# Voting when the Stakes are High

Jørgen Juel Andersen
Jon H. Fiva
Gisle James Natvik

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## Abstract

Rational choice theories of electoral participation stress that an individual's decision to vote depends on her expected net benefit from doing so. If this instrumental motive is relevant, then turnout should be higher in elections where more is at stake. We test this prediction, by studying how turnout is affected by exogenous variation in governments' financial flexibility to provide pork for their voters. By utilizing simultaneous elections for different offices, we identify a positive effect of election stakes on turnout.

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*Jørgen Juel Andersen*
*Norwegian School of Management*
*jorgen.j.andersen@bi.no*

*Jon H. Fiva*
*University of Oslo*
*j.h.fiva@econ.uio.no*

*Gisle James Natvik*
*Norges Bank*
*gisle-james.natvik@norges-bank.no*

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# 1 Introduction

In its simplest form, the rational choice theory of voting suggests that individuals are motivated to vote because they can affect the election's outcome. It follows that turnout is expected to be higher in elections where more is at stake and where a participant is more likely to cast a decisive vote (Downs (1957), Riker and Ordeshook (1968)). While several studies have investigated how the expected probability of being pivotal matters (see Blais (2000)), little attention has been directed to how the stakes of the election affect political participation. In this paper we explore whether turnout rates vary with the benefits of being pivotal: do more people vote when the stakes are high?

An election's stakes depend on how strongly the winning candidate can influence outcomes that voters care about. A key determinant of a politician's influence is the budgetary constraints that he or she will face in office, which in general cannot be taken as exogenous. Our approach to handling the endogeneity of electoral stakes is to utilize variation in local government (municipality) revenue in Norway from hydropower production, which is largely determined by geography. Higher revenue from hydropower production equips elected officials with more funds to distribute, and thus affects the stakes of the local election.[1]

Our identification strategy exploits the Norwegian institutional feature that elections for the local and regional governments are held simultaneously, with identical sets of eligible voters. By focusing on the *difference* in voter turnout in the two elections—the turnout difference hereafter—our estimates are unlikely to be biased by (unobserved) population characteristics.

Our main finding is that extra revenues from taxing hydropower production increases turnout in the local election relative to the regional election. This finding is remarkably robust. It is visible in the raw data, and it does not disappear as we gradually control for an extensive list of local characteristics known from the rational choice literature to

[1] Hægeland, Raaum, and Salvanes (2008) use the same source of variation to identify effects of school resources on pupil achievement.

affect turnout. Furthermore, while these observables do explain turnout *levels*, they have only a small impact on turnout *differences*. Hence, in order for our qualitative finding to be driven by unobservables, these must both be correlated with hydropower income, and influence the turnout difference far more strongly than observables do. We argue that this is not likely to be the case.

Quantitatively, we find that if hydropower tax revenue increases from zero to its maximum level, the turnout difference responds with about 6 percentage points. The estimates imply that it takes around 9,000 Norwegian kroner (USD 1500) to increase voter participation by 1 percentage point in the local election relative to the regional one. We consider this a lower bound of the causal effect of interest. The reason is that if hydropower tax revenues triggers people to vote in the local election, this is also likely to reduce the cost of voting in the regional election, since voting for both elections takes place in the same voting booth. In the elections we study, voters may cast preferential votes for specific candidates. As a robustness check, we therefore investigate whether hydropower income also motivates voters to alter the parties' lists of candidates. The evidence suggests that it does.

In terms of Downs' "calculus of voting" model, our results only make sense if hydropower revenue *increases* the incentive to vote at the local level relative to the regional level. Of course, in theory this need not be the case. As resource wealth feeds into greater provision of public goods by the local government, the marginal utility of these goods is likely to decline, reducing how strongly voters' prefer one candidate's prioritization of public goods relative to another candidate's choices. On the other hand, if extra revenues instead are used for purposes targeted at particular recipients, or pork barrel spending, it becomes more important to vote in the local election.[2] We therefore inspect how local revenues derived from hydropower taxation relate to local spending priorities. The data reveals that the two core welfare services that local governments must provide (education and elderly care) are downprioritized relative to noncore expenditure categories such as

[2]A related argument is made by Schwartz (1987).

local roads, cultural activities and industry support. Thus, the spending pattern appears consistent with the hypothesis that hydropower income raises the instrumental incentive to vote in the local election.

The literature on voter motivation is vast, and a survey is beyond the scope of this paper. In short, a broad distinction is made between theories that focus on the instrumental motive to vote and theories where the act of voting in itself generates utility (Dhillon and Peralta (2002)). It is well understood that the "calculus of voting" framework cannot explain observed turnout *levels* in large-scale elections (for instance, Schachar and Nalebuff (1999)). Our analysis fits into this literature, as we show that the instrumental motive to vote may still matter on the *margin* (as suggested by Blais (2000), Dowding (2005) and Geys (2006b)).

The rest of this paper is organized as follows. In section 2 we describe the institutional setting and assess how revenues from hydropower taxes are spent. Section 3 uses a simple version of the pivotal voter model to obtain an empirical strategy for estimating the effect of hydropower income on turnout. The data and our empirical specification are presented in section 4. Section 5 gives the results for voter turnout, while in section 6 we conduct a brief analysis of preferential votes. Section 7 explores the robustness of our main result and Section 8 addresses potential endogeneity issues applying an instrumental variable approach. Section 9 concludes.

# 2 Fiscal Effects of Hydropower

The central question we explore in this paper is how hydropower income affects voter turnout in local elections. A priori, it is not obvious whether hydropower income will increase or reduce the instrumental motive to vote. On the one hand, if hydropower-rich governments simply use their extra revenues to provide more of the same basic welfare services as do poorer local governments, and voters' utility over these services is concave, this income will reduce the importance of the local election to voters. On the other hand,

if hydropower income triggers pork barrel spending that is targeted at specific recipients in the electorate, this income source will stimulate the instrumental incentive to vote. Hence, before we analyze how hydropower income affects turnout in a local election, it is important to know how this extra income is spent. In this section we therefore describe the institutional setting and how local spending varies with hydropower income.

## 2.1 Institutional Setting and Hydropower Revenues

In Norway there are three layers of government: the central government, the regional governments (counties) and the local governments (municipalities). The main entities of interest in this paper are the 431 local governments, which play an important role within the Norwegian welfare state.

The local governments are mostly financed by regulated local tax sharing and grants from the central government. On average, this source of revenue accounts for about 80 percent of the total local government revenues. The remainder stem from user charges, which are limited to cover costs only, and property taxation. In this study we focus on commercial property taxation levied on hydropower producers. [3] Importantly, property tax revenues are not redistributed across local governments.

Large hydropower plants are typically found in mountainous areas that receive substantial precipitation, and where glaciers have shaped the landscape so that hydropower production is relatively easy. Hence, a topography that is favorable to production of hydropower facilitates large revenues for local governments if they levy commercial property taxes. [4] In 2007, 65 percent of Norway's local governments levied such taxes. The tax rate is chosen by the local government, but cannot exceed 0.7 percent. Almost all local governments choose to tax at the maximum rate (Hægeland, Raaum, and Salvanes (2008)).

For most of Norway's local governments the revenues from commercial property tax-

[3] Local governments also have the possibility to levy property taxation on housing, studied in Fiva and Rattsø (2007).

[4] Hydropower accounts for 98-99 percent of total electricity production in Norway (Statistics Norway).

ation are small. About two thirds of all local governments receive less than 4 percent of their total revenues from this source. However, for some local governments, revenues from commercial property taxation constitute an important source of income. In 2007, 37 local governments received more than 10 percent of their total income from commercial property taxation. In per capita terms, the average revenue from this tax source is about NOK 2,000 (USD 350). The maximum is about NOK 52,000 (approximately USD 9,000) per capita. As revenues from commercial property taxation predominantly stem from taxing hydropower plants, we refer to this revenue source as hydropower income.[5]

## 2.2 Fiscal Flexibility and Spending Priorities

While their revenue side is relatively restricted, the Norwegian local governments have more flexibility concerning the composition of government spending, subject to a set of minimum standards set by the central government. In 2007 local governments spent on average NOK 67,000 (USD 11,500) per capita. About 57 percent was spent on the major welfare services that Norwegian local governments have responsibility for, namely child care, education and elderly care. About 6 percent was spent on traditional local public goods (fire protection and infrastructure). The remainder was spent on central administration, social assistance, primary health care, cultural activities, industry support, planning, and local roads. See Table 1 and 2 for details.

In Table 3 we present results from simple regressions where we relate spending per capita to hydropower income for 12 different expenditure categories, controlling for population size and population share living in remotely populated areas in each municipality. We find that hydropower-rich local governments spend more per capita on every local budget category. This is not surprising, and says little about how hydropower-income affects spending priorities. We therefore continue by focusing on each expenditure com-

[5]Out of the 37 local government with more than 10 percent of their income from commercial property taxation, 30 have major power stations (capacity above 10MW per hour). Three local government have only minor hydropower stations (capacity below 10MW per hour) and four do not have any hydropower. In these cases the property tax revenues stems mainly from fisheries and oil industries.

ponent as share of total spending, and explore how these spending shares vary with hydropower income.

Results for spending shares are presented in Table 4. We see a systematic negative association between the fraction spent on the two major welfare services (schooling and elderly care) and hydropower income (again controlling for population size and density). On the other hand, hydropower income is positively related to the shares spent on culture, industry support, planning, and local roads, respectively. All these associations are statistically significant at the 1-percent level. In addition we find a positive relationship between hydropower income and central administration, but this association is statistically significant only at the ten percent level.

This spending pattern likely reflects that most local governments without hydropower revenues must spend most of their funds just to achieve the minimum standards set by the central government concerning the provision of the major welfare services (for example, maximum class size in primary schools). Local governments enriched by hydropower revenues, on the other hand, have the financial flexibility to pursue interests beyond their primary tasks.

