Voter Turnout and Fiscal Policy

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Abstract

Though a large literature on causes of voter turnout has flourished, there is scant evidence on consequences of turnout on policies implemented in practice. Using data on French municipalities, and instrumental variables for turnout based on rainfall and influenza incidence, we estimate that a 1 percent increase in turnout decreases the municipal budget by more than 2 percent. This effect is mediated by a decrease in sales and purchases of physical assets. With a model of electoral competition, we show that a party with a low budget platform has a numerical advantage causing its win when turnout is high.

1 Introduction

Over the last 40 years, in most Western democracies, voter turnout - i.e. the percentage of registered voters who cast a ballot in an election - has consistently declined. For instance, in French municipal elections in 1965, 78.2 percent of registered individuals voted in the first round, while in 2008 this figure dropped to 66.5 percent.[1] A low level of electoral participation is often considered a worrying sign for the health of a democracy. Yet, although a large body of empirical studies has identified many determinants

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[1]The corresponding turnout figures for US presidential elections are 61.9 in 1964 and 57.37 in 2008 and the drop is much larger for midterm elections. For more data, see Blais 2000.

of variations in voter turnout, little is known on its consequences. The aim of this paper is to study the effect of turnout on policies implemented after an election. Using data on French municipalities, our main finding is that increased voter turnout decreases both public revenues and expenditures. This effect is large, with an elasticity in the order of -2.

This result means that, on average, the marginal voter favors lower spending. It is in contrast with what surveys of frequent and marginal voters suggest. Since marginal voters tend to be poorer than frequent voters, the former should prefer higher public expenditures, and higher turnout should give an advantage to fiscally liberal candidates.[2] Our contribution here is to provide a direct estimation of the marginal voter's fiscal preferences, and our results, surprising in the light of the survey evidence, are consistent with the conclusions of a simple model of political competition.

Empirically, the identification of a causal impact of voter turnout poses two challenges. First, the rules that govern the elections of public representatives, that set their collective decision procedures, and that delimit their power, differ across nations, and even across infra-national polities.[3] This heterogeneity impedes the comparison of policies across governments and requires controlling for a wide range of variables in order to test the impact of turnout on policies.

To address this first challenge, we take advantage of two features of French municipalities: their institutional homogeneity and their number. There are around 36,000 municipalities in France, all subject to the same national law that sets the election date and election rules, as well as the number of municipal councilmen and their rights and duties. In every election, municipal residents vote to elect municipal councilmen who will be in charge of setting the municipal budget for a term that lasts six or seven

[2]This argument is raised in several papers that focus on whether voter turnout advantages Democratic or Republican candidates. These papers disagree on whether frequent and marginal voters differ enough for higher turnout to have an impact on electoral outcomes. See the seminal paper by Wolfinger and Rosenstone 1980.

[3]Such variety characterizes US municipalities, for instance, where municipal government can take the form of either mayor-council or council-manager government, municipal and county governments may exist side-by-side, or in other configurations.

years. For this study, we use longitudinal data that contains information on fiscal policy, and on voter turnout in municipal elections. Our data covers more than 90 percent of all French municipalities, and spans the years 1998 to 2012. Two municipal elections took place over this period: one in March 2001, the other in March 2008.

The second challenge is that turnout is endogenous. It is potentially correlated with unobservable characteristics of a town that are correlated with municipal fiscal policy, such as voters' expectations of projects that each candidate would implement if elected. To overcome this challenge, we propose two instrumental variables for voter turnout. The first instrument is the log of the number of new patients with clinical symptoms of the flu who visit a general practitioner in the month preceding the elections (i.e. the log of flu incidence). We find that a larger flu incidence decreases voter turnout; sick people tend not to vote. The second instrument is the amount of rainfall in the afternoon of election day. We estimate that more rainfall increases voter participation. This latter result suggests, bearing in mind that French elections always take place on a Sunday, that the opportunity cost of voting is mostly the value of activities that depend on the weather, such as outdoor activities.

Our identification assumption is that, controlling for observable municipal characteristics, our instruments are uncorrelated with the unobservable factors that affect the trend of the fiscal outcomes we examine. To capture potential effects of the trend in flu or weather variables, we control for many observable municipal factors, including geographical and meteorological variables and for the value of the instrument in preceding years. In addition, we note that, when we restrict our sample to observations covering the years *before* a municipal election year, we find no significant correlation between changes in any fiscal outcome, and the value of any instrumental variable measured at the time of the following election.

Our first main result establishes that a 1 percent increase in turnout decreases municipal revenues by around 2 percent. This represents, for a one percent increase in turnout, an average decrease of 24.5 euros per

capita per year. As mentioned above, the sign and the order of magnitude of the estimated coefficient is the same for both election years, and for both instrumental variables, provided they are strong enough.

These estimates can also be used to derive estimates of voting costs. Indeed, the main result can be expressed differently: an additional vote decreases the yearly budget by 3.17 euros, on average. Thus, the maximum expected benefit from voting of the marginal voter is 3.17 euros per year for 7 years, the length of a term, since in the worst-case scenario the voter would not have benefited at all from this extra spending. This figure is an upper bound on voting costs, net of non financial benefits such as a warm glow from performing one's civic duty.

Our second main result is that this aggregate effect is due largely to sales and purchases of municipal assets, which are almost entirely physical assets (e.g. public buildings). An increase in turnout induces a decrease in both sales and purchases of these assets. The effect can be very large: a 1 percent increase in turnout may increase such sales by more than 5 percent, and decrease purchases of these assets by more than 8 percent. In addition, we find that turnout has little impact on debt and no impact on taxes. Marginal voters are more opposed than motivated voters to changes in the public assets owned by the municipality.

We do not claim that we have identified universal or permanent predictors of voter turnout. In fact, we find that the strength of either instrument varies across elections: rainfall only significantly affects turnout in 2001, flu incidence only significantly affects turnout in 2008. However, it is remarkable that all estimations of the impact of voter turnout on a given fiscal outcome yield very similar results, regardless of the instrument we use or the election year we consider, and that this estimation is significant whenever the impact of the instrument on voter turnout is significant.

What can explain these systematic results? To address this question, we estimate the effect of voter turnout on electoral outcomes. We find that it has no significant impact on observable characteristics of the elected candidates or party, such as the probability that the incumbent mayor

is reelected, or that a left or right-wing party wins a majority of seats in the municipal council. However, candidates or parties may also differ in unobservable ways. Of particular importance would be the details of parties' electoral platforms, such as the nature of the new public goods that the municipality would provide if they win the elections and the budget required to buy these new public goods.

Our interpretation of the main results relies on a new model of electoral competition in which two parties, which value two different public goods, compete on the amount of the good to provide. Municipal residents are divided into two groups, a group that values the good valued by one party, and another group that values the good of the other party. This setup is consistent with our finding that most of the effects are on sales and purchases of municipal assets. In our model, residents face random voting costs, drawn on the day of the election, and vote if the difference in utility between the two platforms is higher than the voting cost.

Our main assumption is that group members may differ in their degree of fiscal conservatism. In other words, raising municipal revenues imposes different costs across residents - even among residents who value the same public good - whether these revenues are raised through taxes, the sale of current assets, or borrowing.

The core of our explanation relies on the following argument. If one party proposes a smaller budget than the other, it could attract the votes of residents who prefer the good it would invest in to the good the other would invest in, as well as the votes of residents who prefer the good promoted by the other party, but who find that party's budget too high. Everything else equal, the party with the smaller budget thus has a numerical advantage. The party with the higher budget could attract only the votes of residents who prefer the good it promotes *and* do not find its budget too high.

Given this disadvantage, why would a party run on a bigger platform? Although the party with the larger budget has fewer supporters, these supporters may have a higher participation level than the supporters of the other party, either because they are intrinsically more motivated, or

because they face smaller voting costs than the rest of the population. The party with the smaller budget is thus more likely to win when voting costs are low (i.e. turnout is high), and the other party is more likely to win if voting costs are high (i.e. turnout is low). In fact, we show that if parties have different budgets, this is the only possible configuration.

Our interpretation relies on general assumptions on the heterogeneity of preferences among voters, not on specific features of French institutions. Our work thus highlights the fact that, in any institutional context, measures to increase turnout, such as information campaigns or reforms facilitating voter registration - policies that affect marginal voters - can have a major impact on public policy, even if they are independent of the institutional context, or do not target a specific population.

Related Literature. A large empirical literature has aimed at identifying determinants of turnout. Blais 2001 reviews some of the most often cited, and finds that for a large part, variations in turnout remain unexplained. A recent literature has proposed and estimated new factors, such as candidates' ethnicity (Washington 2006), access to media (Stromberg 2004, Gentzkow 2006, Enikolopov, Petrova and Zhuravskaya 2011), information on candidates (Banerjee et al. 2010) or voting technology (Card and Moretti 2007, Fujiwara 2010). None of this papers links turnout and policy, except for Fujiwara 2010, who finds that an increase in turnout caused by a technological change that affected largely poor citizens has increased health care spending.

Fujiwara 2010 is related to a different group of papers, that studies the effect of the extension of voting rights, such as Husted and Kenny 1997, Lott and Kenny 1999, Miller 2009. These papers find that enfranchisement caused an increase in welfare spending, especially in public health policies. Although related, our work differs substantially from these studies. First, these studies usually cannot distinguish the effect of the change in the size of the eligible population from the actual impact of voter turnout (that

is voters relative to registered individuals) itself. Then, the determinants studied in these papers could have modified the number of voters in a way that politicians could anticipate, and, in some cases, encouraged by supporting enfranchisement laws. Last, any political change affecting turnout may stem from other political or cultural changes that are unobserved, and these latter changes could affect subsequent policies more than changes in turnout. Our focus is different here, since we are interested in variations of voter turnout for a given registered population that cannot be anticipated more than a few weeks before the elections, and independent of political changes.

In political science, several papers use surveys of frequent and marginal voters to estimate the effect of turnout on the probability that Democrat or Republican candidates win (Wolfinger and Rosenstone 1980, Leighley J. and J. Nagler 2007). Two recent papers have studied the direct impact of turnout on this probability. Gomez et al. 2007 show that lower turnout increases the Republican party's vote share in national elections. Hansford and Gomez 2010, who also use rainfall as an instrument, confirm this finding and also show that an increase in turnout decreases the vote share of the incumbent. None of these papers directly tests the impact of voter turnout on implemented policies.

Several empirical papers build on the theoretical literature on rational turnout (see survey by Dhillon and Peralta 2002 and Feddersen 2004). Most models in the game theoretic branch of the literature assume that potential voters make a rational decision by comparing their cost of voting to their probability of being pivotal in the election, conditional on the other voters' strategies. This leads to the paradox of voting in large elections since the probability of changing the outcome becomes negligible. To judge how large this paradox is, we need to have a rough idea of voting costs, which is a byproduct of our results. Blais et al. 2011 run an experiment comparing first past the post and proportional elections. They show that the consideration of being pivotal plays a larger role in proportional elections and argue that this is due to the fact that the calculation of probability

here is more involved.

