, time dummies and heteroscedasticity-robust standard errors clustered at the municipality level. The latter is shown in parentheses below the coefficient estimates. Significance levels are shown by *** p<0.01, ** p<0.05, * p<0.1.*