The expenditure components that gain priority as hydropower income increases have the common feature that they may be targeted at well-defined interest groups. For instance, a larger administration is particularly beneficial for those voters who gain employment from this. Higher spending on cultural services matters most for those who produce them or have an appreciation for the these services. While industry support may be useful for the local community as a whole, it is particularly useful for the recipient companies. Furthermore, although roads are typically considered as public goods, the roads provided by local governments in Norway are small and are not the main transportation routes within the municipalities, which are provided by the central or regional government. Instead locally financed roads are typically utilized only by the residents of the neighborhood where they are located. Finally, planning is a logical need as these types of projects expand.

A natural interpretation of the pattern shown in Table 4 is that hydropower income allows local politicians to allocate resources to new purposes beyond the primary welfare services that poorer municipalities must focus on, and that these new purposes benefit specific groups of voters. Hence, of the two opposing effects of hydropower income on the instrumental incentive to vote mentioned above—providing more of the basics or providing more of the discretionary services—the local spending patterns indicate that the positive effect is likely to dominate the negative effect.

# 3 Theory and Empirical Strategy

## 3.1 The Model

f Consider the following formulation of the conventional "calculus of voting" model.

An eligible voter $i$ in local voting district $l$ votes if her expected benefit from voting exceeds her cost:

$$p^L_{l,i}B^L_{l,i} + D^L_{l,i} \geq C^L_{l,i}, \tag{1}$$

where $p^L_{l,i}$ is citizen $i$'s probability of casting a decisive vote (indexed by $L$) and $B^L_{l,i}$ is her subjective value of influencing the election outcome, the "party differential" in the terminology of Downs (1957). Hence, the product, $p^L_{l,i}B^L_{l,i}$, is the total instrumental incentive to vote. $D^L_{l,i}$ denotes $i$'s direct benefit from voting in the local election, termed the "consumption benefit" of voting by Riker and Ordeshook (1968), and $C^L_{l,i}$ is $i$'s cost of voting.[6]

[6]Even though $D^L_{l,i}$ was initially introduced as the "consumption benefits from voting" by Riker and Ordeshook (1968), it can be assigned the more general interpretation of a "catch-all" variable. In the literature, the catch-all term has been associated with a range of factors that may give individuals utility of voting per se, for instance: demographic variables such as age (Strate, Parrish, Elder, and Ford (1989)), gender (Schlozman, Burns, Verba, and Donahue (1995)), marital status (Stoker and Jennings (1995)), education (Leighley and Nagler (1992a)), income (Leighley and Nagler (1992b)); attitudinal and behavioral factors such as general political knowledge (Galston (2001)), strength of partisanship (Huckfeldt and Sprague (1992)), feelings of civic duty (Blais and Young (1999)), political trust (Hetherington (1999)), church attendance (Cassel (1999)); social variables such as social pressure (Funk (2010)), group consciousness (Miller, Gurin, and Gurin (1981)), political disagreement (Mutz (2002)), and social capital (Lake and Huckfeldt (1998)); and institutional variables such as closeness of the election (Schachar and Nalebuff (1999)), party loyalty (Schuessler (2000)), contact from political organizations (Wielhouwer

The probability of being pivotal can be interpreted in the traditional way, where voters may be pivotal in terms of altering political representation. Alternatively, voters may be pivotal by influencing which group(s) within the community will receive patronage rewards or local public benefits (Schwartz (1987); Smith and Bueno de Mesquita (2010)). When pork barrel politics dominate the local political agenda, this interpretation of $p_{l,i}^L$ may be particularly relevant.

The terms $C_{l,i}^L$ and $D_{l,i}^L$ may differ across individuals. Hence, the net cost of voting, $C_{l,i}^L - D_{l,i}^L$, is distributed within the population of local government $l$, with a cumulative distribution function $F\left(e_l^L; \mathbf{Y}_l\right)$ representing the fraction of eligible voters with $C_{l,i}^L - D_{l,i}^L \leq e_l^L$. $\mathbf{Y}_l$ is a vector of local government specific characteristics that influence the distribution of net voting costs.

For expositional convenience, we assume that the instrumental incentive does not differ across individuals in $l$, $p_{l,i}^L B_{l,i}^L = p_l^L B_l^L$. The share of $l$'s potential voters who turn out for the local election, "local turnout" hereafter, is then $F\left(p_l^L B_l^L; \mathbf{Y}_l\right)$.[7]

Now consider the decision to vote in the regional government election (indexed by $R$). Completely analogously to (1), the citizen will choose to vote if

$$p_{l,i}^R B_{l,i}^R + D_{l,i}^R \geq C_{l,i}^R. \tag{2}$$

As for the local election, assume that the net cost of voting at the regional election, $C_{l,i}^R - D_{l,i}^R$, differs across the inhabitants in $l$, with a cumulative distribution function $G\left(e_l^R; \mathbf{Y}_l\right)$. Assume also that the instrumental motive to vote in the regional election is identical for all voters in $l$, $p_{l,i}^R B_{l,i}^R = p_l^R B_l^R$. The share of voters in $l$ who vote in the

and Lockerbie (1994)), campaigns (Ansolabehere, Lyengar, Simon, and Valentino (1994)), and barriers to registration (Rosenstone and Wolfinger (1978)); and, finally, genes (Fowler and Dawes (2008)). See Geys (2006a) and Degan and Merlo (forthcoming) for more comprehensive reviews of the literature. For our purposes the exact interpretation of $D$ is not important.

[7]Rather than assuming that individuals have the same $p_l^L B_l^L$, we could let them be heterogenous in this respect too. In this case turnout could be represented by $H\left(0, Y_l\right)$ denoting the mass of voters with $C_{l,i}^L - D_{l,i}^L - p_{l,i}^L B_{l,i}^L < 0$. However, because this formulation allows a less transparent representation of how local income affects local turnout we simplify the analysis by assuming that individuals have the same $p_l^L B_l^L$.

regional election, "regional turnout" hereafter, is then $G\left(p_l^R B_l^R; \mathbf{Y}_l\right)$.

## 3.2 The Effect of Local Government Income on the Turnout Difference

Within the model laid out above, local government income, $I_l$, affects turnout in the local election in $l$ as follows:

$$\frac{dF\left(p_l^L B_l^L; \mathbf{Y}_l\right)}{dI_l} = f\left(p_l^L B_l^L; \mathbf{Y}_l\right)\left[p_l^L \partial B_l^L/\partial I_l + B_l^L \partial p_l^L/\partial I_l\right] + \tag{3}$$
$$d\mathbf{Y}_l/dI_l\left[f\left(p_l^L B_l^L; \mathbf{Y}_l\right)\left(p_l^L \nabla \overline{B_{\mathbf{Y}}^L} + B_l^L \nabla p_{\mathbf{Y}}^L\right) + \nabla F_{\mathbf{Y}}\left(p_l^L B_l^L; \mathbf{Y}_l\right)\right],$$

where $\nabla \overline{B_{\mathbf{Y}_l}^L}$, $\nabla \overline{p_{\mathbf{Y}_l}^L}$ and $\nabla F_{\mathbf{Y}_l}\left(p_l^L B_l^L; \mathbf{Y}_l\right)$ are the gradients of $B_l^L$, $p_l^L$ and $F\left(p_l^L B_l^L; \mathbf{Y}_l\right)$ with respect to $\mathbf{Y}_l$, and $d\mathbf{Y}_l/dI_l$ is a vector of how each characteristic is affected by $I_l$.[8] $f\left(p_l^L B_l^L; \mathbf{Y}^l\right) \equiv F_1\left(p_l^L B_l^L; \mathbf{Y}_l\right)$ is the mass of eligible voters who are "on the margin" in the sense that they are indifferent between turning out and abstaining from participation in the election. In the first term of the expression, this mass is multiplied by the effect of hydropower income on the instrumental incentive to vote, which is the expression inside brackets. The total product thus captures how strongly a marginal increase in income affects local election turnout via the instrumental incentive to vote.

The second term in (3) captures how $I_l$ may influence turnout through an association with local characteristics, hereafter referred to as the "selection effect". This effect depends on how strongly hydropower income relates to each characteristic in $\mathbf{Y}_l$, $\frac{d\mathbf{Y}_l}{dI_l}$, and how strongly each characteristic in $\mathbf{Y}_l$ relates to a voter's benefit and the probability of being pivotal ($\nabla B_{\mathbf{Y}_l}^L$ and $\nabla p_{\mathbf{Y}_l}^L$) and the distribution of net voting costs in local community $l$ ($\nabla F_{\mathbf{Y}_l}$). An intuitive example of this effect would be that local governments with high $I_l$ attract citizens with a strong conviction that voting per se is important, and who therefore have low values of $e_l^L$ and $e_l^R$.

[8] Hence, e.g. $\nabla F_{\mathbf{Y}}\left(p_l^L B_l^L; \mathbf{Y}_l\right)$ is a vector of the derivatives of $F$ with respect to each component of $\mathbf{Y}_l$.