A growing theoretical literature examines whether compulsory voting is welfare enhancing. Compulsory voting is often suggested as a way of increasing turnout, and has been implemented in several countries. Yet, evidence from simulations (Citrin et al. 2003), suggests that introducing mandatory voting might have little impact on implemented policies. Börgers 2004 shows that, in a population where the expected number of supporters for the two candidates is equal, compulsory voting is welfare reducing. Krasa and Polborn 2009 point out that the result depends on the assumption that the general electorate is equally split. If this is not the case, mandatory voting is welfare improving. Note that both papers consider mandatory voting as an exogenous decrease in the cost of voting, which corresponds exactly to the our identification assumption on the effect of rainfall or flu incidence. Aldashev 2013 examines a particular type of social inefficiency, the impact of turnout on rents extracted by elected officials. He shows that the direction of the effect critically depends on the source of the variation in turnout.

Finally, some empirical papers address the effect of political variables on local public finances. Enikolopov and Zhuravskaya 2007 find that the effect of decentralization in Russia critically depends on whether local representatives are elected or appointed. Using data on local governments in Sweden, Pettersson-Lidbom and Tyrefors 2011 find that representative democracy increased both political participation and size of government, relative to direct democracy. In the US, Ferreira and Gyourko 2009 show that partisanship, i.e the fact that the mayor belongs to the Democratic or the Republican party, does not have an impact on policy outcomes (size of government, tax rates) at the municipal level in US cities.

The remainder of the paper is organized as follows. In Section 2 we present the data and institutional background. In Section 3 we expose our identification strategy. We present our results in Section 4, and interpret them in the context of a model of electoral competition in Section 5. All tables

are in Section 7 and Appendix C.

2 Institutional Background and Data on French Municipalities

Institutional Background. Since the French Revolution, in 1789, the French territory has been divided in municipalities, the smallest administrative unit in the country. France now counts more than 36,000 municipalities.[4]. The rules that govern municipal elections, and the rights and duties of municipal councilmen, are set in national law, and apply uniformly across the French territory.[5]

Municipal councilmen are elected through direct universal suffrage. After the election, councilmen elect a mayor among themselves, who will be the agenda setter for the municipal term. In practice, when a majority of councilmen are affiliated to a given party, the leader of this party is elected as mayor. Mayors are responsible for the enforcement of decisions passed at the council. A mayor has no extra decision power, however, since every decision taken by a council must be approved by a simple majority of councilmen.

By law, candidates must run in parties - which can be local parties of candidates running behind a common leader, or under a common local platform, with no affiliation to a national party - in municipalities with more than 3500 residents, and must run individually in the other ones. Even in these latter municipalities though, candidates are usually affiliated to a local party, and two or three parties partition the set of all candidates.

Elections are held on the same days nationwide, always on a Sunday, usually in March. Any adult above 18, French or EU national, whose main residence is in the municipality, can register to vote. The number of councilmen, and other rules of the electoral system of a municipality, depend

[4] as of January 1st 2012

[5] Our sample contains no data on the roughly 500 municipalities located in Corsica or in overseas territories and departments, some of which are governed by different laws than the rest of France.

on the number of residents. For all municipalities, municipal elections may comprise two rounds, held a week apart. Provided that more than 25 percent registered voters cast a ballot, any candidate (or party) who obtains a number of votes larger than half the size of voter turnout in the first round is elected directly. We give more details on election rules in Appendix A.

Since the conditions of the second round (the number of council seats left to be filled, the identity of the candidates running, etc.) result from the outcome of the first round, we focus exclusively on the impact of turnout in the first round. The two most recent municipal elections took place on Sunday, March 11th, 2001 and on Sunday, March 9th, 2008.[6] The last election before 2001 took place in 1995, and the first election after 2008 will be organized in 2014. Our data span the years 1998 to 2012, so that they cover part or all of the three terms 1995-2001, 2002-2008 and 2009-2014. For simplicity, in the rest of the paper, we will refer to the three periods 1998-2001, 2002-2008 and 2009-2012 as municipal terms.

Data on municipal elections. We obtained data on municipal elections from the French Ministry of Home Affairs, which has kept records on every election since 2001 only. These data contain information on the number of registered individuals and electoral participation for the 2001 and 2008 municipal elections. They also contain some information on the ideological affiliation (left-wing, right-wing, or unknown) of elected councilmen in 2001, and in 2008. In addition, for a substantial number of municipalities, we obtained the names of incumbent mayors from an online unofficial database.[7]. We had no data on turnout for around 1000 municipalities, so that our sample contains around 35,000 municipalities.

Data on municipal finances. Data on municipal finances are available from the French Ministry of Finances, for the period 1998-2012.[8] For every

[6]These are the days of the first rounds, the second rounds took place on Sunday, March 18th, 2001 and on Sunday, March, 16th, 2008 respectively.

[7]The source is the website FranceGenWeb http://www.francegenweb.org/mairesgenweb/

[8]Data for the period 2000-2012 are available online *http* : *//www.colloc.bercy.gouv.fr/*. We also obtained detailed data for the period 1998-2001,

year of the period studied, and for almost every municipality, we observe the amount raised through each of the following sources of municipal revenues: local taxes, rents from its assets, asset sales and use of savings (we cannot distinguish these two sources), received subsidies, and loans. There is no other source of revenues, so that the sum of these amounts is the total amount of municipal revenues, by definition.

Local taxes consist primarily of ownership and residence taxes. The rates of these taxes are set by municipal councils, but must remain within certain bounds defined in the national law. Municipal assets are physical assets, which can be rented or sold at the market price. Municipal subsidies comprise unconditional subsidies and conditional subsidies. Unconditional subsidies are distributed every year, from the national government to the municipalities, according to a formula set in the national law that integrates the number of residents, the surface of the municipality, and other social and economic or geographic factors, irrespective of the nature of municipal fiscal decisions. Conditional subsidies underwrite physical assets, and may be granted by any government,national or local, to a municipality. There are several different types of conditional subsidies, granted on varying conditions, yet most of conditional subsidies are automatic refunds on value-added taxes paid by the municipality when it acquires some assets.

We also observe the amount spent in each of the following expense items, for almost every municipality: personnel expenditure, maintenance expenditure, asset purchases, annuities, and contributions. Asset purchases exclude savings here, annuities are the sum of reimbursement of capital and payment of installments, and contributions are subsidies a municipal-

which we used to interpolate the content of the aggregated data of the rest of the period. Except for the years 1998 to 2001, these data lack detailed information on a few sources of revenue and objects of expenditure. We use the detailed data on the first years to infer from the latter data the value of these missing items. Note that it is unlikely that this lack of information is attributable to any sort of municipal obfuscation, however. Although municipal councils have a high level of autonomy, their accounts come under close scrutiny. The accounts are examined yearly by the an independent agency made up of civil servants not subject to political fluctuations, so that misappropriation of funds does not seem of concern here. The *Chambre Régionale des Comptes* is the agency in charge of examining local public finances.

ity grants to private parties, or to other administrative divisions. The sum of these amounts is the total amount of municipal expenses. The difference between total revenues and total expenses is the amount of municipal savings, by definition.

Data on municipal social/demographic characteristics. Data on municipal social, economic and geographic characteristics are available from the *Institut National des Statistiques et Etudes Economiques*[9]. They are mainly based on the last two censuses, which took place in 1999 and 2007. We observe the number of residents of a municipality; its total population, the size of its labor force; the number of employed individuals, the number of its residents in each of the following age categories: 0 to 14, 15 to 29, 30 to 44, 45 to 59, 60 to 74, and 75 years old or more; the median income of its residents; and the surface it covers. Since median income is reported only for towns that have more than 50 households, our sample of observations is limited to around 30,000 municipalities when we use these variables.

Data on weather and flu. We use data on weather conditions from *Meteo France*, the French national meteorological service. This service maintains records on rainfall from a network of more than 1100 observation stations. Throughout France, voting stations open at 8pm, at the earliest, and close at 8pm, at the latest. So, we obtained, for each station, the quantity of rain that fell in the morning (8am-12pm), at midday (12pm-4pm), and in the afternoon and evening (4pm-8pm), for March 11th, from 1996 to 2001, and for March 9th, from 2003 to 2008. We use data on the incidence of influenza-like illnesses from the *Réseau Sentinelles* (roughly equivalent to the Center for Disease Control), an organization that gathers data from general practitioners in France, to follow the spread of the main infectious diseases over time and place.[10] This organization does not disclose their data at the medical doctor level, but instead provide an interpolated aggre-

[9] Available online at $http://www.insee.fr/fr/bases-de-donnees/$

[10] http://websenti.b3e.jussieu.fr/sentiweb/. We are grateful to Clément Turbelin for his help in obtaining the data, and for his generous explanations.

gated estimation of monthly incidence, that is the number of new patients per 100,000 persons and per month, who visited a general practitioner with symptoms of influenza, for more than 700 evenly geographically distributed locations of observation. For our purpose, we obtained the incidence in the month of February, which is the closest month before the first round of the elections, for the years 1996 to 2001, and 2003 to 2008.[11]

We thus have data on turnout and fiscal variables for around 35,000 municipalities, and social and demographic data for around 30,000 municipalities. Table 1 contains the list and descriptive statistics of all variables used in this study. In Appendix B, we show on maps the geographic distribution of municipalities for which we have at least turnout and fiscal data, as well as locations of observation of weather and flu incidence.

3 Specification and Identification

3.1 Specification

Two elections took place over our period of study, in March 2001 and in March 2008. Our data thus cover part or all of the following three terms: 1998-2000 (term 1), 2001-2007 (term 2), and 2008-2012 (term 3).

In most of the paper, we estimate the impact of turnout on fiscal policy separately for each election. For a municipality i and a term $t \in \{1, 2\}$, our main equation of interest is:

$$\log \overline{F}_{i,t+1} - \log \overline{F}_{i,t} = \alpha_t + \beta \log Turnout_{i,t} + \xi X_{i,t} + \epsilon_{i,t} \qquad (1)$$

where, for any fiscal policy outcome F, $\overline{F}_{i,t}$ denotes the average of yearly values of F over the years of term t (observed in our data) in municipality i.[12] The dependent variable $\log \overline{F}_{i,t+1} - \log \overline{F}_{i,t}$, then, is the net relative

[11] We also obtained incidence data for the month of March, for the same years. If we use the March data instead of February data, the results are similar but not as robust.

[12] We aggregate data over a term because of the serial correlation of fiscal policy variables that could bias the estimation of the standard errors. Such aggregation is also more consistent with the decision process of municipal councils which plan revenues and

growth in average F, from one term to another. Variable $Turnout_{i,t}$ is the percentage of registered voters in municipality i who voted in the election held at the end of term t, and $X_{i,t}$ is a vector of covariates estimated before or at the time of this election.

We also estimate the impact of turnout on fiscal policy jointly for both elections, pooling data of all three municipal terms. In this case, the specification is:

$$\log \overline{F}_{i,t+1} - \log \overline{F}_{i,t} = \alpha'_i + \alpha'_t + \beta' \log Turnout_{i,t} + \xi' X_{i,t} + \epsilon'_{i,t} \qquad (2)$$

with the same notations as before, where we also include dummy variables for each elections α'_t, and municipal fixed effects α'_i.

3.2 Identification

Voter turnout in a municipality is endogenous to characteristics of the municipality and the given political competition. Turnout depends on various observable social and economic variables, such as the number of residents in the municipality. Turnout could also be correlated with unobservable municipal characteristics, such as voters' beliefs about what candidates would do if elected. If the implementation of some costly program is at stake in an election, voters have more incentive to participate, and the expected budget after the election- either expenses or revenues - would be larger than if no costly program were involved.

To identify the causal effect of turnout, we must rely on factors that affect it, but are exogenous to policy decisions. We propose two types of instrumental variables that do not directly impact budgetary decisions: variables based on rainfall on election day at three times of the day (morning, midday, afternoon), and variables based on flu incidence in the month preceding the election. Using these instrumental variables, we estimate the previous equations in 2SLS and LIML. The specification of the first stage of the estimations is:

spending over a term.

$$\log Turnout_{i,t} = \theta_t + \gamma Z_{i,t} + \chi_t X_{i,t} + \eta_{i,t} \quad (3)$$

with the same notations as before, where $Z_{i,t}$ is the estimated value(s) of the (set of) instrumental variable(s) in municipality i measured in municipal term t, as it is measured at the location of observation closest to i. We run most estimations separately for the 2001 and the 2008 elections (we include a municipal fixed-effect in the specification used for the estimations on data pooling both elections).

Both of these instrumental variables should impact municipal turnout. It can be expected that flu incidence impacts turnout negatively, both because sick people may not be able to cast a ballot. Rainfall could influence turnout in two opposite ways. On the one hand, rain may deter voters from venturing out and vote. On the other hand, sunny weather may encourage voters to engage in outdoor activities, or go out of town for the weekend, especially since French always elections occur on Sunday.

To be valid, these instrumental variables must be uncorrelated with shocks on changes in municipal fiscal variables. Several points support this assumption. First, these variables are hard to predict more than a few weeks before the elections, especially at the local level, so that they should not have a direct impact on public policy over the years before the elections. In addition, the weather conditions were never so extreme, or the flu epidemics never so dramatic that they could have triggered any substantial municipal expenditures, in infrastructure for instance, after the elections.

It is possible that these instrumental variables are correlated with local social and economic variables, such as the percentage of children in the population, or with geographic variables, such as the distance to Paris, which may affect municipal budget trends. To address this point, we include social, economic, and geographic municipal variables measured at the time of the election in the vector of covariates. Since it is possible that trends in weather or flu incidence are correlated with unobservable social and economic factor influencing fiscal policy, we also include the values of

instrumental variables for the four years before the elections in the vector of covariates.[13] Finally, to check directly whether instrumental variables are correlated with budget trends, we also estimate the regression of changes in budget occurring *before* an election, on the value of either instrumental variable at the time of the following election.

4 Results

Since the impact of any given instrument differs across elections, and in order to simplify the comparison between the effect of turnout across elections, we run all estimations for each election separately, and present the results first. Estimations on pooled data are presented at the end of this section.

4.1 Effect of instrumental variables on turnout

We first present the results of the first-stage regressions. In Table 2, Columns 1 to 4 report the results of the regressions of turnout on rainfall in the afternoon of the election day (we present the estimations of the effect of morning and midday rainfall in Section 4.5), separately for the 2001 and 2008 elections, with two different vectors of covariates. We find that rainfall increased participation in both years. The dominant effect of rain on turnout is positive: sunny weather on Sunday of voting gives potential voters incentive to enjoy outdoor activities rather than spend time at the voting station.

[13] The full set of covariates is then: log of population registered as primary residents of the municipality, total population of the municipality, number of people who are between 0 and 14 years old, between 15 and 29, between 30 and 44 years old, between 45 and 59 years old, between 60 and 74 years old, more than 74 years old, median income, surface of the municipality, polynomials of latitude and longitude, log of distance to Paris, and dummy variables indicating *regions*. This set of covariates is interacted with the number of municipal councilmen, values of rainfall on the day of the election for each of the four years preceding the election, flu incidence in February for each of the four years preceding the election.

Although the estimated coefficients are positive for both years, the impact of rain is not statistically significant at 5 percent in 2008. We found anecdotal evidence in the main French provincial newspaper (*Ouest-France*) that corroborates this story. [14]

In columns 5 to 8 of Table 2, we report the results of the regression of turnout on flu incidence in the month preceding the elections, in 2001 and 2008. We find that a larger incidence of the flu decreases turnout, in both 2001 and 2008. Being sick increases the cost of voting.

Numerically, an increase of 1 percent in flu incidence decreases turnout by 0.0076 percent in 2008. Using summary statistics in Table 1 and the fact that average flu incidence in February 2008 was 1709, a rough approximation indicates that an increase of 1 percent in flu incidence corresponds to $population \times incidence/100 = 1798 \times \frac{1709}{100{,}000}/100 = .307$ more sick people on average. Such a change decreases turnout by 0.0076 percent, that is by $0.0076 \times 7.72 = 0.059$ voters. Since we use monthly incidence, and flu symptoms usually last a week, the actual number of reported cases of patients who may still suffer from the flu at the time of the election may be around one fourth of the monthly incidence. Overall, we conclude that for $\frac{1}{4} \times \frac{.307}{0.059} = 1.3$ sick people in the month before the elections, 1 person fewer will not vote, which seems a reasonable order of magnitude.

The results indicate that the coefficient is significantly different from 0 in 2008 only. We found abundant anecdotal evidence that the flu epidemic that struck in 2008 was particularly long and virulent.[15]

[14] *Ouest-France* mentions that turnout was expected to be lower in areas that would have nicer weather on voting day. In 2001, we found many articles that mention outdoor activities that were organized to take advantage of the good weather. See *Ouest-France* of Saturday, February 19th 2001, and March 10th 2001. Fewer articles mentioned a nice weather in 2008.

[15] In 2008, a proportion of patients infected by the most common strain of influenza (Type A H1N1, representing 67% of the flu cases that year), appeared to be resistant to the main drug used to treat it (oseltamivir, commercialized under the name of Tamiflu). The European Center for Disease Prevention and Control and other agencies reported at the beginning of February 2008 that they had: "detected an unusually high rate of resistance to the antiviral drug oseltamivir (Tamiflu) in random samples of seasonal influenza virus taken from around the continent." The share of resistant strains was then estimated to be around 14%, compared to 1% in the previous years (Dyer 2008). In France, Van Der Werf 2008 estimated at the end of the epidemics that around 30 percent

4.2 Effect of turnout on municipal revenues

Total municipal revenues. Table 3 reports the results on the impact of turnout on the increase from one term to the next in average municipal revenues, separately for the 2001 and 2008 elections, with and without social and demographic covariates.

We first estimate the coefficients of this regression in OLS (columns 1 and 2 for 2001 and columns 7 and 8 for 2008). The results show that turnout has a positive impact, small and not significant, on municipal revenues. We then estimate the coefficients of the same regression in 2SLS. The instrumental variables in these estimations are rainfall in the afternoon of election day (columns 3 and 4 for 2001, columns 9 and 10 for 2008), and log of flu incidence in the month before the election. In all these estimations, the estimated coefficient is negative: a bigger turnout in municipal elections leads to smaller municipal revenues after the elections.

Coefficients estimated using 2SLS are much smaller than those estimated with OLS. This difference is consistent with what we consider to be the main source of endogeneity. If some or all candidates have bigger projects, political participation is more valuable, so that turnout and growth in municipal budgets are positively correlated, and OLS estimations of the regression of turnout on growth in municipal budget are biased upwards.

Although all the estimated coefficients in 2SLS are negative, the F-statistic for testing the hypothesis that the instrument does not enter the first stage regression is relatively large in 2001 if we use rainfall as the IV, and in 2008 if we use flu incidence as the IV. In the other cases, the instruments may be weak and lead to biased estimations (see e.g. Bound, Jaeger and Baker 1995).

It is remarkable that, regardless of the instrument used, and regardless of the year of analysis, we obtain quite similar results. This similarity is

of all infected patients had contracted that resistant strain. Media coverage confirms this trend. A broad search in the newspaper *Ouest-France* indicated that around 50 articles mentioned the flu between February 1st and March 15th 2008 (compared to less than 10 over the same period in 2001).

particularly surprising, since the instruments could affect different types of voters: outdoor activities should presumably largely concern young households while the flu disproportionately affects older voters. Although the magnitude of the effect of these instruments on turnout varies from one election to another, and depends on the specific weather or flu conditions, the direction of the effect of turnout on budget is the same.

What is the order of magnitude of these effects? Given that the average budget is 2.2 million and the average population around 1798 inhabitants, a 1 percent increase in turnout corresponds to a fall in budget of around 24.5 euros per capita per year (considering an elasticity of -2, i.e a value close to the average elasticity). We can also express this as the expected impact of an additional vote. Given that the average number of voters who do cast a ballot is around 772, the minimum expected gain for an individual from voting is a decrease (resp. an increase) of around 3.17 euros of yearly budget if he votes for (resp. against) the candidate proposing the lower budget.[16]

These results also provide information on voting costs. The previous estimation of the expected gain or loss in terms of budget for every additional vote, in the order of 3.17 euros per year for 7 years (approximately 22 euros, in 2000 euros), is an upper bound, since people tend to discount the future at higher rates. If the vote is for a reduction in budget, the maximum gain in utility is easy to express: in the worst case scenario, the voter would not have benefited at all from this extra spending, and 22 euros is the maximum expected gain. If the vote is in favor of an increase in budget, the gain could be larger depending on the utility derived from this expenditure. Furthermore, no information can be obtained for those voters who did not actually turn out.[17]

[16] We know that on average 7.72 additional voters decrease the budget by 22 euros per capita and we can thus derive the impact of one additional voter.