A similar expression to (3) applies for the effect of local government income on the local turnout in the regional election. Hence, income will affect the difference between the local turnout in the local and regional elections, the "turnout difference" hereafter, in the following way:

$$\begin{aligned}\frac{d\left[F_l - G_l\right]}{dI_l} &= f_l\left(p_l^L \partial B_l^L/\partial I_l + B_l^L \partial p_l^L/\partial I_l\right) - g_l\left(p_l^R \partial B_l^R/\partial I_l + B_l^R \partial p_l^R/\partial I_l\right) \\ &\quad + \frac{d\mathbf{Y}_l}{dI_l}\Delta s_l^Y, \end{aligned} \tag{4}$$

where

$$\Delta s_l^Y = f_l\left(p_l^L \nabla \overline{B_{\mathbf{Y}_l}^L} + B^L \nabla p_{\mathbf{Y}_l}^L\right) + \nabla F_{\mathbf{Y}_l} - g_l\left(p_l^R \nabla \overline{B_{\mathbf{Y}_l}^R} + B^R \nabla p_{\mathbf{Y}_l}^R\right) - \nabla G_{\mathbf{Y}_l}.$$

Here we have used the compressed notation $F_l = F\left(p_l^L B_l^L; \mathbf{Y}_l\right)$, $f_l \equiv f\left(p_l^L B_l^L; \mathbf{Y}_l\right)$, and so on, while $g_l \equiv g\left(p_l^R B_l^R; \mathbf{Y}_l\right)$ is the mass of voters $l$ who are on the margin at the regional election, and $\nabla G_{\mathbf{Y}_l}$ is the gradient containing all the derivatives of $G$ with respect to $\mathbf{Y}_l$.

As in the expression for turnout in the local election (3), we see two channels through which income potentially affects the turnout difference. First, local income may affect the instrumental incentive to vote in the local and regional elections differently. This is likely to be the case since higher income at the local level raises the financial flexibility under which the local government operates, but does not affect the financial situation of the regional government.

Next, there is the selection effect, in which the same relationship between income and characteristics, $d\mathbf{Y}_l/dI_l$, now is multiplied by $\mathbf{\Delta s}_l^Y$, hereafter referred to as the "selection difference". This term will be quantitatively smaller than the selection effect in (3) if the effects of characteristics $\mathbf{Y}_l$ on the consumption benefits of voting, the probability of being influential, and the distributions of net costs of voting go in the same direction for the two elections. Importantly, equation (4) illustrates that a selection effect can affect the turnout difference only if income is related to local characteristics and these

characteristics influence individuals' propensity to vote at the regional election differently from their propensity to vote in the local election.

## 3.3 Local Government Income and the Instrumental Incentive to Vote

The spending patterns documented in Section 2 suggested that hydropower income is predominantly used to provide goods and services that benefit more narrowly defined groups than do the primary tasks of local governments. Hence, we expect that a voter's benefit of being pivotal, $B^L_{l,i}$, increases with hydropower income.[9] On the other hand, if income stimulates political participation through this channel, equilibrium turnout will increase, and the probability of being pivotal will decline with income, $\partial p^L_l/\partial I_l < 0$. However, this second-order effect can only dampen, not overturn, the total impact of income on the instrumental incentive to vote in the local government election, and $p^L_l \partial B^L_l/\partial I_l + B^L \partial p^L_l/\partial I_l > 0$ if $\partial B^L_{l,i}/\partial I_l > 0$.

## 3.4 Empirical Strategy

From (3) we know that in a simple regression of local turnout, $T^L_l$, on local income, $I_l$,

$$T^L_l = \mu^L + \beta^L I_l + \varepsilon^L_l, \tag{5}$$

the coefficient $\beta^L$ captures the selection effect of income in addition to the instrumental effect we are interested in. To handle this, we therefore consider the difference between turnout in the local and the regional elections in each $l$, and estimate an equation of the type

$$T^L_l - T^R_l = \mu^{LR} + \beta^{LR} I_l + \varepsilon^{LR}_l. \tag{6}$$

[9] This argument, and in particular the conditions for $\partial B^L_{l,i}/\partial I_l > 0$ to hold, is more formally addressed in the Appendix.

where the superscript $LR$ denotes that we are studying the difference between local and regional elections. From (4) and the ensuing discussion, it follows that specification (6) will identify how hydropower income affects the instrumental incentive to vote if the selection difference is (on average) zero (in the model, if $\mathbf{\Delta s}_l^Y = 0$).

On the other hand, if the selection difference is non-zero, we may suffer from the selection problem even with specification (6). We would therefore like to infer the severity of this potential problem. To do this we partition the vector $\mathbf{Y}_l$ into observables, $\mathbf{X}_l$, and unobservables, $\mathbf{Z}_l$. The selection effect in (4) will then consist of two parts:

$$\mathbf{\Delta s}_l^Y \frac{d\mathbf{Y}_l}{dI_l} = \frac{d\mathbf{X}_l}{dI_l}\mathbf{\Delta s}_l^X + \frac{d\mathbf{Z}_l}{dI_l}\mathbf{\Delta s}_l^Z,$$

where $\mathbf{\Delta s}_l^X$ and $\mathbf{\Delta s}_l^Z$ are the selection differences for $\mathbf{X}_l$ and $\mathbf{Z}_l$, respectively. Hence, when we run the following regression of the turnout difference where we include the observables $\mathbf{X}_l$,

$$T_l^L - T_l^R = \mu + \beta^{LR} I_l + \mathbf{X}_l\alpha + \varepsilon_l^{LR}, \tag{7}$$

our estimate of $\beta^{LR}$ will be contaminated by a selection effect only through $\mathbf{\Delta s}_l^Z$. A comparison of estimates of $\beta^{LR}$ from specifications 6 and 7 then allows us to assess the importance of selection on unobservables. If we include variables which we a priori expect to be important for voter behavior, and find that this leaves $\beta^{LR}$ basically unaltered, then it is unlikely that unobservable variables bias $\beta^{LR}$. A more formal argument along these lines is given in Altonji, Elder, and Taber (2005).

# 4 Data and Econometric Specification

## 4.1 The Sample

The local and regional governments in Norway are headed by councils elected through open-list proportional representation (PR).[10] Voters can affect the election outcome by voting for a party list and by casting preferential votes for particular candidates. Candidates are elected based on the votes they individually receive.[11] This is in contrast to closed-list PR systems, where candidates are elected strictly according to the order in which the party have nominated them.

Elections for both the local and the regional governments take place every four years. Local governments choose whether elections will take place over one or two days. The election outcomes we analyze are based on elections held on September 9-10, 2007. The regional governments ($n = 19$) are, like the local governments, multi-purpose authorities, but with more limited tasks. Their primary responsibilities are providing upper secondary education, roads, and transportation.

At the local and regional level of government there are 7 main political parties. In addition there are some independent lists (that is, local lists that are independent of the traditional political parties) that receive substantial support in some of the local elections in our sample. Independent lists are more issue-oriented than traditional party lists and are frequently based on internal geographic divides within the bounds of the municipality (Aars and Ringkjøb (2005)).

The mayor is the key player in the local government. In about 90 percent of the local governments, the mayor is elected by the members of the local government at the

[10] The mathematical formula used to translate votes into seats in Norwegian elections is the modified Saint-Lagüe method.

[11] At the local government level parties have the option to give some candidates an increased share of the poll (a maximum of 25 percent of the total number of votes received by the party's list). Together with preferential votes, which voters may cast to candidates on *any* party list, this is the basis for the distribution of seats. At the regional level the parties cannot give candidates an increased share of the poll, and preferential votes cannot be given to candidates from other lists. The voters may however affect the ordering of candidates at different lists, but for this to overrule the ordering proposed by the party prior to the election, a candidate must receive a preferential vote from at least eight percent of the party's electors.

beginning of the election term. The remaining 10 percent hold direct elections for mayor together with the ordinary local elections. The mayor cannot be removed during his or her election term of office.

In Norwegian politics, the main political divide is between the social democratic left bloc and the conservative right bloc. In the 2007–2011 election period, 44 percent of the mayors are from the left-wing bloc, 50 percent are from the right-wing bloc, and 6 percent are from independent lists.

The dataset used in this analysis consists of a cross section of Norwegian local governments in 2007. The total number of local governments was 431 that year, but we lose five observations for various reasons.[12] Table 5 shows descriptive statistics for all variables used in the analysis.

## 4.2 Econometric Specification

We follow the empirical strategy explained in section 3, and base our inference on the difference between turnout in the local and regional elections using the specifications in equation (7). In the vector of controls, $\mathbf{X}_l$, we include the richest set we have available of the characteristics suggested by the literature as important determinants of voter turnout (see footnote 6).

First, we include in the vector of controls various measures capturing population characteristics. In particular, we include the size and age distribution of the electorate, as well as the distribution of educational and marital status within the population. We also include variables capturing population size and density, and recent immigration (measured as the number of people moving into the municipality in 2006 relative to the size of the population). Furthermore, we include the average wage level (measured in NOK 100,000, approximately USD 15,000) for men and women, respectively. Finally in this category of controls we include two measures that proxy for social capital, namely donations per

[12] Two local governments (Kristiansund and Frei) merged January 1 2008, two local governments have implemented parliamentary systems (Oslo and Bergen), and we lack data on property taxation for one local government (Torsken).

capita (NOK) collected during the country's annual televised charity fundraiser, and the number of church services attended per capita.

Second, we include controls for various institutional characteristics of each local government: whether elections were held during one or two days (dummy), whether there are direct local elections for the mayor or not (dummy), the party fragmentation of the local government based on the previous local election, and whether an independent list exists for the local election (dummy). These political institutional characteristics are potentially endogenous to voter turnout and are not included in all specifications.[13]

Finally, we include region fixed effects, which implies that all inference comes from within region variation in our explanatory variables. Our econometric specification is therefore

$$T_l^L - T_l^R = \mu_R + \beta^{LR} I_l + \mathbf{X}_l \alpha + \varepsilon_l^{LR}, \tag{8}$$

where $\mu_R$ is the region fixed effect and $\varepsilon_l^{LR}$ is an error term.

# 5 Results

## 5.1 Descriptive Statistics on Voting Behavior

In the local elections the average voter turnout is 64 percent, while the average turnout in the regional elections is 58 percent. In fact, throughout the sample, the turnout in the regional election is lower than turnout in the local government election. The maximum deviation between the two is 20 percentage points.