[17] Consider two candidates H and L where H implements a high per capita budget b_H and L a lower one b_L. Let P_v be the probability H is elected if an individual favoring candidate L votes and P_{nv} be the probability if he does not ($P_v < P_{nv}$ since we consider someone favoring L). Finally we denote g the extra benefit this individual derives from having the high budget implemented. In this discussion we implicitly assume that g cannot be negative. In other words you can get zero benefits from the

To go further we need to make some assumptions on the distribution of voting costs. If we assume that costs are equal across the population, we know, from the previous discussion, the maximum financial benefits for voters voting against the increase. Given that costs are identical, we can state that an upper bound on voting costs, net of non-financial benefits of voting such as the satisfaction of performing one's civic duty, is 22 euros.

If we assume that voting costs are heterogeneous but are independent of the preferences for the budget, we can also infer that the average voting costs (net of non financial benefits from voting) for the first three quartiles of the population (i.e population that does vote) is below 22 euros. Indeed this can be derived from the behavior of the voters voting against the budget.

Detailed municipal revenues. In Table 4, we estimate separately the impact of turnout on each source of municipal revenues. We run the estimations separately for each election year, using rainfall in 2001 and flu incidence in 2008 as instrumental variables, since they are the best respective IV. We present the estimations with all the covariates in our data.

We find first that a higher turnout reduces revenues from the sale of municipal assets and use of savings (columns 1 and 2 of Table 4). The effect is very large, and is the main force behind the observed impact of turnout on total revenues. Although we cannot distinguish the effect of turnout on asset sales (which are physical assets) from its effect on the use of savings due to data limitations, the former effect should be much larger than the smaller. The law mandates that municipal savings yield no returns, so that municipalities have little incentive to save, as confirmed in estimations presented in the section on municipal expenses.

We also find some negative impact of turnout on loans in 2001 (columns

extra public good but you will not suffer from it. The expected utility from voting is then $P_v(g - b_H) + (1 - P_v)(-b_L)$ while not voting yields $P_{nv}(g - b_H) + (1 - P_{nv})(-b_L)$. Thus a marginal voter who is indifferent to voting must have a cost of voting c such that $c = (P_{nv} - P_v)(b_H - b_L - g)$. What we actually observe in the data is the average value of $(P_{nv} - P_v)(b_H - b_L)$.

3 and 4).[18] However, turnout has no significant effect on revenues from municipal taxes (columns 5 and 6). What explains this absence of effect? Even though municipal councils have the power to set the municipal budget, they face multiple constraints that could prevent substantial changes in local tax rates. First, by law, local tax rates must remain within certain bounds that depend on the average rate of comparable municipalities. Second, tax competition between municipalities constrains the tax rate. Tax competition could be particularly intense due to the high density of towns in France since a high density lowers the total cost of moving from one municipality to another. Third, changes in taxes apply more or less uniformly across the population of voters, whereas instruments such as the sale of physical assets can be much more targeted towards specific groups of the municipal population.[19]

In columns 7 and 8, we estimate that a higher turnout has no significant impact on the growth of unconditional subsidies received by the municipality. These subsidies are granted automatically according to a formula set in the national law that incorporates municipal demographic, geographic and social variables. Therefore, this result shows only that there is no correlation between the IV and these variables. We find that conditional subsidies, however, are significantly smaller in municipalities with higher turnout (columns 9 and 10). These subsidies are project based subsidies, mostly refunds on sales taxes, so that municipalities with a lower turnout may not only sell but also buy more assets, a point we further examine in the section on municipal expenses.

Finally, we find no significant effect of turnout on municipal rents (columns 11 and 12). Changes in physical assets do not affect the amount of revenues municipalities aim to raise from this source.[20]

[18] These estimations could be biased, since lots of municipalities take no loan at all in at least one term.

[19] Local taxes stem mainly from real estate taxes. These taxes affect all but the poorest residents, who may be tax-exempt under ceratin conditions, whereas other sources of revenue could spare political supporters of the current municipal council.

[20] Municipal rents consist of payments from services provided by the municipality, and returns from physical assets, such as municipal real estate or equipment. These rents also contain taxes designed to fund certain services, such as garbage collection.

4.3 Effect of turnout on municipal expenses

Table 5 reports the results of the 2SLS regressions of turnout on growth in municipal expenses, for different types of expenditures. We ran the estimations separately for each election year, and used rainfall in 2001 and flu incidence in 2008 as instrumental variables.

We find that total municipal expenses are bigger when voter turnout is lower (Columns 1 and 2). In both elections, the impact of turnout on growth in total expenses is significant at 10 percent. In addition, it is of the same order of magnitude as the effect of turnout on growth in total revenues. The extra revenues raised by municipal councils elected with a low turnout are thus spent, not saved. Municipalities have little incentive to save, since, by law, their savings yield no interest. This result is confirmed in columns 3 and 4, which show that voter turnout has no significant effect on the growth of savings.

The main expenses that turnout affects are physical assets (Columns 5 and 6). We find that a 1 percent increase in turnout decreases asset purchases by more than 10 percent. In both elections, this effect is statistically significant.

We also find, after the 2001 elections only, that a higher voter turnout decreases annuities (Columns 7 and 8). This last result, large but not significant, may suggest that the extra expenditures of municipalities with low turnout were funded partly through debt, at least in 2001. The 2007-2008 financial crisis made borrowing harder for French municipalities in 2008 and after, which may explain why we don't find an effect of turnout on annuities in the 2008 elections.[21]

Besides asset expenses and annuities, no other type of expense is affected as much by voter turnout. It does not affect expenses in personnel (columns 9 and 10), contributions paid by the municipality (columns 11 and 12), or maintenance expenses (columns 13 and 14).[22]

[21] Indeed, in 2009, Dexia, a bank that has been the main creditor of local governments in France, announced huge losses, which led to substantial restructuring thereafter. This restructuring led to a decrease in available credit to municipalities.

[22] In some specifications, we find a small positive impact of turnout on increase in

4.4 Effect of turnout on other outcomes

Electoral outcomes. Does turnout affect the identity of elected councilmen? To address this question, we construct three binary variables to address this question: a variable equal to 1 if the mayor is reelected (both in the council and as mayor), a variable equal to 1 if a majority of seats in the council are won by candidates from a left-wing party, and a variable equal to if 1 if the ideology (left-wing or right-wing) of a majority of councilmen is the same in both 2001 and 2008. We call this latter dependent variable the "probability that a majority of councilmen is from the incumbent ideology", and we can estimate the regression of this variable on turnout in 2008 only, since we have no information on municipal councils before 2001.

Table 6 reports the 2SLS estimations separately for each election, using rainfall as the instrumental variable for the 2001 election, and flu for the 2008 election. We find no impact of turnout on the probability that the incumbent mayor is reelected, or the incumbent ideology wins in 2008. This may contrast with the "anti-incumbent" effect, which states that higher turnout may harm the probability of reelection of incumbent representatives. The reality of this anti-incumbent effect has not been tested, though, and our results suggest that it does not hold, although we stress that these results may not be robust due to data limitations. Similarly, since turnout favors more fiscally conservative policies, we may have expected it to also favor right-wing parties. The fact that right-wing parties, at the local level at least, always implement more fiscally conservative policies remains to be proven though (see Ferreira and Gyourko 2009). In addition, for a local party wishing to cater to a certain group of residents, it may be a better strategy to find a new public asset to invest in that really addresses the needs of this group, than to increase or decrease local taxes for instance. We examine more this hypothesis in Section 5.

maintenance expenses. Selling some equipment spares the municipality the expenses required for its maintenance. The positive effect of turnout on maintenance expenses and its negative impact on asset sales are thus complementary.

Social and economic outcomes We also estimate, in Table 6, the effect of turnout on the increase of three municipal characteristics that we observe until 2011: median income, unemployment, and number of residents. Turnout only significantly affects median income in 2008. This increase in local residents' income may result from the fact that new assets are bought from local residents themselves. Since more assets are bought when turnout is low, the income of the sellers, some of whom could have the median income, increases. Municipalities with low turnout also sell more assets, though, most likely to residents as well. Also, French law mandates that public administration buy and sell at market price, thus limiting the possibility for municipalities to distribute some net cash flow to some of their residents through asset sales and purchases. A different interpretation of this result is that municipalities that sell and buy more assets may provide public goods that cater better to their residents' needs. Residents, who may then save their own private spending, can buy more goods from local business, thereby increasing local median income. For instance, a new local school may save commuting expenses to residents with children.

4.5 Additional results

Placebo test of the identification assumption. The identification requires that instrumental variables only impact the budget through their effect on voter turnout on the election day. In particular, it requires that instrumental variables are not correlated with growth in municipal revenues. To test this assumption, we run a series of placebo estimations. For each year preceding an election, we partition our data into two fictitious terms, one comprising all observations before that year, and another comprising all observations from that year up to the true election year. Then, we estimate the impact of the best instrument on the growth in municipal revenues from one fictitious term to the other. Table 8 in Appendix C shows the results of these estimations. We find no significant impact of either instrument on growth in revenues before the election, for any fictitious year of election.

Other estimations. We report, in Table 9 in Appendix C, the results of the regression of revenues on turnout, with data of both elections pooled together. We can then include municipal fixed effects in the regressions. The OLS estimation (column 1) shows no significant impact of turnout, as before. No instrument has a significant impact on revenues, which is unsurprising given their strength. However, when both instruments are used, the LIML estimation of the coefficient is negative, and quite large. This estimation, more reliable but less precise than the 2SLS estimation given the instruments we have, is consistent with our previous results.
In Table 10, we present additional results of the first and second stage 2SLS estimations of the impact of other weather variables: rainfall in the morning of the election, and rainfall at midday. We find no significant impact of either variable on turnout. These results suggests that unmotivated voters may base their vote more on the weather of the afternoon than the weather at any other time of the day.

5 Interpretation of results

Intepretation. Two main findings emerge from our empirical results: (1) an exogenous increase in turnout at the time of the election decreases both revenues and expenses, and (2) this decrease is mainly a decrease in sales and purchases of public physical assets.

Our interpretation relies on the fact that turnout affects *who* is elected: the programs of the individual candidates or parties differ, and an increase in turnout affects their probability of election. If a party or a candidate's platform reflects her supporters' preference, our results mean that the preferences of the most motivated voters - the ones who cast a ballot when there is a high exogenous shock on voting costs - differ from the preferences of the least motivated voters.[23]

[23]If we suppose that voters or candidates are "sufficiently" well-informed and rational, a high or low turnout caused by an exogenous cause should have no effect on the policy implemented by a given candidate if elected. This assumption may fail, though. For instance, a winning candidate may not realize that a high turnout is due to fac-

Individual candidates or parties can choose among several fiscal instruments to implement their program: buying or selling physical assets, increasing or lowering local taxes, or borrowing. Buying and selling particular assets, such as a school, permits greater targeting of certain groups than the other instruments, since local taxes affect almost every household, and must by law remain within certain bounds. So, it seems natural that the parties will compete mostly on which public good to provide, thus appealing to a particular group. This explains finding (2) above. However, it does not explain finding (1), which states that the candidate or party with the highest budget tend to win when turnout is low. To understand this point, we consider an election with two parties, who each support investment in a specific new asset, competing in a winner-take-all election. This assumption simplifies the discussion, and fits the actual context of most municipal elections (see section 2), in which two parties compete to obtain a majority of seats in the council.

Parties prefer different assets. Furthermore, they promise in their campaign the quantity of the new asset they would acquire if elected. Similarly, municipal residents differ both in terms of how they rank new public assets, and in their fiscal conservatism (i.e. in how much they dislike higher budgets).

If the two competing parties have different budgets, the party with the smaller budget is the preferred party both of residents who prefer the new asset it proposes, and of residents who prefer the other new asset, but find the other party's budget too high. The other party can, however, attract only voters who strongly prefer her platform.[24]

Everything else equal, the party with the smaller budget then has a numerical advantage. It is thus not profitable for the other party to have a higher budget, unless setting a higher budget makes some of its own

tors independent of residents' preferences, and might infer from it that voters will hold him/her more accountable. H/She may then increase his/her effort to contain the costs of municipal expenses.

[24]Conservative voters may not actually vote for a party with a small budget, but may simply abstain due to less incentive to vote for the party that would invest in their favorite public good if its budget is too high.

supporters more likely to vote. In fact, the voters that will be the most likely to turn out are the fiscally liberal supporters of the high spending party: they gain more of their preferred public good than the others and don't care much about the budget. If there is a positive shock on voting cost, this party may win.

Electoral competition thus creates the conditions for a natural sorting. If voting cost is low and turnout is high, this discussion suggests that the party with the smaller budget is more likely to win. Conversely, if voting cost is high and turnout is low, the party with the higher budget is more likely to win. Such sorting naturally leads to the situation described in finding (1) above. We formalize these ideas in the model presented in the next section.

We emphasize that, in our interpretation, the effect of turnout on the size of the budget of the winning party does not depend on the actual cause of random shocks on voting costs. This feature is consistent with the result that different instruments show the same impact of turnout on the budget, even though the individuals whose cost of voting is affected by the weather are not the same as those affected by the flu, and likely value different types of public goods.[25]

Model. The model we present has a high degree of symmetry. Relaxing the symmetric assumptions would not affect the main result. However, no other asymmetric feature than the one we consider impacts the relation between turnout and budget.

We consider two groups of equal size, denoted 1 and 2, and two parties also denoted 1 and 2. Parties simultaneously set budgets x_1 and x_2 for their respective programs in order to maximize their probability of being elected.

Each group member decides whether to turn out to vote and if so, for whom to vote. We assume that both groups have a continuum of voters,

[25]For instance, we may assume that those who do not vote when it does not rain, because they pursue weekend plans, are young professionals while those most affected by the flu may be the elderly.

and that a voter casts a ballot if the difference between the utilities she would obtain from her preferred program relative to her least preferred, is bigger than her voting cost. The utility of a member i of group g is given by $u(x_g) - \alpha_i x_g$ if party g wins, and $-\alpha_i x_{-g}$ otherwise, where u is C^2, concave, and $u(0) = 0$, and where α_i is drawn from a uniform distribution on $[0, 1]$. Thus the good financed by party g is valuable only for a member of group g. Voters also care about the level of spending, to varying degrees; the parameter α_i measures the degree of fiscal conservatism of voter i.

The cost of voting of any member of group g is $\frac{c}{\theta_g}$, where c is randomly drawn from a uniform distribution on $[0, C]$, and $\theta_1, \theta_2 > 0$. We assume that C is "large enough" in the sense that we consider only equilibria such that for c close to the upper limit of the interval, nobody votes. The only asymmetry between groups is that they differ in θ_g, in other words in voting costs. We normalize $\theta_1 = 1$ and $\theta_2 \equiv \theta > \theta_1$. For any level of shock on voting costs, members of group 2 will have a lower cost of voting than members of group 1.

We make the following tie-breaking assumption. If both parties obtain the same positive number of votes, neither of them gets elected. This assumption is not necessary, but simplifies the presentation. It ensures that candidates have some incentives for different platforms. Such an assumption seems reasonable since if parties are too similar, other candidates may step in.[26]

To understand the mechanics of the model, consider a case where party 2 proposes a higher budget than party 1. In such a situation, we have several types of voters:

- Voters of group 1 who come and vote for party 1: such that $u(x_1) - \alpha_i x_1 + \alpha_i x_2 \geq c$
- Voters of group 2 who are fiscally liberal and vote for party 2: such that $u(x_2) - \alpha_i x_2 + \alpha_i x_1 \geq c$

[26] We could also make an alternative, possibly weaker assumption, which is to assume that some cost is incurred by both candidates in case of equality.

- Voters of group 2 who are fiscally conservative and vote for party 1: such that $-u(x_2) + \alpha_i x_2 - \alpha_i x_1 \geq c$

Thus the number of voters turning out in favour of party 1 in the case where all three types of voters are present is given by:

$$S_1 = \left(1 + \frac{u(x_1)}{x_1 - x_2} - \frac{c}{x_1 - x_2}\right) + \left(1 - \frac{u(x_2)}{x_1 - x_2} - \frac{c}{\theta(x_1 - x_2)}\right)$$

The number of voters turning out for party 2 is given by:

$$S_2 = \left(\frac{u(x_2)}{x_1 - x_2} - \frac{c}{\theta(x_1 - x_2)}\right)$$

Thus we have

$$S_1 - S_2 = \left(1 + \frac{u(x_1)}{x_1 - x_2} - \frac{c}{x_1 - x_2} + 1 - 2\frac{u(x_2)}{x_1 - x_2}\right)$$

which is decreasing in c as the intuitive discussion above suggested, so that typically party 1 wins for low values of c while party 2 wins otherwise. The following proposition confirms these patterns and presents sufficient conditions for such an equilibrium to exist. The proof of the proposition is in Appendix D.

Proposition. (1) If, in a pure strategy equilibrium, both parties have a strictly positive probability of winning and there exists $\hat{c} \in (0, C)$ such that one party wins if and only if $c \leq \hat{c}$, and the other party wins if and only if $c \geq \hat{c}$ then, the former party's budget is strictly smaller than the latter party's budget.
(2) If $\theta \in (1, 2)$ and $u'(0) \in (\frac{1}{\theta}, 1]$, then such an equilibrium exists, where party 1 wins if and only if $c < \hat{c}$ and party 2 if and only if $c > \hat{c}$.

The first part of the proposition states that, if there is an equilibrium in which the cost of voting has a monotone impact on the elected budget (provided one of the parties wins), then the party with the smaller budget wins for small values of c, and conversely, the party with the biggest budget

wins when c is larger. We focus on this type of equilibrium since it is the only one with "clear" comparative statics. The second part of the proposition identifies sufficient conditions such that this equilibrium indeed exists.

6 Conclusion

Whereas most of the literature on voter turnout examines the determinants of turnout, we take in this paper a first step towards understanding the effect of turnout on policy outcomes. We show that higher turnout has a large and significant negative impact on municipal revenues and spending and that this effect is due mostly to a decrease in the sale and purchases of physical assets. We use these results to estimate some bounds on voting costs, and we provide a new model suggesting an explanation for this set of results.

In our model, the impact of a higher turnout on welfare may be positive or negative. Some other interpretations that we mention have clearer welfare implications, though: if turnout makes the elected officials more accountable, the effect will undoubtedly be positive. Regardless of one's interpretation, our paper shows that public policies aimed at encouraging voter turnout, and independent of the political context, could have a sizable welfare impact. Estimating this impact remains an open question.

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7 Tables

Table 1: Summary statistics

Variable	Mean	Std. Dev.	N
MUNICIPAL FISCAL VARIABLES			
Total Revenues	2195.88	13136.35	107236
Asset Sales & Use of Savings	391.85	2669.81	107236
Loans	151.67	1057.56	107236
Rents	585.19	3790.39	107236
Subsidies - Unconditional	315.57	1779.04	107236
Subsidies - Conditional	141.56	626.55	107236
Local Taxes	610.04	3862.71	107236
Total Annual Expenses	1983.92	12162.36	107236
Annuities	205.01	1442.28	107236
Asset Purchases	534.77	3164.22	107236
Contributions	323.22	2202.94	107236
Maintenance	317.21	1736.97	107236
Personnel	603.71	4061.95	107236
Savings	211.96	1136.95	107236
VOTER TURNOUT			
Voter Turnout per 100 Registered Individuals	78.38	8.81	64414
# Voters	772.72	2466.74	64414
# Registered municipal residents	1150.52	4329.5	64414
RAINFALL in MM			
Afternoon Rainfall on Election Day D, Month M, Year Y	0.67	1.5	65936
Past Afternoon Rainfall - D, M, Y-1	0.48	1.25	65936
Past Afternoon Rainfall - D, M, Y-2	0.74	1.63	65936
Past Afternoon Rainfall - D, M, Y-3	0.35	0.92	65936
Past Afternoon Rainfall - D, M, Y-4	0.03	0.15	65936
FLU INCIDENCE per 100,000			
Flu incidence in February in Election Year Y	1251.94	907.66	65936
Past Flu incidence in February, Y-1	1710.41	1276.88	65936
Past Flu incidence in February, Y-2	2172.32	1491.01	65914
Past Flu incidence in February, Y-3	2130.32	1389.69	65936
Past Flu incidence in February, Y-4	273.23	306.4	63554
ADMINISTRATIVE/GEOGRAPHIC VARIABLES			
Region Code	49.01	24.96	64414
# Councilmen	14.47	5.91	64414
Latitude	47.05	2.15	64414
Latitude ^{2}	2218.61	200.61	64414
Longitude	2.59	2.61	64414
Longitude ^{2}	13.5	15.15	64414
Distance to Paris	324.24	173.68	64414
SOCIAL/DEMOGRAPHIC VARIABLES			
Population	1797.71	7723.15	64414

Continued on next page...