As mentioned above, voting for a party list is not the only way to influence the composition of the local government. An alternative is to cast preferential votes for favored candidates (or to delete unfavored candidates from the party list). The option to alter the party list is utilized by 51 percent of voters in the local election and by 29 percent of voters in the regional election as captured by the variables PreferentialVotesLocal and

[13]For a detailed description of all variables included in the analysis, see Table 14 in the Appendix.

PreferentialVotesRegional; see Table 5).

## 5.2 Simple Correlations

As a simple first investigation, we plot the association between voter turnout and hydropower income and accompanying regression lines in Figure 1. We see that turnout in both the local and the regional elections correlate positively with hydropower income (upper and middle panel, respectively). The association is strongest for the local election. The slope of the regression lines based on the local and regional elections are 0.23 and 0.09 (both statistically significant at the 1-percent level).

In the bottom panel of Figure 1 we plot the association between our main outcome variable, the difference in turnout for the two elections (Dturnout), and hydropower income. The slope of the regression line is 0.14 and statistically significant at the 1-percent level.

## 5.3 Contrasting Turnout in the Two Coinciding Elections

In Table 6 we analyze the difference between turnout in the two elections using Ordinary Least Squares (OLS) to estimate variants of equation (8). The variants differ by which variables we include in our set of controls.

We start out with specification (1) where we do not include any control variables, equivalent to the regression line displayed in the lower panel of Figure 1. We then add control variables in four steps: Specification (2) includes region dummies, specification (3) includes a control variable for the size of the electorate, and specification (4) includes the full battery of the population characteristics we have available. Finally, specification (5) is augmented with political institutional variables.

All specifications give a positive and statistically highly significant estimate for the effect of hydropower tax income. In the richest specification the point estimate is 0.11, statistically significant at the 1-percent level. Quantitatively, this implies that if revenues

from hydropower taxes increase by NOK 9,000 (USD 1,500) per capita, the turnout difference rises with about one percentage point. Alternatively, when hydropower tax revenues rise from the minimum (0) to the maximum (NOK 52,000, or USD 9,000) observed level, the turnout difference increases by about 6 percentage points. Assuming a baseline turnout rate at 65 percent, this implies that about one out of seven citizens who otherwise would have abstained from voting are motivated to participate in the election.

From the "calculus of voting" model we would expect the size of the electorate to be negatively associated with voter turnout, as the probability of an individual vote being pivotal in the election is lower the larger is the electorate. We find this effect in our data. The estimates in column (3) suggest that together with regional dummies and hydropower income, electorate size explains about 42 percent of the variation in turnout difference.

We have experimented with a functional form where we allow the impact of hydropower income on turnout to depend on the number of voters. The interaction term was not statistically significant at conventional levels.[14] This may imply that "prize pivotalness" (Schwartz (1987); Smith and Bueno de Mesquita (2010)) is empirically more relevant than "outcome pivotalness" (Downs (1957)) in the context we examine. The idea in Schwartz (1987) and Smith and Bueno de Mesquita (2010) is that political parties depend on the continuing support of particular groups to stay in power and therefore have incentives to cater to the same interest groups by offering local public benefits. When a party allocates rewards contingent upon group-level voting results, it motivates group members to coordinate on supporting the party even if voters cannot individually influence who will win the election.

Local characteristics have limited explanatory power, as seen in column (4) of Table 6. While several population characteristics are associated with the local government turnout levels (see Table (13) in the Appendix), few are statistically significant for the turnout

[14]Results are available upon request. That the benefits from voting and the probability of casting a decisive vote, in the traditional sense, matters independently, but not multiplicatively is in line with survey evidence provided by Blais, Young, and Lapp (2000).

difference.[15] Hence, turnout in the regional election seems to capture how observable characteristics affect citizens' general motive to vote, independently of what is at stake in the local and regional elections.

Our interest in point estimates for population characteristics follows from the discussion in Section 2.4. When we find that observable variables have negligible effect on the turnout difference, the possibility that omitted variables are driving our results becomes less of a concern: the relevant omitted variable must both be appropriately correlated with hydropower income, and affect turnout far more strongly than do our observables. Furthermore, by comparing point estimates of hydropower tax income in specification (1) and (4) of Table 6, we learn that omitted variables must reduce this point estimate by almost six times as much as our full list of controls, including population size and region fixed effects, to make it disappear. This seems unlikely.

Although omitted variables are unlikely to be driving our main result, there is one factor that could impact our estimates: the cost of voting. Once an individual is inside the voting booth, part of the voting cost (in our model, $C$) is sunk. It is therefore reasonable to expect that if hydropower income motivates individuals to participate in the local election, some of these people will cast a vote in the regional election too. The upward sloping relationship between hydropower income and regional turnout in Figure 1 is consistent with this behavior. Hence, our point estimates may be interpreted as a *lower bound* of how hydropower income affects turnout via the instrumental incentive to vote.

[15] Local governments with a large number of recent immigrants tend to have a lower turnout difference. This effect is statistically significant at the five percent level in specification (4). Most likely, this captures that newcomers are less rooted in their community and consequently are less likely to vote at the local election (Geys (2006a); Gentzkow, Shapiro, and Sinkinson (2009)).

## 5.4 Independent Lists: Special Interests and Cognitive Costs of Voting

The broad hypothesis behind our study is that when hydropower tax revenue equips local governments with more discretionary funds to distribute, individuals are motivated to seek political influence through voting. An alternative means for influencing politics is to create a local list, independent of the nationwide political parties. Indeed, the conventional understanding of independent lists in Norway is that these are initiated when there are particularly controversial issues of extending beyond the conventional partisan divide (Aars and Ringkjøb (2005)), and our evidence in Section 2 indicates that the room for special interest politics at the local level is particularly large when hydropower tax revenue is high. Furthermore, one might hypothesize that when the party structure for the local election differs from the regional election, the cognitive cost of deciding who to vote for at the regional level increases. If this is the case, a mechanism behind our findings may be that hydropower stimulates the turnout difference through the emergence of independent lists, and voters are more vested in influencing the outcome in this contest rather than the regional election.

To assess this possibility, we have controlled for whether the set of parties participating in the local and regional elections differed. The dummy PartyIndepLists equals 1 if independent lists participated, and is 0 otherwise.[16] We see from Table 6 that the estimated coefficient is positive, as expected. Importantly, however, the impact of hydropower income is basically unaltered when this control variable is included—compare specification (4) and (5). Hence, the reason hydropower income stimulates the turnout difference is not that it makes independent lists emerge.

However, the existence of independent lists may still be relevant for the interpretation of our results. If hydropower income triggers people to vote in the local election, they automatically sink the cost of going to the polling booth for the regional election, but

[16] We only consider local party lists that got votes sufficient to gain at least one seat in the local council (41 percent of the local governments fulfilled this criteria). The results are similar if we consider local lists that got at least one vote (53 percent of the local governments).

not the cognitive cost of choosing which party to support in that election. Consequently, hydropower income may to a larger extent incentivize individuals to vote in just the local election, rather than both elections, when the set of available party lists is different in the two elections (for instance in local elections where coattail voting is expected to be less prominent). To address this hypothesis, we introduce an interaction term between PartyIndepLists and hydropower income. The results are given in Table 7. The interaction term is positive and statistically significant at the 5-percent level. In fact, if we compare these results to the baseline results reported in Table 6, we see that the estimates from that specification are strongly driven by local electoral districts where the party lists available are not the same for the two elections. This result is confirmed when we split the sample according to the presence of independent lists.[17]

We interpret the interaction effect as confirmation that by focusing on the turnout difference, we estimate a lower bound for how hydropower income affects the incentive to vote because part of the cost of participating in the regional election is sunk if the voter is already at the polls to participate in the local election. When the cognitive cost of voting in the regional election is high this issue is less important. Hence, the sum of the direct effect and the interaction effect in Table 7 is likely to be a better representation of how hydropower income impacts turnout. This effect is then 0.16 rather than 0.11 as in the baseline specification.

# 6 Preferential Votes

As an extension of our main analysis we consider a different dimension of political participation and its connection to hydropower income: the use of preferential votes. As explained in Section 4.1, voters in local elections may cast "side votes" for a specific candidate on *any* party list. A similar, but not identical, feature exists for the regional election. Clearly, this option constitutes an alternative way for voters to affect election

[17]Details are available upon request.

outcomes.

We follow the empirical approach laid out in Section 4, but we now use the share of votes that have been corrected (in percentage points) as the dependent variable. In Table 8 we contrast vote correcting behavior at the local level to vote correcting behavior at the regional level (that is, estimates on Equation (8) with the difference in corrected vote shares as the dependent variable).

This exercise yields a positive effect of hydropower income, which is statistically significant at the 5-percent level. The point estimate is 0.17, indicating that if hydropower tax revenues were to increase from the minimal to the maximum level in our sample, that is from 0 to NOK 52,000 (USD 9000), the share of votes that are corrected would increase with about 9 percentage points.

In contrast to the cost of voting for a party, an individual's cognitive cost of casting a preferential vote in the regional election should not be affected by the existence of independent lists. Hence, if the effects of independent lists in section 2.4 really are due to the cognitive costs of voting, they should *not* turn up for preferential votes. We therefore test whether an interaction term between PartyIndepLists and hydropower income does affect the number of preferential votes. The interaction effect is not statistically different from zero (see Table 9).

# 7 Sensitivity Checks

Areas with substantial hydropower income typically are sparsely populated. To ensure that our results are not driven by some omitted population size variable we have experimented with a more homogenous sample, where we only include local governments with less than 10,000 inhabitants. In Table 10 we provide results from this exercise for the specifications where all covariates are included and voter turnout is the dependent variable.

For ease of comparison we reproduce our baseline results for specification (1) in Table

10. As is evident from the tables, our results do not change much when excluding local governments with population size above 10,000 (specification (2)). We have also investigated to what extent our results are driven by outliers by applying a robust regressions method, which we report in specification (3).[18] We also report results from robust regressions on the more homogenous sample (specification (4)). The point estimate is smaller in specification (3) relative to our baseline estimate from specification (1). However, in all specifications, we find that the impact of hydropower revenues is statistically significant at the 1-percent level.

# 8 Endogeneity

When assessing the causal effect of election stakes, a challenge is that these stakes generally are not exogenous, but will depend on the policies chosen by politicians in response to fiscal needs, personal popularity and so on.[19] To circumvent this problem, we have used a research design where such policy endogeneity is unlikely to be a concern since hydropower income is largely determined by geographical factors. However, as noted in Section 2.1, local governments do have the option whether or not to levy commercial property taxes, they can choose to set the tax rate below the maximum rate (even though few do), and there are also some local governments receiving commercial property tax revenue from non-hydropower sources (such as the petroleum and fishery industries).

To investigate whether endogeneity poses a threat to our identification strategy we rely on instrumental variable techniques where we employ measures of topographic variation as instruments for hydropower income. More specifically, we use five variables capturing variations in altitude across local governments.

As documented in our first stage regression, reported in Table 11, there is a positive relationship between altitude and hydropower income. The F-test of the excluded in-

[18]The robust regression iteratively re-weights observations to reduce the importance of outliers. We implement it with STATA's rreg command.

[19]Besley and Case (2000) offer a general discussion of bias due to policy endogeneity.

struments indicate that the instruments are relevant (with an F statistic of about 10). Furthermore, the second stage results, reported in Table 12, lend support to our main finding: local hydropower revenues do seem to stimulate local political participation. The estimated effects are stronger than what we reported in our baseline specification, and they are statistically significantly different from zero at the 1-percent level.[20]

# 9 Conclusion

We have found that in communities where windfall gains from hydropower production equip the local government with extra funds to distribute, more people vote in the local rather than in the regional election, even though both elections are held simultaneously. It is reasonable to view this effect as causal, both because the eligible voting populations are the same for the two elections and because the estimated effect hardly changes as we include a rich set of observable variables.

Our interpretation of the local revenue effect is that when more wealth is controlled by the local government, the elected officials have more flexibility to pursue targeted spending programs. Thus, individuals have a stronger incentive to participate in the political process so as to influence the direction of the spending. Consequently, some individuals who otherwise would not have participated, are are motivated to vote at the election. Viewed through the lens of the basic election turnout framework, the "calculus of voting" model of Downs (1957), this is evidence that the instrumental incentive to vote indeed matters for turnout rates.

Because our empirical strategy is constructed to establish causality rather than to distinguish between competing models, other mechanisms than those in the plain Downsian model of turnout may also be valid. To us, a particularly plausible alternative explanation is that public sector wealth increase the rents from holding office and thus stimulates candidates' efforts to mobilize voters in the race for office (as in Schachar and Nalebuff

[20]For our most elaborate specification, a Wu-Hausman test fails to reject the assumption of exogeneity of hydropower income ($p = 0.064$).

(1999)). The instrumental incentive is thus moved up one link in the explanatory chain, from individual voters to parties. In order to reveal and identify the exact mechanism from windfall gains to voter turnout, however, detailed micro-level data is required. We plan to pursue this question in future research.

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Figure 1: The Relationship Between Voter Turnout and Hydropower Income (per capita) for Elections Held September 9–10, 2007.

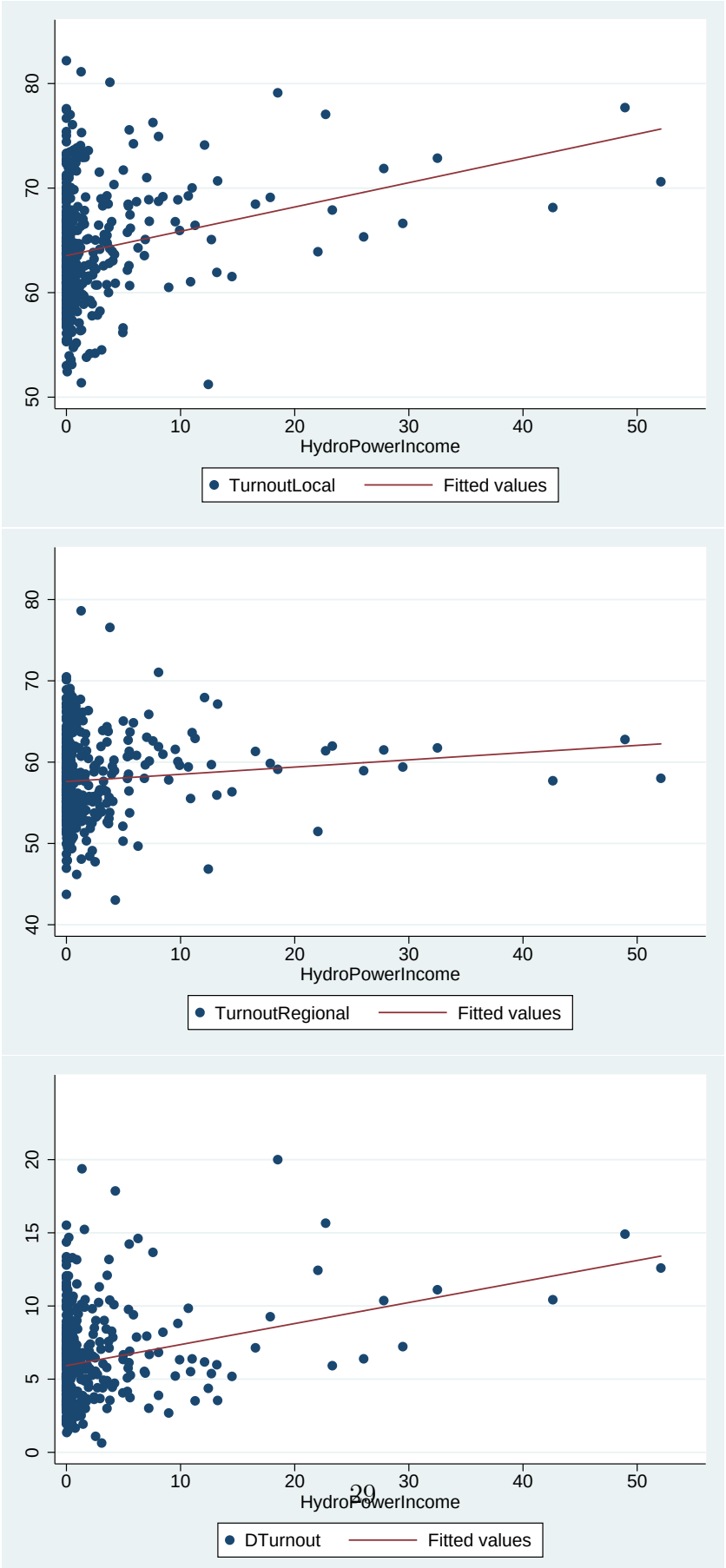

Table 1: Descriptive Statistics, Public Spending in NOK 1,000 per capita

| Variable | Mean | Std. Dev. | Min. | Max. |
|---|---|---|---|---|
| PerCapita_ChildCare | 5.523 | 2.662 | 2.743 | 44.848 |
| PerCapita_Schooling | 14.961 | 4.077 | 9.347 | 42.926 |
| PerCapita_ElderlyCare | 17.212 | 5.26 | 8.061 | 50.306 |
| PerCapita_Fire | 0.894 | 0.654 | 0.073 | 7.538 |
| PerCapita_Infrastructure | 3.569 | 1.984 | 0 | 13.459 |
| PerCapita_Administration | 5.963 | 3.443 | 1.703 | 30.776 |
| PerCapita_SocialAssistance | 4.665 | 2.328 | 1.393 | 29.439 |
| PerCapita_Health | 2.809 | 1.442 | 1.156 | 11.801 |
| PerCapita_Culture | 3.482 | 4.222 | 0.925 | 49.666 |
| PerCapita_IndustrySupport | 1.885 | 2.568 | 0.015 | 30.098 |
| PerCapita_Planning | 1.141 | 1.004 | 0.046 | 10.976 |
| PerCapita_Roads | 1.984 | 1.866 | 0.329 | 17.928 |
| N | | 426 | | |

Table 2: Descriptive Statistics, Shares of Public Spending

| Variable | Mean | Std. Dev. | Min. | Max. |
|---|---|---|---|---|
| Share_ChildCare | 8.540 | 2.864 | 3.77 | 20.095 |
| Share_Schooling | 22.819 | 4.566 | 11.079 | 45.949 |
| Share_ElderlyCare | 25.853 | 4.794 | 9.65 | 46.039 |
| Share_Fire | 1.32 | 0.76 | 0.096 | 10.549 |
| Share_Infrastructure | 5.342 | 2.35 | 0 | 16.731 |
| Share_Administration | 8.487 | 2.758 | 3.243 | 22.686 |
| Share_SocialAssistance | 7.046 | 2.538 | 1.492 | 25.19 |
| Share_Health | 4.077 | 1.381 | 1.887 | 13.502 |
| Share_Culture | 4.784 | 3.293 | 1.652 | 31.396 |
| Share_IndustrySupport | 2.443 | 2.164 | 0.029 | 15.352 |
| Share_Planning | 1.65 | 0.945 | 0.086 | 7.576 |
| Share_Roads | 2.787 | 1.746 | 0.418 | 17.913 |
| N | | 426 | | |