... table 1 continued

Variable	Mean	Std. Dev.	N
Surface	15.13	14.73	64414
Median Income	23838.99	5894.65	58459
Employed	676.78	2905.41	64414
Labor Force	934.57	4280.41	64414
Residents 0-14 years old	316.68	1281.18	64408
Residents 15-29 years old	325.14	1934.44	64408
Residents 30-44 years old	355.09	1515.68	64408
Residents 45-59 years old	326.52	1297.73	64408
Residents 60-74 years old	227.21	899.02	64408
Residents 75 or more years old	132.75	612.22	64408
ELECTORAL OUTCOMES			
Incumbent mayor reelected	0.68	0.47	40691
Left party wins majority	0.36	0.48	52988
Incumbent ideology wins majority	0.05	0.22	28235
OTHER POLITICAL VARIABLES			
Other issue on the ballot	0.51	0.5	64414
# Votes for Right in 2007 presidential elections	516.26	1837.44	31714
# Votes for Left in 2007 presidential elections	452.83	1810.14	31714
Turnout in previous municipal election	0.79	0.09	32700

NOTES. Our data cover more than 30,000 municipalities, and three municipal terms. Municipal fiscal variables are measured in every term. All other variables are measured before or at the time of the election. MUNICIPAL FISCAL VARIABLES. Municipal fiscal variables are in thousand Euros of 2000. By definition, the mean of a revenue (expenditure) variable V is the mean, over three terms, of the average amount of yearly revenue (expense) V raised (spent) in a term. We cannot distinguish in the data asset sales and use of savings with our data on municipal finances. ADMINISTRATIVE/GEOGRAPHIC VARIABLES. The region code is conventional, and independent of social, demographic, etc. variables. In the estimations, we use a dummy variable for every region and every number of councilmen. ELECTORAL OUTCOMES. We only observe the incumbent ideology with a majority of seats for the 2008 election. OTHER POLITICAL VARIABLES. We only observe the number of voters at the municipal level for the main candidates of the left and the right in the presidential elections of 2007, so that we can only use this variable in 2008. See section 2 for more information on the data. SOURCES: See section 2.

Table 2: **Effect of Instrumental Variables on Turnout - OLS Estimation**

	Dependent Variable: Log Turnout							
	(1) 2001	(2) 2001	(3) 2008	(4) 2008	(5) 2001	(6) 2001	(7) 2008	(8) 2008
Afternoon Rain	0.0018*	0.0018*	0.0020*	0.00068				
	(0.00056)	(0.00055)	(0.00055)	(0.00043)				
Log Flu Incidence					-0.0032	-0.0018	-0.015*	-0.0076*
					(0.0021)	(0.0020)	(0.0031)	(0.0021)
Log Population		-0.023*		-0.023*		-0.025*		-0.021*
		(0.0053)		(0.0057)		(0.0061)		(0.0065)
Log Surface		0.017*		0.012*		0.018*		0.012*
		(0.0011)		(0.0011)		(0.0012)		(0.0011)
Log Med. Income		-0.012*		-0.029*		-0.014*		-0.029*
		(0.0052)		(0.0044)		(0.0052)		(0.0047)
Observations	35,616	29,398	34,048	28,784	34,688	28,703	32,470	27,438
R^2	0.447	0.497	0.521	0.641	0.449	0.496	0.527	0.645
Residents by Age	N	Y	N	Y	N	Y	N	Y
Past Afternoon Rain	N	Y	N	Y	N	N	N	N
Past Flu Incidence	N	N	N	N	N	Y	N	Y
Other Political Var	N	Y	N	Y	N	Y	N	Y
Clusters	1169	1169	1494	1494	726	726	726	726

NOTES. This table reports the OLS estimation of the regression of voter turnout on rainfall in the afternoon of election day (columns 1 to 4), and on the log of flu incidence in the month preceding the election (columns 5 to 8), separately for the 2001 and 2008 French municipal elections. There is one observation by municipality. All regressions include administrative/geographic covariates: latitude, longitude, squared latitude, squared longitude, log of distance to Paris, and dummy variables for the number of council seats and French administrative *regions*. Columns 2, 4, 6 and 8 also include social and demographic covariates, and the past values of the main explanatory variable (afternoon rainfall or flu incidence) measured in the four years previous to election year. Columns 4 and 8 also include municipal turnout in 2001, and other political variables (see Table 1). Rainfall (flu incidence) is observed at every point of a given set of locations of observations. We define the rainfall (flu incidence) in a municipality as the rainfall (flu incidence) in the closest location of observation. Standard errors are clustered at the location of observation level. The number of clusters is reported at the bottom of each column. + Significant at the 10 percent level. ∗ Significant at the 5 percent level.

Table 3: **Effect of Turnout on Total Municipal Revenues - OLS and 2SLS estimations**

Dependent Variable: Increase in Revenues from One Term to the Next

	(1) 2001 OLS	(2) 2001 OLS	(3) 2001 2SLS	(4) 2001 2SLS	(5) 2001 2SLS	(6) 2001 2SLS	(7) 2008 OLS	(8) 2008 OLS	(9) 2008 2SLS	(10) 2008 2SLS	(11) 2008 2SLS	(12) 2008 2SLS
Log Turnout	-0.0088	0.0019	-2.76*	-2.37*	-0.75	-3.15*	-0.030	0.025	-0.42	-0.13	-1.87*	-2.61+
	(0.017)	(0.018)	(1.14)	(1.01)	(1.85)	(0.85)	(0.019)	(0.023)	(1.24)	(3.07)	(0.73)	(1.45)
Log Population		-0.0089		-0.057+		-0.081*		0.018		0.012		-0.036
		(0.014)		(0.029)		(0.036)		(0.015)		(0.073)		(0.042)
Log Surface		0.0020		0.044*		0.058*		-0.0061*		-0.0051		0.026
		(0.0027)		(0.018)		(0.016)		(0.0029)		(0.036)		(0.018)
Log Med. Income		0.12*		0.093*		0.077*		0.10*		0.100		0.035
		(0.012)		(0.021)		(0.024)		(0.013)		(0.090)		(0.048)
Observations	35,616	29,398	35,616	29,398	34,688	28,703	34,048	28,784	34,048	28,784	32,470	27,438
Residents by Age	N	Y	N	Y	N	Y	N	N	N	Y	N	Y
Past Afternoon Rain	N	N	N	Y	N	Y	N	N	N	N	N	N
Past Flu Incidence	N	N	N	N	N	N	N	Y	N	Y	Y	Y
Other Political Var	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y
IV	None	None	Rain	Rain	Flu	Flu	None	None	Rain	Rain	Flu	Flu
Fstat	.	.	9.75	11.3	2.31	.77	.	.	12.7	2.55	25.1	13.5

NOTES. This table reports the estimations of the regression of the increase in the log of average annual municipal revenues in a term, from one term to the next, on voter turnout in the municipal election between both terms, separately for the French municipal elections of 2001 (columns 1 to 6) and 2008 (columns 7 to 12). There is one observation by municipality. We report results of both OLS estimations and 2SLS estimations (se top of column). The instrument used in 2SLS estimations is indicated at the bottom of each column. All regressions include administrative/geographic covariates: latitude, longitude, squared latitude, squared longitude, log of distance to Paris, and dummy variables for the number of council seats and French administrative *regions*. Columns 2, 4, 6, 8, 10 and 12 also include social and demographic covariates. Columns 4, 6, 10 and 12 include the past values of the instrumental variable, measured in the four years before the actual election year. For the 2008 election only, columns 8, 10 and 12 also include municipal turnout in 2001, and other political variables (see Table 1). Rainfall (flu incidence) is observed at every point of a given set of locations of observations. We define the rainfall (flu incidence) in a municipality as the rainfall (flu incidence) in the closest location of observation. Standard errors are clustered at the location of observation level in the 2SLS estimations. The number of clusters is reported in Table 2. When relevant, we show the F-statistic for testing the hypothesis that the IV does not enter the first stage regression. + Significant at the 10 percent level. ∗ Significant at the 5 percent level.

Table 4: **Effect of Turnout on Municipal Revenues, by Source of Revenues - 2SLS estimation**

Dependent Variable: Increase in Revenues from One Term to the Next

	Asset Sales & Use of Savings		Loans		Taxes		Unconditional Subsidies		Conditional Subsidies		Rents	
	(1) 2001	(2) 2008	(3) 2001	(4) 2008	(5) 2001	(6) 2008	(7) 2001	(8) 2008	(9) 2001	(10) 2008	(11) 2001	(12) 2008
Log Turnout	-5.68*	-13.4*	-7.46+	-4.70	0.087	1.15	0.52	0.48	-4.92*	-8.49*	-0.28	0.69
	(2.81)	(5.91)	(4.16)	(4.53)	(1.35)	(0.91)	(0.50)	(0.49)	(2.16)	(3.61)	(0.91)	(1.24)
Observations	29,333	27,414	18,227	16,201	29,380	27,425	29,398	27,438	29,374	27,420	29,340	27,352
IV	Rain	Flu	Rain	Flu	Rain	Flu	Rain	Flu	Rain	Flu	Rain	Flu

NOTES. This table reports the 2SLS estimation of the regression of the increase in the log of average annual municipal revenues over a term (or over part of a term if observations are missing), from one term to another, on voter turnout in the municipal election between both terms, separately for each source of revenue, and separately for the French municipal elections of 2001 and 2008. There is one observation by municipality. We only report the results of the 2SLS estimations, using the best instrumental variable, that is rainfall in the afternoon of election day for the 2001 election, and log flu incidence in the month preceding the election for the 2008 election. All regressions include all covariates of our data: administrative/geographic covariates, and social and demographic covariates, and the past values of the instrumental variable (afternoon rainfall or flu incidence), measured in the four years before the actual election year, and - for the 2008 election only - municipal turnout in 2001, and other political variables. See Table 1 for the detailed list of covariates, and sources of revenues. Rainfall (flu incidence) is observed at every point of a given set of locations of observations. We define the rainfall (flu incidence) in a municipality as the rainfall (flu incidence) in the closest location of observation. Standard errors are clustered at the location of observation level in the 2SLS estimations. The number of clusters is reported in Table 2. + Significant at the 10 percent level. $*$ Significant at the 5 percent level.

Table 5: **Effect of Turnout on Municipal Expenses, by Item of Expense - 2SLS estimation**

Dependent Variable: Increase in Expenses from One Term to the Next

	Total Expenses		Savings		Asset Purchases		Annuities		Personnel		Contributions		Maintenance	
	(1) 2001	(2) 2008	(3) 2001	(4) 2008	(5) 2001	(6) 2008	(7) 2001	(8) 2008	(9) 2001	(10) 2008	(11) 2001	(12) 2008	(13) 2001	(14) 2008
Log Turnout	-3.04*	-2.91+	2.09	-0.40	-6.98*	-12.7*	-3.12	0.50	0.58	-0.051	0.82	2.29	-0.83	0.98
	(1.07)	(1.55)	(2.87)	(2.49)	(3.00)	(4.86)	(2.36)	(2.17)	(0.69)	(0.81)	(2.63)	(1.57)	(0.85)	(0.77)
Observations	29,398	27,438	27,921	25,752	29,392	27,436	28,055	25,753	29,346	27,384	29,398	27,438	29,398	27,438
IV	Rain	Flu	Rain	Flu	Rain	Flu	Rain	Flu	Rain	Flu	Rain	Flu	Rain	Flu

NOTES. This table reports the 2SLS estimation of the regression of the increase in the log of average annual municipal expenses over a term (or over part of a term if observations are missing), from one term to another, on voter turnout in the municipal election between both terms, separately for each item of expense, and separately for the French municipal elections of 2001 and 2008. There is one observation by municipality. We only report the results of the 2SLS estimations, using the best instrumental variable, that is rainfall in the afternoon of election day for the 2001 election, and log flu incidence in the month preceding the election for the 2008 election. All regressions include all covariates of our data: administrative/geographic covariates, and social and demographic covariates, and the past values of the instrumental variable (afternoon rainfall or flu incidence), measured in the four years before the actual election year, and other political variables. See Table 1 for the detailed list of covariates, and items of expenses. Rainfall (flu incidence) is observed at every point of a given set of locations of observations. We define the rainfall (flu incidence) in a municipality as the rainfall (flu incidence) in the closest location of observation. Standard errors are clustered at the location of observation level in the 2SLS estimations. The number of clusters is reported in Table 2. + Significant at the 10 percent level. ∗ Significant at the 5 percent level.

Table 6: **Effect of Turnout on Other Outcomes - 2SLS Estimation**

Dependent Variable:	*Probability that Majority of Councilmen is in Left-wing Party*		*Probability that Incumbent Mayor is Reelected*		*Probability that Majority of Council from Incumbent Ideology*	*Increase in Unemployment*		*Increase in Median Income*		*Increase in Population*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	2001	2008	2001	2008	2008	2001	2008	2001	2008	2001	2008
Log Turnout	0.097	1.11	3.25	1.86	3.17	0.28	0.063	-0.30	-0.45+	-0.21	-0.44
	(1.75)	(1.46)	(3.53)	(1.44)	(2.48)	(1.72)	(0.96)	(0.35)	(0.24)	(0.18)	(0.40)
Observations	21,514	23,352	11,127	24,341	18,317	23,609	22,018	29,398	26,717	29,398	27,438
IV	Rain	Flu	Rain	Flu	Flu	Rain	Flu	Rain	Flu	Rain	Flu

NOTES. This table reports the estimation of the regression of electoral and social outcomes on voter turnout in the municipal election between both terms, and separately the 2001 and 2008 French municipal elections. Electoral outcomes are the probability that the mayor is reelected (both in the council and as mayor), the probability that a majority of seats in the council are won by candidates from a left-wing party, and the probability that the ideology (left or right-wing) of a majority of councilmen is the same after both 2001 and 2008 elections. This latter dependent variable is only defined for 2008 elections, since we have no information on municipal councils before 2001. See section 2 for institutional details on municipal councils. Social outcomes are increases in log of number of unemployed, size of population, and median income, measured at the end of a term, from one term to another. There is one observation by municipality. We only report the results of the 2SLS estimations, using the best instrumental variable, that is rainfall in the afternoon of election day for the 2001 election, and log flu incidence in the month preceding the election for the 2008 election. All regressions include all covariates of our data. See Table 1 for the detailed list of covariates. Standard errors are clustered at the location of observation level in the 2SLS estimations. The number of clusters is reported in Table 2. + Significant at the 10 percent level. $*$ Significant at the 5 percent level.

Appendix A Electoral System of French Municipal Councils

For Online Publication

Below 3500 residents, the electoral system follows a first-past-the-post voting method. Candidates run individually, although they are usually affiliated with a local group, which may be linked to a national party, and every voter can give at most one vote to any arbitrary number of candidates smaller than the number of seats. The candidates fill the available positions in order of highest vote.[27] Above 3500 residents - apart from the three biggest cities Paris, Lyon and Marseilles - council seats are distributed according to a party-list proportional representation system. Candidates run in groups, which may also be linked to a national party, and every voter can vote for at most one group. The group with the most votes obtains at least half the seats; the remaining seats are distributed according to some highest average method. The number of councilmen depends on the number of municipal residents too, as shown in the following table.

[27] A candidate can be elected in the first round only if more than half voters and at least a quarter registered voters voted for her or him.

Table 7: **French Municipal Councils**

# Residents	**# Municipal councilmen**	**Voting System**
Less than 100	9	Individual/First-past-the-post (FPTP)
100 - 499	11	Individual/FPTP
500 - 999	15	Individual/FPTP
1000 - 2 499	19	Individual/FPTP
2 500 - 3 499	23	Individual/FPTP
3500 - 4999	27	Party-list /Proportional
5000-9999	29	Party-list /Proportional
10000-19999	33	Party-list /Proportional
20000-29999	35	Party-list /Proportional
30000-39999	39	Party-list /Proportional
40000-49999	43	Party-list /Proportional
50000-59999	45	Party-list /Proportional
60000-79999	49	Party-list /Proportional
80000-99999	53	Party-list /Proportional
100000-149999	55	Party-list /Proportional
150000-199999	59	Party-list /Proportional
200000-249000	61	Party-list /Proportional
250000-299999	65	Party-list /Proportional
300000 or more	69	Party-list /Proportional

Appendix B Maps

For Online Publication

Figure 1: French Municipalities (located in Continental France, which excludes Overseas Territories and Corsica.) The thick black lines delimit French *regions*. Municipalities are delimited by grey borders. Municipalities filled in blue are in the sample, white-colored are out of the sample. We excluded municipalities for which we had either no fiscal data, or no record of voter turnout. In most cases, the missing information is voter turnout.

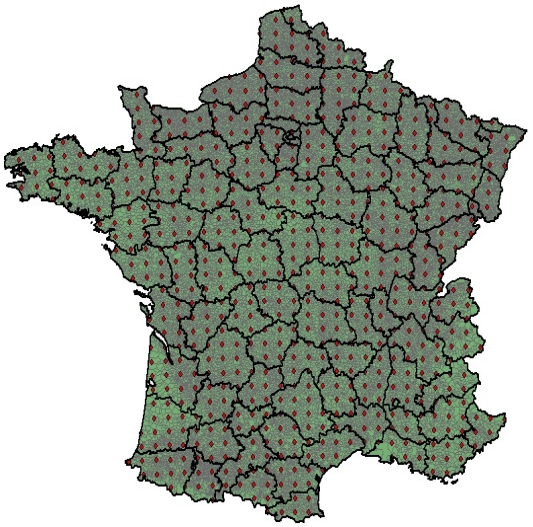

Figure 2: Observation Locations of Flu Incidence (Red Circles) - 2001 and 2008.

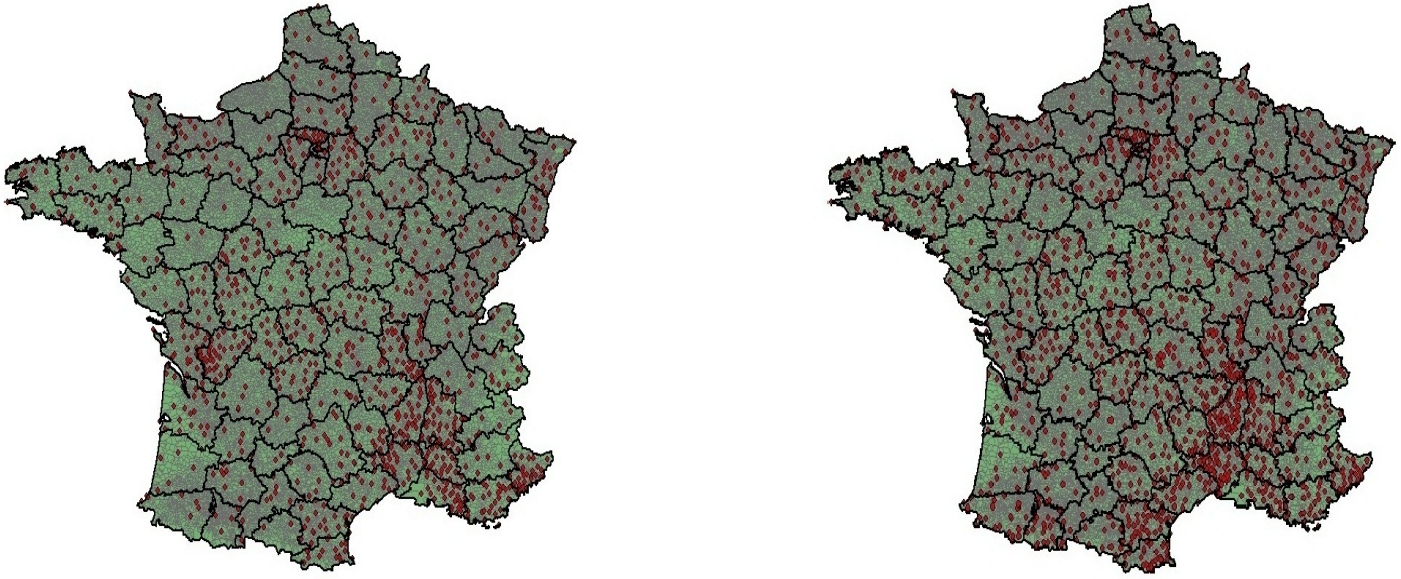

Figure 3: Observation Locations of Rainfall (Red Circles) - 2001 (Right) and 2008 (Left).