Table 3: The Relationship Between Public Spending (per capita) and Hydropower Income

| | (1) Child b/se | (2) School b/se | (3) Elderly b/se | (4) Fire b/se | (5) Infra b/se | (6) Admin b/se | (7) Social b/se | (8) Health b/se | (9) Culture b/se | (10) Industry b/se | (11) Planning b/se | (12) Roads b/se |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HydroPowerIncome | 0.28*** | 0.19*** | 0.27*** | 0.03*** | 0.13*** | 0.26*** | 0.17*** | 0.09*** | 0.37*** | 0.28*** | 0.11*** | 0.17*** |
| | (0.10) | (0.03) | (0.05) | (0.01) | (0.03) | (0.03) | (0.05) | (0.01) | (0.11) | (0.08) | (0.02) | (0.04) |
| Population | 0.02*** | -0.03** | -0.04** | -0.00** | -0.01** | -0.03** | 0.01** | -0.02** | -0.01 | -0.01** | 0.00* | -0.01** |
| | (0.01) | (0.01) | (0.02) | (0.00) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.00) | (0.01) |
| ShareInRuralAreas | -0.24 | 2.86*** | 6.30*** | 0.17 | -0.37 | 3.85*** | 0.36 | 1.42*** | -0.34 | 1.08** | 0.57*** | 0.00 |
| | (0.43) | (0.89) | (0.97) | (0.13) | (0.40) | (0.78) | (0.46) | (0.31) | (0.78) | (0.49) | (0.20) | (0.43) |
| _cons | 4.82*** | 13.36*** | 13.92*** | 0.79*** | 3.55*** | 3.80*** | 4.00*** | 2.04*** | 2.93*** | 0.85*** | 0.58*** | 1.73*** |
| | (0.34) | (0.53) | (0.65) | (0.08) | (0.25) | (0.45) | (0.24) | (0.20) | (0.58) | (0.27) | (0.10) | (0.27) |
| $N$ | 426 | 426 | 426 | 426 | 426 | 426 | 426 | 426 | 426 | 426 | 426 | 426 |
| adj. $R^2$ | 0.346 | 0.159 | 0.297 | 0.078 | 0.148 | 0.410 | 0.166 | 0.331 | 0.252 | 0.458 | 0.439 | 0.289 |

Note: Robust standard errors in parentheses. HydroPowerIncome is measured in NOK 1000 per capita. Population is the number of inhabitants in 1000s.

Table 4: The Relationship Between Shares of Total Public Spending (percent) and Hydropower Income

| | (1) Child b/se | (2) School b/se | (3) Elderly b/se | (4) Fire b/se | (5) Infra b/se | (6) Admin b/se | (7) Social b/se | (8) Health b/se | (9) Culture b/se | (10) Industry b/se | (11) Planning b/se | (12) Roads b/se |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HydroPowerIncome | 0.02 | -0.23*** | -0.24*** | 0.00 | 0.02 | 0.03* | 0.01 | -0.00 | 0.15*** | 0.15*** | 0.04*** | 0.07*** |
| | (0.05) | (0.03) | (0.03) | (0.01) | (0.02) | (0.02) | (0.03) | (0.01) | (0.05) | (0.04) | (0.01) | (0.02) |
| Population | 0.05*** | 0.00 | -0.02 | -0.00 | -0.00 | -0.04*** | 0.04*** | -0.01*** | -0.00 | -0.01** | 0.01** | -0.01* |
| | (0.01) | (0.01) | (0.01) | (0.00) | (0.01) | (0.01) | (0.01) | (0.00) | (0.01) | (0.01) | (0.00) | (0.01) |
| ShareInRuralAreas | -3.04*** | -2.36** | 2.72*** | -0.02 | -1.79*** | 3.32*** | -1.25*** | 1.23*** | -1.15* | 1.67*** | 0.54** | -0.24 |
| | (0.55) | (0.93) | (0.94) | (0.13) | (0.41) | (0.64) | (0.47) | (0.31) | (0.63) | (0.39) | (0.22) | (0.41) |
| _cons | 9.57*** | 24.46*** | 25.20*** | 1.35*** | 6.20*** | 7.12*** | 7.31*** | 3.62*** | 5.01*** | 1.40*** | 1.21*** | 2.85*** |
| | (0.38) | (0.61) | (0.61) | (0.08) | (0.27) | (0.40) | (0.27) | (0.18) | (0.43) | (0.25) | (0.12) | (0.27) |
| $N$ | 426 | 426 | 426 | 426 | 426 | 426 | 426 | 426 | 426 | 426 | 426 | 426 |
| adj. $R^2$ | 0.209 | 0.121 | 0.089 | -0.005 | 0.033 | 0.230 | 0.093 | 0.117 | 0.065 | 0.268 | 0.082 | 0.052 |

Note: Robust standard errors in parentheses. HydroPowerIncome is measured in NOK 1000 per capita. Population is scaled by 1000, inhabitants in 1000s.

Table 5: Descriptive Statistics

| Variable | Mean | Std. Dev. | Min. | Max. | N |
|---|---|---|---|---|---|
| TurnoutLocal | 64.051 | 5.488 | 51.224 | 82.189 | 426 |
| TurnoutRegional | 57.81 | 5.019 | 43.036 | 78.616 | 426 |
| DTurnout | 6.241 | 3.059 | 0.638 | 20 | 426 |
| PreferentialVotesLocal | 51.405 | 13.076 | 23.093 | 91.473 | 426 |
| PreferentialVotesRegional | 28.925 | 8.83 | 14.033 | 64.012 | 426 |
| DPreferentialVotes | 22.48 | 10.093 | -8.236 | 62.92 | 426 |
| HydroPowerIncome | 2.197 | 5.761 | 0 | 52.079 | 426 |
| lnVotingPopulation | 8.199 | 1.093 | 5.088 | 11.755 | 426 |
| VotingPopulation | 7025.803 | 11642.053 | 162 | 127338 | 426 |
| Population | 9071.353 | 15003.096 | 214 | 161730 | 426 |
| ShareInRuralAreas | 0.493 | 0.274 | 0.007 | 1 | 426 |
| RecentImmigrants | 0.045 | 0.016 | 0.014 | 0.093 | 426 |
| ShareVotersAged18to37 | 0.297 | 0.035 | 0.185 | 0.398 | 426 |
| ShareVotersAged38to57 | 0.354 | 0.022 | 0.284 | 0.423 | 426 |
| ShareVotersAged58to77 | 0.252 | 0.03 | 0.159 | 0.361 | 426 |
| ShareVotersAged77plus | 0.097 | 0.024 | 0.041 | 0.171 | 426 |
| ShareWomen | 0.497 | 0.01 | 0.449 | 0.52 | 426 |
| ShareUnMarried | 0.488 | 0.031 | 0.384 | 0.642 | 426 |
| ShareWidow | 0.067 | 0.016 | 0.03 | 0.115 | 426 |
| ShareDivorced | 0.075 | 0.018 | 0.032 | 0.122 | 426 |
| ShareLowerSecondaryEducation | 0.348 | 0.066 | 0.173 | 0.592 | 426 |
| ShareUpperSecondaryEducation | 0.445 | 0.045 | 0.243 | 0.552 | 426 |
| CharityDonations | 47.338 | 15.237 | 23.9 | 159.33 | 426 |
| ChurchServiceAttendance | 1.838 | 0.676 | 0.539 | 4.521 | 422 |
| GrossWageMen | 3.216 | 0.444 | 2.016 | 5.306 | 426 |
| GrossWageWomen | 2.056 | 0.183 | 1.702 | 2.944 | 426 |
| DirectElectionMayor | 0.117 | 0.322 | 0 | 1 | 426 |
| TwoVotingDays | 0.481 | 0.5 | 0 | 1 | 426 |
| PartyFragmentation | 0.747 | 0.098 | 0 | 0.859 | 424 |
| PartyIndepLists | 0.406 | 0.492 | 0 | 1 | 426 |
| Altitude0to299 | 0.531 | 0.353 | 0 | 1 | 424 |
| Altitude300to599 | 0.227 | 0.189 | 0 | 0.951 | 424 |
| Altitude600to899 | 0.127 | 0.161 | 0 | 0.815 | 424 |
| Altitude900to1199 | 0.075 | 0.134 | 0 | 0.593 | 424 |
| Altitude1200 | 0.04 | 0.119 | 0 | 0.785 | 424 |

Table 6: The Relationship Between Hydropower Income and Voter Turnout, Local Relative to Regional Election Results.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | b/se | b/se | b/se | b/se | b/se |
| HydroPowerIncome | 0.14*** | 0.15*** | 0.09*** | 0.12*** | 0.11*** |
| | (0.02) | (0.02) | (0.02) | (0.03) | (0.03) |
| lnVotingPopulation | | | -1.33*** | -1.36*** | -1.58*** |
| | | | (0.14) | (0.26) | (0.27) |
| ShareInRuralAreas | | | | -0.10 | -0.51 |
| | | | | (0.79) | (0.82) |
| RecentImmigrants | | | | -26.94** | -25.12* |
| | | | | (13.44) | (12.82) |
| ShareVotersAged18to37 | | | | -4.35 | -4.54 |
| | | | | (14.84) | (14.86) |
| ShareVotersAged38to57 | | | | -26.36* | -29.14** |
| | | | | (14.66) | (14.31) |
| ShareVotersAged58to77 | | | | -2.02 | -1.12 |
| | | | | (14.25) | (14.58) |
| ShareWomen | | | | -12.18 | -13.84 |
| | | | | (18.39) | (17.72) |
| ShareUnMarried | | | | 12.66 | 12.79 |
| | | | | (8.65) | (8.55) |
| ShareWidow | | | | -4.80 | -9.79 |
| | | | | (20.71) | (20.86) |
| ShareDivorced | | | | 3.10 | 1.43 |
| | | | | (14.80) | (14.40) |
| ShareLowerSecondaryEducation | | | | 0.84 | 2.95 |
| | | | | (3.71) | (3.43) |
| ShareUpperSecondaryEducation | | | | -4.54 | -0.42 |
| | | | | (4.79) | (4.53) |
| CharityDonations | | | | -0.03* | -0.03* |
| | | | | (0.02) | (0.02) |
| ChurchServiceAttendance | | | | -0.21 | -0.27 |
| | | | | (0.27) | (0.27) |
| GrossWageMen | | | | 0.44 | 0.33 |
| | | | | (0.56) | (0.55) |
| GrossWageWomen | | | | -2.10 | -1.46 |
| | | | | (1.37) | (1.32) |
| DirectElectionMayor | | | | | -0.14 |
| | | | | | (0.30) |
| TwoVotingDays | | | | | -0.01 |
| | | | | | (0.26) |
| PartyFragmentation | | | | | 2.72* |
| | | | | | (1.57) |
| PartyIndepLists | | | | | 0.98*** |
| | | | | | (0.27) |
| $N$ | 426 | 426 | 426 | 422 | 420 |
| adj. $R^2$ | 0.074 | 0.244 | 0.424 | 0.458 | 0.480 |
| Regional Fixed Effects | No | Yes | Yes | Yes | Yes |

Note: Robust standard errors in parentheses.