Appendix C Additional Results

For Online Publication

Table 8: **Placebo Tests - Effect of Instruments on Increase in Total Municipal Revenues *Before* the Elections**

Dependent Variable: Increase in Revenues from the Fictitious Term [1998 *to* Y], *to the Fictitious Term* [$Y+1$ *to Election Year* -1]

	(1) Y=1998	(2) Y=1999	(3) Y=1998	(4) Y=1999	(5) Y=2000	(6) Y=2001	(7) Y=2002	(8) Y=2003	(9) Y=2004	(10) Y=2005	(11) Y=2006
Afternoon Rain in 2001	-0.0024	-0.00036									
	(0.0016)	(0.0014)									
Afternoon Rain in 2008			0.000033	0.0012	0.00044	0.00025	0.0021	0.0018	0.0015	0.00045	-0.00050
			(0.0018)	(0.0016)	(0.0015)	(0.0017)	(0.0018)	(0.0020)	(0.0021)	(0.0022)	(0.0022)
Observations	29,398	29,398	28,784	28,784	28,784	28,784	28,784	28,784	28,784	28,784	28,784

	(1) Y=1998	(2) Y=1999	(3) Y=1998	(4) Y=1999	(5) Y=2000	(6) Y=2001	(7) Y=2002	(8) Y=2003	(9) Y=2004	(10) Y=2005	(11) Y=2006
Log Flu Incidence in 2001	-0.00065	-0.0058									
	(0.0043)	(0.0054)									
Log Flu Incidence in 2008			-0.010	-0.0065	-0.0051	-0.0046	0.0016	0.00013	0.0044	0.0094	0.0090
			(0.0077)	(0.0075)	(0.0074)	(0.0074)	(0.013)	(0.012)	(0.011)	(0.0100)	(0.010)
Observations	28,703	28,703	27,438	27,438	27,438	27,438	27,438	27,438	27,438	27,438	27,438

NOTES. This table reports the estimation of the regression of the increase in the log of average yearly municipal revenues, from the years 1998-Y to the years $Y+1$-Election year-1, on rainfall in the afternoon (upper rows), or on log of flu incidence (lower rows), at the time of municipal elections *after* Y, separately for each municipal election year, 2001 (columns 1 and 2) or 2008 (columns 3 to 11). There is one observation by municipality. All regressions include all covariates of our data: administrative/geographic covariates, and social and demographic covariates, and the past values of the instrumental variable (afternoon rainfall or flu incidence), measured in the four years before the actual election year, and other political variables (see Table 1). See Table 1 for the detailed list of covariates, and sources of revenues. Rainfall (flu incidence) is observed at every point of a given set of locations of observations. We define the rainfall (flu incidence) in a municipality as the rainfall (flu incidence) in the closest location of observation. Standard errors are clustered at the location of observation level in the 2SLS estimations. The number of clusters is reported in Table 2. + Significant at the 10 percent level. $*$ Significant at the 5 percent level.

Table 9: **Effect of Turnout on Revenues - Municipal Fixed Effects**

	Dependent Variable: Increase Revenues from One Term to the Next				
	(1)	(2)	(3)	(4)	(5)
	OLS	2SLS	2SLS	2SLS	LIML
Log Turnout	0.040	58.9	-3.45	-1.29	-11.5
	(0.028)	(127)	(2.44)	(1.88)	(32.3)
Observations	56,731	55,106	51,338	51,338	51,338
Number of insee	29,178	27,553	25,669	25,669	25,669
IV	NA	Rain	Flu	Both	Both

NOTES. This table reports the 2SLS fixed effect estimations of the regression of the increase in the average yearly municipal revenues over a term (or over part of a term if observations are missing), from one term to the next, on voter turnout in the municipal election between both terms, for all observations. The instrumental variable used in 2SLS estimations is indicated at the bottom of each column. All regressions include all covariates of our data (except the ones that we only observe in 2001 or later). See Table 1 for the detailed list of covariates, and sources of revenues. Standard errors are clustered at the location of observation level in the 2SLS estimations. The number of clusters is reported in Table 2. + Significant at the 10 percent level. ∗ Significant at the 5 percent level.

Table 10: **Effect of Other Rainfall Variables on Turnout - OLS Estimations**

	Dependent Variable: Log Turnout			
	(1)	(2)	(3)	(4)
	2001	2001	2008	2008
Morning Rainfall	0.00025		0.00047	
	(0.00055)		(0.00054)	
Midday Rainfall		0.00061		-0.00072
		(0.00080)		(0.00062)
Observations	27,947	27,947	28,784	28,784

NOTES. This table reports the OLS estimation of the regression of voter turnout on rainfall in the morning and at midday of election day, separately for the 2001 and 2008 French municipal elections. There is one observation by municipality. All regressions include all covariates. + Significant at the 10 percent level. ∗ Significant at the 5 percent level.

Appendix D Proof of the Proposition

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(i) As formulated in the main text we have:

$$S_1(c) = \left(1 + \frac{u(x_1)}{x_2 - x_1} - \frac{c}{x_2 - x_1)}\right)^* + \left(1 - \frac{u(x_2)}{x_2 - x_1} - \frac{c}{\theta_2(x_2 - x_1)}\right)^*$$

and the number of voters (multiplied by C) for party k is then:

$$S_2(c) = \left(\frac{u(x_2)}{x_2 - x_1} - \frac{c}{\theta_2(x_2 - x_1)}\right)^*$$

where $Z^* \equiv min(max(Z, 0), 1)$.
We study equilibria (supposing they exist) such that both parties have a strictly positive probability of winning and there exists $\hat{c} \in (0, C)$ such that, one party wins if and only if $c \leq \hat{c}$ and the other if and only if $c > \hat{c}$. We first show that it has to be that $S_1(\hat{c}) = S_2(\hat{c}) < 1$. Suppose on the contrary that $S_1(\hat{c}) = S_2(\hat{c}) = 1$ (i.e all voters turn out if the voting cost is $\hat{c}$). Then, $S_1(c) = S_2(c) = 1$ for $c \in (0, \hat{c}]$, so that, on this interval, no party is elected given our tie-breaking rule. Such an equilibrium does not satisfy the description above.
In such an equilibrium, parties must have different budgets. Suppose by contradiction that it is not the case. Then we see party 1 would never win regardless of c since voters in her group have a higher voting cost (higher θ_g).
Use the notation $x_j < x_k$ for $j, k \in \{1, 2\}, j \neq k$. A unique intersection $\hat{c}$ may only arise in the two cases (a) and (b) below.
(a) No voter from group k votes for party j. In this case, $S_j(c) = S_k(c)$ can be written:

$$1 + \frac{u(x_j)}{x_k - x_j} - \frac{c}{\theta_j(x_k - x_j)} = \frac{u(x_k)}{x_k - x_j} - \frac{c}{\theta_k(x_k - x_j)}$$

In this case, $(\theta_k - \theta_j)\hat{c} = \theta_j\theta_k\big(u(x_j) - x_j + x_k - u(x_k)\big)$
- If $\theta_j < \theta_k$, $S_k(c) - S_j(c)$ strictly increases in c, so that k wins on $c \in \big(\hat{c}, \theta_k u(x_k)\big)$, and j wins on $\big(0, \hat{c}\big)$. Thus, j's expected utility is $\hat{c}$, and k's expected utility is $\theta_k u(x_k) - \hat{c}$. Since both maximize their utility, we have $u'(x_j) = 1$, and $u'(x_k) = \frac{\theta_j}{\theta_k}$. Note that $u'(x_j) > u'(x_k)$ since $\theta_k > \theta_j$. Therefore, $x_k > x_j$, which is consistent with our initial assumption.
- If $\theta_j > \theta_k$, a similar logic yields that j wins on $c \in \big(\hat{c}, \theta_j u(x_j) - \theta_j x_j + \theta_j x_k\big)$, and k wins on $\big(0, \hat{c}\big)$. So, k's utility is $\hat{c}$, and j's utility is $\theta_j u(x_j) - \theta_j x_j + \theta_j x_k - \hat{c}$. Since both maximize their utility, we have $u'(x_j) = u'(x_k) = 1$, which contradicts $x_j < x_k$.
(b) Some voters from group k vote for party j. In this case,

$$1+\frac{u(x_j)}{x_k-x_j}-\frac{c}{\theta_j(x_k-x_j)}+1-\frac{u(x_k)}{x_k-x_j}-\frac{c}{\theta_k(x_k-x_j)}=\frac{u(x_k)}{x_k-x_j}-\frac{c}{\theta_k(x_k-x_j)}$$

In this case, $S_k(c)-S_j(c)$ strictly increases in c regardless of the comparison between θ_j and θ_k, so that j wins for $c\in\big(0,\hat{c}\big)$, and k wins for $c\in\big(\hat{c},\theta_k u(x_k)\big)$.
In both cases (a) and (b), we have therefore shown that parties' budgets are different, and the party with the smallest budget wins if and only if $c\leq\hat{c}$, whereas the other party wins if and only if $c\geq\hat{c}$.

(ii) We now show that $\theta_2\in(1,2)$ and $u'(0)\leq 1$ are sufficient conditions for an equilibrium with the property of the part (i) to exist.
$\theta_2\in(1,2)$ prevents the intersection of case (b) in the proof above from occurring. Indeed, the intersection (b) occurs only if there is a strictly positive number of voters from group k voting for party j at $\hat{c}$, that is only if $\theta_k\big(x_k-x_j-u(x_k)\big)>\hat{c}$ (and $x_k-x_j-u(x_k)>0$). Since $\hat{c}=\theta_j\big(u(x_j)-2x_j+2x_k-2u(x_k)\big)$ in this case, the last inequality amounts to $u(x_1)<(\theta_k-2\theta_j)\big(x_k-x_j-u(x_k)\big)$, which is impossible since $u(x_1)\geq 0$, and $\theta_k-2\theta_j<0$.
We saw in the proof above that case (a) can only occur if $x_1<x_2$, at $\hat{c}$ defined as:

$$\hat{c}=\frac{\theta_2}{\theta_2-1}(x_2-x_1)+\frac{\theta_2}{\theta_2-1}u(x_1)-\frac{\theta_2}{\theta_2-1}u(x_2)$$

since, in this equilibrium, party 1 gets $\frac{\theta_2}{\theta_2-1}\big(x_2-x_1+u(x_1)-u(x_2)\big)$, and party 2 gets $\frac{\theta_2^2}{\theta_2-1}u(x_2)+\frac{\theta_2}{\theta_2-1}\big(-x_2+x_1-u(x_1)\big)$, so that utility maximization yields $x_1=0$ and $u'(x_2)=\frac{1}{\theta_2}$.
We now show that these budgets indeed define an equilibrium. Let us rule out any possible deviation:

- If party 1 deviates to x, where $x\geq x_2$, the share of voters she gets is always smaller or equal to the share of voters party 2 gets for any c (since $\theta_2>\theta_1$, so her utility is zero. So, no such deviation is profitable.

- If party 1 deviates to x, where $x<x_2$, we have $u(x)-x<u(x_1)-x_1<\theta u(x_2)-x_2$, that is $u(x)+x_2-x<\theta u(x_2)$, by the envelope theorem, given the definition of x_1 and x_2. In addition, we have $\theta u(x_2)>\theta\big(x_2-x-u(x_2)\big)$, since $2u(x_2)>x_2$.
  From these two inequalities, we conclude that the last person who casts a ballot votes for party 2. So, either party 1 never wins, in which case she gets 0, or she wins for $c\leq\hat{c}$, in which case x_1 is optimal. No such deviation is profitable.

- If party 2 deviates to x, where $x > x_2$, either S_1 is always larger than S_2, which yields zero to party 2, or S_1 and S_2 intersect at $\hat{c}$, in which case x_2 is party 2's best response to x_1. So, no such deviation is profitable.

- If party 2 deviates to x, where $0 < x < x_2$, since $\frac{u(x)}{x} < 1$ for any $x > 0$, $S_2(c) < 1$, so that S_1 and S_2 necessarily intersect at $\hat{c}$, in which case $x = x_2$ is optimal. So, no such deviation is profitable.