Table 7: The Relationship Between Hydropower Income and Voter Turnout, Local Relative to Regional Election Results. Hydropower Income Effect Allowed to be Conditional on the Existence of Independent Local Lists.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | b/se | b/se | b/se | b/se |
| HydroPowerIncome | 0.02 | 0.05 | 0.06 | 0.05 |
| | (0.04) | (0.03) | (0.04) | (0.04) |
| HydroXPartyIndepLists | 0.08* | 0.05 | 0.09* | 0.11** |
| | (0.05) | (0.04) | (0.05) | (0.04) |
| PartyIndepLists | 1.01*** | 0.81*** | 0.77*** | 0.77*** |
| | (0.29) | (0.28) | (0.27) | (0.27) |
| lnVotingPopulation | -1.41*** | -1.40*** | -1.39*** | -1.52*** |
| | (0.13) | (0.15) | (0.27) | (0.28) |
| ShareInRuralAreas | | | -0.23 | -0.43 |
| | | | (0.79) | (0.81) |
| $N$ | 426 | 426 | 422 | 420 |
| adj. $R^2$ | 0.323 | 0.444 | 0.483 | 0.487 |
| Regional Fixed Effects | No | Yes | Yes | Yes |
| Population Characteristics | No | No | Yes | Yes |
| Institutional Characteristics | No | No | No | Yes |

Note: Robust standard errors in parentheses.

Table 8: The Relationship Between Hydropower Income and Preferantial Voting, Local Relative to Regional Election Results.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | b/se | b/se | b/se | b/se | b/se |
| HydroPowerIncome | 0.55*** | 0.46*** | 0.17** | 0.19** | 0.17** |
| | (0.10) | (0.09) | (0.08) | (0.08) | (0.08) |
| lnVotingPopulation | | | -5.82*** | -4.92*** | -5.35*** |
| | | | (0.35) | (0.74) | (0.81) |
| ShareInRuralAreas | | | | 8.12*** | 7.15*** |
| | | | | (2.22) | (2.26) |
| RecentImmigrants | | | | -80.34** | -73.91** |
| | | | | (36.70) | (36.00) |
| ShareVotersAged18to37 | | | | 52.26 | 42.36 |
| | | | | (46.58) | (44.45) |
| ShareVotersAged38to57 | | | | -43.73 | -63.44 |
| | | | | (42.79) | (41.74) |
| ShareVotersAged58to77 | | | | 3.35 | -9.83 |
| | | | | (42.17) | (39.51) |
| ShareWomen | | | | 16.78 | 17.48 |
| | | | | (46.83) | (46.64) |
| ShareUnMarried | | | | -13.86 | -20.96 |
| | | | | (24.26) | (23.75) |
| ShareWidow | | | | -11.93 | -49.17 |
| | | | | (72.30) | (70.20) |
| ShareDivorced | | | | 25.55 | 25.01 |
| | | | | (36.20) | (36.14) |
| ShareLowerSecondaryEducation | | | | -8.19 | -5.58 |
| | | | | (10.36) | (10.42) |
| ShareUpperSecondaryEducation | | | | -35.69*** | -29.31** |
| | | | | (12.46) | (12.39) |
| CharityDonations | | | | 0.01 | 0.00 |
| | | | | (0.04) | (0.03) |
| ChurchServiceAttendance | | | | 0.48 | 0.35 |
| | | | | (0.78) | (0.79) |
| GrossWageMen | | | | 1.49 | 1.30 |
| | | | | (1.58) | (1.56) |
| GrossWageWomen | | | | -5.72 | -5.13 |
| | | | | (4.15) | (4.05) |
| DirectElectionMayor | | | | | -4.45*** |
| | | | | | (1.11) |
| TwoVotingDays | | | | | -0.21 |
| | | | | | (0.88) |
| PartyFragmentation | | | | | 0.93 |
| | | | | | (6.32) |
| PartyIndepLists | | | | | 1.84*** |
| | | | | | (0.69) |
| $N$ | 426 | 426 | 426 | 422 | 420 |
| adj. $R^2$ | 0.096 | 0.246 | 0.562 | 0.597 | 0.620 |
| Regional Fixed Effects | No | Yes | Yes | Yes | Yes |

Note: Robust standard errors in parentheses.

Table 9: The Relationship Between Hydropower Income and Preferantial Voting, Local Relative to Regional Election Results. Hydropower Income Effect Allowed to be Conditional on the Existence of Independent Local Lists.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | b/se | b/se | b/se | b/se |
| HydroPowerIncome | 0.31*** | 0.18 | 0.15 | 0.12 |
| | (0.12) | (0.11) | (0.12) | (0.13) |
| HydroXPartyIndepLists | -0.10 | -0.03 | 0.04 | 0.08 |
| | (0.16) | (0.15) | (0.14) | (0.15) |
| PartyIndepLists | 1.69** | 2.15*** | 1.61** | 1.68** |
| | (0.77) | (0.73) | (0.72) | (0.71) |
| lnVotingPopulation | -5.96*** | -5.99*** | -5.06*** | -5.30*** |
| | (0.35) | (0.37) | (0.74) | (0.80) |
| ShareInRuralAreas | | | 7.75*** | 7.21*** |
| | | | (2.24) | (2.26) |
| $N$ | 426 | 426 | 422 | 420 |
| adj. $R^2$ | 0.473 | 0.570 | 0.601 | 0.620 |
| Regional Fixed Effects | No | Yes | Yes | Yes |
| Population Characteristics | No | No | Yes | Yes |
| Institutional Characteristics | No | No | No | Yes |

Note: Robust standard errors in parentheses.

Table 10: Sensitivity Checks: The Relationship Between Hydropower Income and Voter Turnout, Local Relative to Regional Election Results.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | b/se | b/se | b/se | b/se |
| HydroPowerIncome | 0.11*** | 0.12*** | 0.06*** | 0.11*** |
| | (0.03) | (0.03) | (0.02) | (0.02) |
| ShareInRuralAreas | -0.51 | -1.03 | -1.17** | -1.35* |
| | (0.82) | (0.88) | (0.58) | (0.72) |
| lnVotingPopulation | -1.58*** | -1.62*** | -1.23*** | -1.34*** |
| | (0.27) | (0.41) | (0.21) | (0.34) |
| $N$ | 420 | 320 | 420 | 320 |
| adj. $R^2$ | 0.480 | 0.379 | 0.551 | 0.395 |
| Regional Fixed Effects | Yes | Yes | Yes | Yes |
| Population Characteristics | Yes | Yes | Yes | Yes |
| Institutional Characteristics | Yes | Yes | Yes | Yes |
| ExcludedObservations | None | Pop$> 10,000$ | None | Pop$> 10,000$ |
| EstimationMethod | OLS | OLS | Robust reg. | Robust reg. |

Note: Standard errors in parentheses.

Table 11: Local Government Altitude as Instrument for Hydropower Income, First-Stage Estimates.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | b/se | b/se | b/se | b/se | b/se |
| Altitude300to599 | -1.36 | 2.31 | 2.03 | 4.53*** | 4.81*** |
| | (0.95) | (1.61) | (1.57) | (1.65) | (1.74) |
| Altitude600to899 | 7.05** | 7.02** | 5.96** | 6.94*** | 6.47*** |
| | (3.41) | (2.88) | (2.74) | (2.27) | (2.39) |
| Altitude900to1199 | 4.65 | 10.67** | 9.84* | 12.25*** | 13.37*** |
| | (5.67) | (5.16) | (5.01) | (3.42) | (3.77) |
| Altitude1200 | 10.20* | 11.77** | 10.96** | 12.35*** | 11.95*** |
| | (5.75) | (5.22) | (5.15) | (3.74) | (3.80) |
| lnVotingPopulation | | | -0.85*** | -0.14 | 0.07 |
| | | | (0.31) | (0.96) | (0.60) |
| ShareInRuralAreas | | | | 4.23* | 4.55* |
| | | | | (2.17) | (2.44) |
| *N* | 424 | 424 | 424 | 420 | 420 |
| Regional Fixed Effects | No | Yes | Yes | Yes | Yes |
| Population Characteristics | No | No | No | Yes | Yes |
| Institutional Characteristics | No | No | No | No | Yes |

Note: Robust standard errors in parentheses.

Table 12: The Relationship Between Hydropower Income and Voter Turnout, Local Relative to Regional Election Results, Second-Stage Estimates.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | b/se | b/se | b/se | b/se | b/se |
| HydroPowerIncome | 0.30*** | 0.32*** | 0.20*** | 0.22*** | 0.21*** |
| | (0.08) | (0.06) | (0.06) | (0.06) | (0.05) |
| lnVotingPopulation | | | -1.17*** | -1.30*** | -1.53*** |
| | | | (0.15) | (0.29) | (0.27) |
| ShareInRuralAreas | | | | -0.27 | -0.69 |
| | | | | (0.76) | (0.79) |
| *N* | 424 | 424 | 424 | 420 | 420 |
| Regional Fixed Effects | No | Yes | Yes | Yes | Yes |
| Population Characteristics | No | No | No | Yes | Yes |
| Institutional Characteristics | No | No | No | No | Yes |
| F-statistic from 1st. | 8.288 | 9.744 | 10.07 | 11.18 | 11.25 |

Note: Robust standard errors in parentheses.

# 10 Appendix

## 10.1 The Effect of Hydropower Income on Election Stakes

Here we give a simple formalization of how a municipality's income may affect citizen's instrumental incentive to vote.

We assume that a local government may use its income $I$ to provide core welfare services to its citizens and to finance targeted spending ("pork"). Candidates differ by which composition of core services they will provide, and which composition of targeted spending they will choose, if elected. Denote by $G_{j,i}$ the basket of core services provided by candidate $j$, normalized by the preferences of voter $i$. Hence, if voter $i$ prefers the composition of general goods provided by candidate $j$ over the composition provided by candidate $k$, and both candidates spend equally much on core public goods, then $G_{j,i} > G_{k,i}$. Denote by $T_{j,i}$ the targeted spending provided by candidate $j$ to voter $i$. Voters' preferences over spending are given by $U\left(G_{j,i}, T_{j,i}\right)$, which is separable, increasing and concave in each argument: $U_1 > 0$, $U_{11} < 0, U_2 > 0$, $U_{22} < 0$, $U_{12} = 0$. We assume that candidate $j$ will target spending at individual $i$, whereas other candidates will not. Hence, $T_{j,i} > 0$ and $T_{-j,i} = 0$. Finally, we assume that that the candidate who targets individual $i$ with pork also is the candidate who offers the basket of core services that $i$ prefers the most: $G_{j,i} > G_{-j,i}$.

Denote by $B_i$ individual $i$'s utility from having his most preferred candidate, $j$, in office rather than someone else. We may express this benefit as

$$B_i = U\left(G_{j,i}, T_{j,i}\right) - U\left(G_{-j,i}, T_{-j,i}\right).$$

Differentiating with respect to income, $I$, we obtain

$$\frac{dB_i}{dI} = \frac{\partial U}{\partial T_{j,i}}\frac{\partial T_{j,i}}{\partial I} + \frac{\partial U}{\partial G_{j,i}}\frac{\partial G_{j,i}}{\partial I} - \frac{\partial U}{\partial G_{-j,i}}\frac{\partial G_{-j,i}}{\partial I}.$$

From this expression we see that higher hydropower income is likely to have two opposing

effects on the instrumental incentive to vote ($B_i$). First, if $\frac{\partial T_{j,i}}{\partial I} > 0$ higher income raises the instrumental incentive to vote by facilitating more non-core spending. On the other hand, if both $\frac{\partial G_{j,i}}{\partial I} > 0$ and $\frac{\partial G_{-j,i}}{\partial I} > 0$, then higher income may reduce $B_i$, since concavity of $U$ implies that $\frac{\partial U}{\partial G_{j,i}} < \frac{\partial U}{\partial G_{-j,i}}$. It follows that higher income is more likely to raise the instrumental incentive to vote, the more strongly higher income tends to be spent on pork rather than on core welfare services.

The argument above relates to the traditional way of viewing pivotalness (i.e., "outcome pivotalness"). An alternative type of pivotalness that has been forwarded in the literature is "prize pivotalness" (Smith and Bueno de Mesquita (2010)). If parties are able to observe group-level voting, they can make targeted spending decisions contingent on the voting pattern and thus motivate voters to turn out even when they are highly unlikely to affect who wins the election. Note that both of these two types of pivotalness requires spending to be targeted, in the sense that it benefits some voters, but not others. Furthermore, in our discussion we have implicitly assumed that voters are certain about what candidates will do once in office. Schwartz (1987) discusses the role of targeted spending versus "global public benefits" when the credibility of campaign promises is an issue, and argues that targeted spending will stimulate the instrumental incentive to vote more strongly than will non-targeted spending.

Table 13: Simple Cross Sectional Estimates: The Relationship Between Hydropower Income and Voter Turnout at the Local Election.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | b/se | b/se | b/se | b/se | b/se |
| HydroPowerIncome | 0.23*** | 0.17*** | 0.01 | -0.01 | -0.01 |
| | (0.04) | (0.04) | (0.04) | (0.06) | (0.05) |
| lnVotingPopulation | | | -3.35*** | -2.82*** | -2.86*** |
| | | | (0.23) | (0.42) | (0.45) |
| ShareInRuralAreas | | | | 3.01** | 2.85** |
| | | | | (1.38) | (1.36) |
| RecentImmigrants | | | | -44.84** | -42.85** |
| | | | | (21.17) | (21.09) |
| ShareVotersAged18to37 | | | | -6.70 | -7.66 |
| | | | | (23.70) | (24.06) |
| ShareVotersAged38to57 | | | | -9.28 | -13.23 |
| | | | | (23.78) | (24.08) |
| ShareVotersAged58to77 | | | | -10.30 | -9.20 |
| | | | | (23.42) | (24.02) |
| ShareWomen | | | | -42.59* | -45.60* |
| | | | | (24.14) | (24.21) |
| ShareUnMarried | | | | -45.60*** | -44.19*** |
| | | | | (14.93) | (15.15) |
| ShareWidow | | | | 11.39 | 8.74 |
| | | | | (37.55) | (39.18) |
| ShareDivorced | | | | -27.99 | -29.91 |
| | | | | (25.77) | (25.51) |
| ShareLowerSecondaryEducation | | | | -26.44*** | -25.23*** |
| | | | | (7.03) | (6.82) |
| ShareUpperSecondaryEducation | | | | -22.26*** | -18.72** |
| | | | | (7.58) | (7.34) |
| CharityDonations | | | | 0.02 | 0.02 |
| | | | | (0.04) | (0.03) |
| ChurchServiceAttendance | | | | 0.76* | 0.73 |
| | | | | (0.45) | (0.45) |
| GrossWageMen | | | | -0.26 | -0.33 |
| | | | | (0.94) | (0.94) |
| GrossWageWomen | | | | 7.34*** | 7.59*** |
| | | | | (2.60) | (2.56) |
| DirectElectionMayor | | | | | -1.27** |
| | | | | | (0.51) |
| TwoVotingDays | | | | | -0.66 |
| | | | | | (0.44) |
| PartyFragmentation | | | | | 1.42 |
| | | | | | (2.56) |
| PartyIndepLists | | | | | 0.60 |
| | | | | | (0.39) |
| $N$ | 426 | 426 | 426 | 422 | 420 |
| adj. $R^2$ | 0.0571 | 0.120 | 0.475 | 0.578 | 0.587 |
| Regional Fixed Effects | No | Yes | Yes | Yes | Yes |

Note: Robust standard errors in parentheses.

Table 14: Variable Description

| | |
|---|---|
| TurnoutLocal | Casted votes relative to the total number of eligible voters at the local (municipal) election, percentage points. |
| TurnoutRegional | Casted votes relative to the total number of eligible voters at the regional (county) election, percentage points. |
| DTurnout | TurnoutLocal - TurnoutRegional |
| PreferentialVotesLocal | Share of votes that have been corrected at the local (municipal) election. |
| PreferentialVotesRegional | Share of votes that have been corrected at the regional (county) election. |
| DPreferentialVotes | PreferentialVotesLocal - PreferentialVotesRegional |
| HydroPowerIncome | Revenues from commercial property taxation, NOK 1000 per capita |
| VotingPopulation | The number of eligible voters (January 1, 2007) |
| ShareInRuralAreas | Fraction of the population living in rural areas (January 1, 2007) |
| RecentImmigrants | Fraction of population that migrated to the municipality during 2006 |
| ShareVotersAgedXXtoYY | Fraction of eligible voters aged XX to YY (January 1, 2007) |
| ShareWomen | Fraction of women in the population (January 1st, 2007) |
| ShareUnMarried | Fraction of population that are unmarried (January 1, 2007) |
| ShareWidow | Fraction of population that are widowed (January 1, 2007) |
| ShareDivorced | Fraction of population that are divorced (January 1st, 2007) |
| ShareLowerSecondaryEducation | Fraction of population aged 16 above with lower secondary education as highest education (October 1, 2007) |
| ShareUpperSecondaryEducation | Fraction of population aged 16 above with upper secondary education as highest education (October 1, 2007) |
| CharityDonations | Donations per capita (NOK) at annual TV charity show, Oct. 22, 2006. (donations went to *Doctors Without Borders*) |
| ChurchServiceAttendance | Number of church services attended, per capita, 2007. |
| GrossWageMen | Average gross wage for men 17 years and older, 2006. |
| GrossWageWomen | Average gross wage for women 17 years and older, 2006. |
| DirectElectionMayor | Dummy=1 if the municipality hold direct elections for the mayor |
| TwoVotingDays | Dummy=1 if the municipality have two voting days |
| PartyFragmentation | 1 - (Herfindahl index of party fragmentation in the local council at the 2003 election) The Herfindahl-index is generally given by 1/P , when the representatives are equally divided among P parties. |
| PartyIndepLists | Dummy=1 if the municipality had at least one party independent list, that obtained at least one seat in the local council |
| Altitude0to299 | Fraction of local government area 0 to 299 meters above sea level. |
| Altitude300to599 | Fraction of local government area 300 to 599 meters above sea level. |
| Altitude600to899 | Fraction of local government area 600 to 899 meters above sea level. |
| Altitude900to1199 | Fraction of local government area 900 to 1199 meters above sea level. |
| Altitude1200 | Fraction of local government area 1200 meters or more above sea level. |

Note: Election variables are from September 2007, unless otherwise noted. The data are provided by the Norwegian Social Science Data Services and Statistics Norway. Neither of these institutions are responsible for the analyzes conducted or for the conclusions drawn.

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